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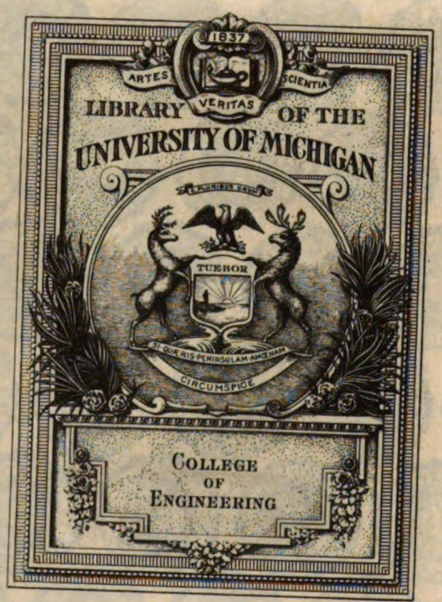

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THE ELECTRICIAN

Established 1861. *The Oldest Weekly Illustrated Journal of*

Electrical Engineering, Industry, Science and Finance

VOLUME CII.

From January 4, 1929, to June 28, 1929

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LONDON:

Printed by W. H. SMITH & SON LTD., The Arden Press, Stamford Street, S.E.1, and Published by BENN BROTHERS, LTD. at Bouverie House, 154, Fleet Street, London, E.C.4.

1929.

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THE ELECTRICIAN

Established 1861. The Oldest Weekly Illustrated Journal of

Electrical Engineering, Industry, Science and Finance.

Bouverie House, Fleet Street, London, E.C.4. Telegrams: "Benbrotric, Fleet, London." Telephone: City 0244 (Ten lines).

No. 2640. [No. 1. Vol. CII.] Friday, January 4, 1929. Annual Subscription, 25s. Overseas, 30s.

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The Index to Vol. CI. of "The Electrician," is included in this issue, and will be found facing page 18.

Current Topics.

London's Future Travelling Facilities.

On several occasions during the last few years Lord Ashfield has mentioned that the Underground Railways Group could not entertain the idea of constructing any further tube railways unless there were instituted a general scheme for co-ordination of London passenger carrying services, and an equitable system of allocating the profits to the several companies or bodies providing such services. Apparently, the Underground administration is now satisfied that the Bills which it and London County Council are promoting to authorise such co-ordination will be duly passed, and will go at least part of the way towards ensuring for the Underground the security as to receipts and profits which it has long regarded as the desideratum which would enable it to plan and carry out a bold policy of expansion. It has long been urged that new tube railways should be constructed in South London, and that an extension of the Piccadilly Line, either independently or in conjunction with the Great Northern and City Railway, beyond Finsbury Park is badly needed, and the construction of the last-mentioned extension has been contemplated, subject to the desired improvement in working conditions being obtained. The Underground has published a list of developments which will be undertaken during the present year, and, although this does not include any extensions of lines, it comprises works which will involve large expenditure, and is an indication of the intention of the Underground administration to spare no effort to give a satisfactory service in return for the security of tenure and relief from undue competition which will be secured by means of the Acts now in the making. The present year's improvements will include the construction of many escalators, modifications of stations, the provision of 372 more cars on the tubes, and 91 new motor cars on the District Railway, the installation of a sixth 15 000 kW generator and new boilers and switchgear at the Lots Road power station, the remodelling of tramcars on the systems under Underground control, and such other details as the provision of roof covers on the present uncovered tramcars.

The B.E.A.M.A. and Trade Credit.

Just before Christmas there was held the winding-up meeting of the Sound Currency Association, at which a brief reference was made to the British Electrical and Allied Manufacturers' Association's recent memorandum concerning trade credit. The Sound Currency Association was formed in 1919 with the object of pressing upon the Government the need for the restoration of the gold standard in this country, and, that object having been achieved, there was no further need for the existence of the Association, and it has accordingly been wound up. The whole of the work was of a voluntary nature, but it was supported by the leading bankers, economists, and others in this country. Mr. D. M. Mason, who has acted as chairman of the Association since its formation, in his final speech referred to the B.E.A.M.A.'s manifesto, and said there seemed to be a feeling prevailing in certain circles that there is a lack of credit to-day. He contended, however, that there is no lack of credit, and that anybody who has good security has no difficulty in obtaining any credit they desire. At the same time, it was impossible to force credit into the country, because the only results were inflation and the very evils which the Association had endeavoured to prevent. The British Electrical and Allied Manufacturers' Association had suggested that the depression during recent years had been due to the monetary policy of the Bank of England, but the system of the Bank of England was, in a sense, governed by the trade of the country. It did not provide the trade, but existed for the purpose of circulating trade, and the function of the gold standard was for the purpose of enabling exports and imports to develop to the greatest extent. That system enabled this country to build up before the war a foreign trade second to none in the history of the world, which had stood the test of time, and it was a satisfaction to know that we had now got a currency which was convertible into gold, was elastic, and free from political influence.

Load-Factor Problems.

The article dealing with "Some Fallacies of Load-Factor" which we publish on a later page of this issue will doubtless give rise to no small amount of criticism. We are aware that some of Mr. E. V. Clark's contentions run counter to the expressed opinions of many electrical engineers, but as the author, who is Lecturer on Electrical Engineering in the University of Adelaide, Australia, is able to view the problem with a detachment which is hardly possible among engineers more intimately connected with the business of electricity supply, his views at least deserve consideration. Mr. Clark's case is that load-factor is so unduly stressed in some quarters that the

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greater importance of diversity factor is far too little considered, if not overlooked, and that the more general adoption of bulk supplies is likely to enforce a truer view of the matter. We shall be glad to provide facilities for a full discussion of the subject in those of our columns devoted to correspondence.

Christmas Toys and Batteries.

IT will be remembered that last year we drew attention to the number of toy motor-cars to be seen in the Christmas bazaars, which incorporated flash lamp headlights operated by batteries. The bazaars just concluded again displayed motor cars similarly fitted, but though we visited many stores and shops no further application of the same principle was seen. As a suggestion to manufacturers of flash lamps and batteries we see no reason why such toys as trains and signals should not also be illuminated by the same means. The sales of these during the Christmas season must be considerable, and if it were possible to include in each sale one or more flash lamp bulbs and a battery, then the already big business in these goods would be still further improved.

British Industries Fair.

THERE has been issued this week a special advance overseas edition of the catalogue of the London Section of the British Industries Fair, which is now being sent to 10 000 business men in Europe, North America, South Africa and the eastern coast of South America, including all those buyers who have notified the Department of Overseas Trade of their intention to attend the Fair. By this publishing feat, which has only been made possible owing to the keenness of British manufacturers to participate in the Fair, trade buyers in cities as far apart as Constantinople, Capetown and Vancouver, will be able to receive a copy of the Fair catalogue before commencing their voyage to England. The London Section of the Fair includes, as in past years, the exhibits of the majority of the large manufacturers of radio apparatus, and from the advance details available it is indicated that there will be shown many new designs of sets, loud speakers and components of outstanding merit. The Electrical Section of the Fair at Birmingham will be one of the largest yet held, and the exhibits promise to reveal many advances and improvements. The exhibition will soon be upon us and the electrical industry generally, and the organisers of the Electrical Section in particular, are to be congratulated on the progress that has been and is still being made. The comprehensive display of exhibits which the industry is showing should do much to impress the numerous foreign buyers who have indicated their intention of attending, with the efficiency of the British electrical manufacturing trade in all its many branches, and since, as last year, many of the exhibits will have some relation to the various electrification schemes of the Central Electricity Board, these, we anticipate, will be of more than considerable interest to the foreign visitor in that no contract for such schemes has yet been placed with a foreign manufacturer, a fact which will at any rate excite curiosity, if nothing else. A list of the electrical exhibitors at both the Birmingham and London Sections of the Fair will be given in our next issue.

Domestic and Colour Lighting.

THE Sales and Publicity Calendar of the Electrical Development Association for January deals with domestic lighting and colour lighting. The supplementary programme which has been issued shows that an extensive national and local advertising campaign has been arranged, while special window displays, posters and publications are also available. The window displays include an artistic arrangement for use with coloured spotlights and coloured lamps, which demonstrates the importance of the principle of specialisation as a selling factor. The fitting strikes us as being a highly successful design which will without doubt command the attention of the public wherever it is shown. Another window trim aims at selling by the art of suggestion and is extremely simple to arrange, irrespective of size of window. Its appeal is direct, and the sale of domestic lighting fittings should be increased as a result of it. The window dressing schemes of the E.D.A. last month were associated with Christmas, and in those cases where these were adopted we have no doubt that extra sales were the reward. For January, specialisation and simplicity are the keynotes of the campaign, and though some of the electrical windows in this country may be regarded as a trifle complex, the E.D.A. designs for January are, on the other hand, pleasingly simple. The idea of devoting electrical windows to special subjects each month is one which is not likely to escape the attention of the public, and so long as the windows are changed at the beginning of the month, the public will become accustomed to look for the change at that time. The scheme may, in fact, be regarded as a means of educating the public into thinking electrically as well as buying electrically; a condition which the whole industry would do much to bring about.

Cinema Lighting.

AMONG the most appreciative of the value of electrical effects should be included the various cinema theatres, the lighting schemes of which are often as entertaining as their projections upon the screen. The theatres in and around London, as well as in the provincial centres, have all adopted a form of illumination which adds to the beauty of the internal decoration, and incidentally augments not only the sales of electrical fittings but also increases the power station load in the district where the hall is situated. The latest addition to the London cinemas is that at Croydon, and as will be understood from the brief description given elsewhere in this issue, the building is of considerable electrical interest. Mr. BASIL DAVIS, whose designs indicate that he has no small understanding of what can be done with electric lighting, is also, we believe, one of that exclusive band of radio transmitters whose early experiments were the forerunners of the present broadcasting system.

Electricity in Bulgaria.

CONSIDERABLE opportunities for export business may be found by British manufacturers of electrical machinery and appliances in the gradual advancement of electrical development in Bulgaria. As evidence of this, there was in 1900 only one electricity supply undertaking, while even in 1914 the number had only increased to four. Between 1923 and 1927, however, there were ten transmission systems brought into being, which number had increased to 74 by the end of 1927. At the present time there are thirty hydro-electric stations actually in operation, of which eleven have a capacity of 100 H.P., a similar number from 100 to 500 H.P., four from 500 to 1 000 H.P., two from 1 000 to 2 000 and two above 2 000 H.P. The Electric Society of Sofia and Bulgaria is the owner of one of these latter, the capacity of the station being 3 720 H.P. The other station, of 7 800 H.P., is operated by an organisation of the name of Granitoid, and these two stations produced during 1927 25 634 994 kWh. In addition to hydro-electric stations there are in Bulgaria 109 power stations of other types which during 1927 produced 11 097 540 kWh. These figures go to show that Bulgaria is not without market value, and though many of the domestic electrical appliances and much of the machinery used are of continental manufacture, the fact that American-made apparatus can find a ready sale there indicates that the market is competitive. Though we are naturally inclined to look to the larger countries for our export sales, the smaller countries of Europe should not be forgotten. The same markets should also prove attractive to the manufacturer of radio equipment, for though German- and Austrian-made components and sets are to be seen in number, the superior quality and overall efficiency of the British-made equipment are already well known and in many cases preferred in that part of the world.

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POWER STATIONS AND LOW-TEMPERATURE CARBONISATION.

Advantages of Semi-Coke Fuel—A Continental Experience—Coal and Modern Stokers—Delivery Through Pipes—The Dunston Station—Question of Bulk Density.

THE problem of the low-temperature carbonisation of coal and its industrial applications, particularly its applications in the power house, were discussed in a paper by Dr. A. T. Demouilpied at a recent meeting of the London Local Technical Group of the Electrical Power Engineers' Association. As pointed out by Mr. W. J. Oswald, who presided, the subject has been prominently in the minds of power station engineers since Mr. R. P. Sloan presented a paper to the World Fuel Conference (held in London in September and October) on the economic utilisation of fuel in the production of electricity.

After a review of low-temperature carbonisation and of some of the processes invented, Dr. Demouilpied went on to discuss the application of the various products produced, the most important of which, he said, was the semi-coke, which was smokeless, burned well, ignited readily, had a higher rating efficiency than coal, and would go further than coal. In view of its activity, it was suitable for making producer gas, and among its other applications he referred to its use as a boiler fuel.

At the Dunston power station of the Newcastle-on-Tyne Electric Supply Co., coal is carbonised and the semi-coke fed on to chain grate stokers. Mr. Sloan had stated that a balance sheet could be worked out there showing a credit balance of nearly 3s. per ton of coal, but Dr. Demouilpied suggested that Mr. Sloan had been too modest in regard to the value of the semi-coke and gas, which he had fixed at 76% of the value of the original coal. Dr. Demouilpied's results with various coals, based on the net calorific values of the coke and gas, and allowing for the heating of the retort, showed values of the order of 82 and 83%.

With regard to the use of the semi-coke in the pulverised form, he said that the cost of drying before or during pulverisation was eliminated if semi-coke were used instead of coal. Owing to the physical structure of the semi-coke it offered a greater combustion surface and burned more readily, and with a short flame, so that it required a smaller combustion furnace. It had also been stated that about 20% less power was required for pulverising semi-coke than for pulverising most coals. Again, semi-coke could be burned satisfactorily with a higher ash content than in the case of coal: the specific gravity of pulverised semi-coke was low, so that the ash had a greater chance of dropping out. Storage was simplified, for the material did not cake, was not liable to spontaneous combustion, and occupied no more room than pulverised coal. Recent tests had shown that the average rate of steam production was about 21½% greater than when the parent coal was used, a fact which had an important bearing on the number of boilers required at a station. Tests had also shown that the efficiency of semi-coke was nearly 12% greater than that of the parent coal from which it was made.

The Discussion.

In the discussion which followed, MR. L. L. ROBINSON said that the results of his investigations of low-temperature carbonisation processes, primarily from the power station engineer's point of view, had damped his ardour rather severely. Recently he had visited Germany and had investigated a process which had been in practical operation at Duisburg for some twelve months. So far as the production of by-products and of a very excellent semi-coke was concerned, the process appeared to be admirable, but the calorific value of the gas produced represented only about 10 per cent. of the calorific value of the original coal, and it was obvious that if one were to use the gas only for boiler firing one would need a good many square miles of plant around the works in order to produce sufficient of the gas. Further, when he had found that the coal used, which he could have burned perfectly well on a modern stoker, was sold at about 5 marks per ton, but that the semi-coke produced from it by the low-temperature carbonisation process was selling at over 25 marks per ton, he had felt that it would be a sin to burn the latter under a boiler.

With modern stokers it was possible to get a boiler efficiency of at least 86% when using coal, and it was difficult to believe that by using coke one could add another 12% to that efficiency.

DR. DEMOUILPIED said he had not claimed a 12% increase in boiler efficiency by the use of semi-coke as compared with the parent coal, but a 12% increase in the efficiency of the fuel. A boiler efficiency of 86%, though admirable, was obtained at a price. His point was that it was a matter of great interest to a boiler engineer, or anyone else, to be able to show a reduction of 1s. per ton in the cost of his fuel. If a coal worth 5 marks per ton could be converted to a fuel worth 25 marks per ton, he would not let Mr. Robinson have a scrap of it for use under boilers. Dr. Demouilpied asked how much it would cost to dry a ton of fuel for pulverising.

MR. E. N. TAYLOR said that depended upon the system of pulverisation. If the fuel were prepared in a central plant, an expensive dryer would be required. If, however, one adopted the system of preparing the fuel in a mill at the point of user and firing direct, the fuel was dried in the mill by means of waste hot gas and passed straight to the boiler: the only loss incurred was that due to the moisture which passed through the boiler and out through the chimney with the waste gas. The cost in that case was merely the loss in boiler efficiency, which probably amounted to about 3%.

Efficiency of Semi-Coke.

DR. DEMOUILPIED was unable to give figures within his own knowledge with regard to the efficiency of semi-coke when burned on mechanical stokers, though he hoped to be able to do so in the near future, but M. Herry, of the Centrale Electrique de Flanders, who was using semi-coke under boilers at the power station near Ghent, was satisfied that the semi-coke from one ton of coal would give, when fed hot and properly controlled and burned, the same kind of efficiency as the ton of coal itself under the boilers.

MR. R. P. WALLIS asked whether the author would recommend that coal should be carbonised at individual power stations, or that the low-temperature carbonisation product should be manufactured at central depots and distributed to the power stations. If the coal were carbonised at the power stations, one had the advantage of being able to add the sensible heat from the retort to the boiler furnace, but that system had the disadvantage that both the gas and the coke produced had to be dealt with, and he understood that a totally different type of furnace would be required to burn each of these products. He had heard that where engineers had had to burn the gaseous and the solid fuel in the same boiler it was found extremely difficult to control the steam output of the boiler, because it would generate steam at varying rates, due to the variation in the quantity and quality of the gas made. It would appear necessary, therefore, to provide means of balancing the variations in gas generation in accordance with the load; otherwise, the station would be one having an electrical load to suit the boilers instead of one in which steam was generated to suit the electrical load.

DR. DEMOUILPIED said he was optimistic enough to believe that in time pulverised fuel, particularly if it be semi-coke (which did not clog and bridge in bunkers) would be delivered through pipes. In America, pulverised fuel was delivered in tanks, and recently he had seen a tank designed in this country for that purpose, so that there would be no difficulty in transport.

MR. E. SMYTHE, referring to the plant at the Dunston power station, said it was installed during the war to produce oils from the Northumberland coals by treating them with a distilling medium, the medium at that time being steam. The process was gradually developed to its present stage, in which the products of combustion, mixed with steam, are used, it being found that steam alone was too costly. The operation of the plant had solved a good many problems. A most excellent semi-coke was produced from Northumberland coal and burned direct on the grates of the boilers. Methods of pulverising the coke had been evolved recently, and semi-coke would be burned direct on the grates of the boilers on one side of the boiler house, and the pulverised coke would be burned under pulverised fuel-fired boilers on the other side. The use of the pulverised fuel seemed to him to solve to a great degree the difficulties in connection with peak load. The calorific

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value of the semi-coke produced was almost identical with that of the original coal. The fuel was fed hot on to the boiler grates, but there was a certain amount of quenching in order to obtain the steam for admixture with the products of combustion, which mixture was used as the distilling medium. Finally, Mr. Smythe urged that there should be a national endeavour to pre-treat all coal burned.

In reply to the Chairman, Mr. Smythe said that the results obtained by burning the semi-coke on the grates of the Babcock boilers at Dunston were better than those obtained by burning the coal itself.

MR. MOUNT pointed out that the bulk density of pulverised coke was very much lower than that of raw coal, and a tank of a given size could transport nearly twice the weight of raw coal as of powdered coke; the importance of this from the point of view of transport costs was obvious. He had heard that two tanks were being manufactured for the transport of powdered coal, so that it appeared that a start was being made in the development of central pulverising plants in this country. The efficiency of coke burning on stokers depended upon air distribution. With regard to the transport of pulverised fuel through pipe lines, he pointed out that the abrasive effect of coals of very low ash content was different from that of coals of high ash content, and one of the biggest problems to be faced in connection with this form of transport was the cost of maintenance of pipe lines. In the burning of powdered coke there would probably be trouble due to the fact that the ash would fall more readily than that of powdered coal and cause slagging, whereas with pulverised coal the ash would go up the chimney. If the plant were not looked after carefully, part of the ash pit would become blocked and one could not get the ash away without damaging the brickwork; the boiler would have to be shut down in order that the brickwork could be repaired. The usual experience was that 20% more power was needed to pulverise coke than to pulverise coal.

DR. DEMOUILPIED, referring to bulk density, said it was stated by Dr. Lander and Dr. Sinnatt (of the Fuel Research Board) in a paper read before the recent World Fuel Conference, that, broadly speaking, it might be assumed that the lump low-temperature coke occupied twice the volume of coal, but that the bulk density of the coke and of coal of a similar degree of fineness would probably be of the same order. With regard to ash he said the scattering of ash from chimneys over large areas was a serious problem, and he was glad to hear that the ash from the low-temperature product showed a tendency to slag. He believed it would be possible to modify the plant in order to overcome the difficulty Mr. Mount had mentioned. The figures showing that 20% less power was required to pulverise semi-coke than to pulverise coal were obtained from an authoritative source. He asked what was the smallest size of any fuel that could be burned successfully on a modern chain grate stoker.

MR. P. PILKINGTON said that the maximum degree of fineness of semi-coke for burning on a chain grate stoker would probably be such that about 40% would pass through a $\frac{1}{8}$ in. sieve.

MR. MOUNT pointed out that the maximum fineness of fuel depended upon the air spaces on the stoker and the quantity of fines or riddlings. With regard to pulverising, he said coke was usually ground more finely than coal, because more time was needed to complete the combustion of coke than of coal, and it was usual in the design of combustion chambers to allow a greater flame travel for coke than for coal.

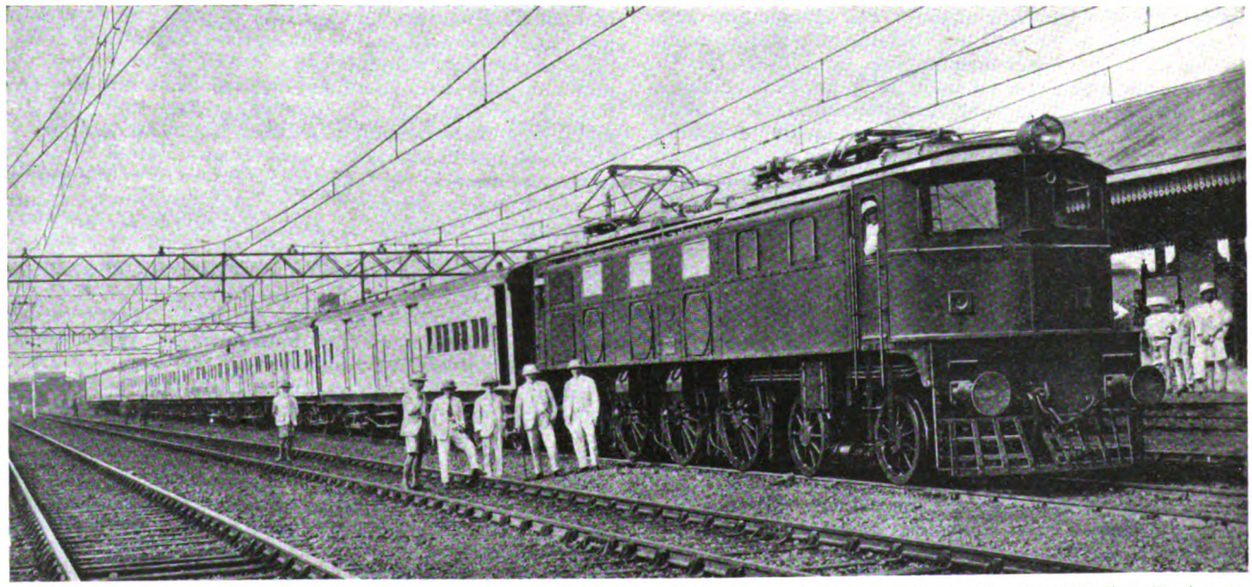
DR. DEMOUILPIED said that Audibert, the eminent French authority, was definitely of opinion that for equal efficiency of combustion, semi-coke need not be pulverised to the same degree of fineness as coal.

MR. E. N. TAYLOR asked for information as to the cost of maintenance of low-temperature carbonising plant per ton of coal treated.

DR. DEMOUILPIED replied that Mr. R. P. Sloan had stated that operation and maintenance charges amounted to about 4s. 8d. per ton of coal distilled; that was a reasonable figure for a successful plant.

MR. R. CHAPMAN pointed out that the figure of 4s. 8d. related to a small experimental plant, and said that Mr. Sloan had given a figure of 3s. 4d. per ton in the case of a larger plant. He asked if the pulverised semi-coke produced by the McEwan-Runge process was capable of being burned direct as pulverised coke.

MR. S. MCEWAN replied that the semi-coke as it left the retort, in the McEwan-Runge system, was pumped directly to the boilers and burned. As much as 40% of the material would remain on a 60-mesh screen. The particles were exploded, puffed-up particles of coal, which could be crushed between the finger and thumb, and the surface area was so large that combustion was instantaneous.



AN important contract for twenty-one 2 160 H.P. electric locomotives for express passenger service on the Great Indian Peninsula Railway has been placed with the Metropolitan-Vickers Electrical Co. The Metrovick sample locomotive submitted, is shown in the accompanying photograph in service. The construction is of the 4-6-2 type, consisting of three driving axles, one four-wheel bogie truck and one two-wheel pony axle working in conjunction with the nearest driving axle. The motors and their gearing are mounted on the frame of the locomotive, and transmit the power to the driving axles through a universal motion flexible link drive, which accommodates the route of movement between the axles and frame of the locomotive. The normal maximum service speed will not exceed 75 miles per hour, but all parts are designed for a speed of 85 miles. The electrical equipment includes six 360 H.P. motors and electro-pneumatic control gear. The pneumatically-operated switches are arrayed in a high tension chamber, those for the line and main resistances being of the single unit type arrayed in groups, and those for the motor combinations and reversing being of the cam group type.

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SOME FALLACIES OF LOAD-FACTOR.

Load-Factor as Affecting Company and Municipal Owned Undertakings—Economic Considerations of Water Heating—Peak Load and Lighting—Domestic Appliances—Advantages of Bulk Supply.

By EDWARD V. CLARK, B.Sc., M.Inst.C.E., A.M.I.E.E.

MUCH has been written concerning the cost of electricity, and the importance of load-factor has been greatly stressed. It is well to remember, however, that load-factor is merely a means to an end, and that if the requirements of cheap electricity for those purposes for which it is most needed can best be attained by working on other lines, the matter of load-factor may be left to look after itself.

In England, electricity supply is largely in the hands of municipalities; and, as pointed out in a previous article*, the points of view of municipalities and companies are widely different. To the company, the profit and loss account and balance sheet are all important. The municipal undertaking considers more the statistical figures, and loves to see low running costs, low figures for the average revenue per unit, and a good position upon the comparative tables generally.

It is probably this that has given such undue prominence to load-factor, so that Dr. S. Parker Smith in the discussion upon Mr. Townend's recent paper before the I.E.E. begins: "To my mind the interesting point in connection with this paper is that improvement in modes of generation does not really seem to be the best solution to make cheap electricity a possibility. Probably improvement of load-factor by better utilisation has much more significance from that point of view." That better load-factors will permit of lower average costs of electricity is unquestionable; but that they will necessarily permit of lower selling rates for electricity for those purposes for which it is now chiefly used is open to considerable question.

An Example.

A supply station has an annual load-factor, let us say, of 25%. It sells so many units for domestic lighting at 6d. per unit, so many for heating and cooking at 1d., so many for industrial power at 1½d., and so on. Its plant is capable of supplying additional units up to 300% of its present sales with the same peak load at an additional cost of, say, 0·35d. per unit, this figure covering not only the extra cost of generation, but also cost of collecting the revenue from such sales, and all other charges directly due to the supply of the extra units.

If any such additional units can be sold at a price of 0·375d. per unit, without adding to the station or feeder peak loads, there is a small profit made upon them. But even should the load-factor be raised to 100%, the average reduction in price of electricity for other purposes could not exceed 0·075d. per unit, to give the same nett return on capital. If these additional units can only be sold at 0·35d., a load-factor of 100% will not allow of any reduction whatever in prices for other purposes; while any lower price must result either in an increase in tariff for some other purpose, or else a poorer financial return.

Nevertheless, a municipal undertaking that could dispose of these additional units at 0·325d. might well consider the business desirable, since it would at once be placed at the head of all public supply stations in the kingdom for load-factor and average price per unit, and probably very well up in average cost per unit and in coal consumption; while any small increase in other rates not exceeding an average of 0·075d. per unit might readily be attributed to rise in cost of coal, or in wages, or as being necessary to maintain ample reserves against obsolescence in view of the rapid growth of the load.

This is, of course, quite elementary. Its application lies in two facts. Firstly, that though it is readily seen that any additional units which improve the load-factor without increasing the plant capacity may be sold at a low figure, it is not easy to arrive at the actual cost; and, secondly, that unless definitely controlled it is exceedingly difficult to ensure that any large amount of new load shall not increase, directly or indirectly, the capital charges of the undertaking.

From these considerations, it naturally follows that in general, companies are much less interested in load-factor as such, than are municipal undertakings. The former must regard any new business upon its merits. If supplied at a rate that will clearly return appreciable profit, it is desirable. But if the rate that can be obtained is too close to the estimated cost, the business had better be turned down as involving risk of loss, and holding little hope of substantial profit.

Load-Factor of 100%.

Figures, however rough, may help to make this clear. Consider an undertaking with load-factor of 25 %, generating costs 0·6d. per unit, overhead charges, etc., other than capital, 0·3d., and average revenue 2d. per unit, all figures based on units generated. Units per kW of peak load are 2 190, realising £18·25 per annum. Costs at 0·9d. amount to £8·2, leaving a margin of £10·05 to meet capital charges on each kW of peak load.

Suppose, now, that the undertaking can bring the load-factor up to the neighbourhood of 100%, without increasing the peak load or the capital expenditure, by the sale of all surplus units at 0·375d. per unit, the extra cost entailed by their generation and sale being 0·35d. per unit. Extra units sold per kW are about 6 000, bringing in an extra £9·4, at a cost of £8·75, thus giving an extra profit per kW of peak load of £0·65. Comparative figures with the same capital are:—

WITH LOAD-FACTOR 25%.—Revenue, £18·25; costs, £8·2; surplus to meet capital charges, £10·05.

WITH LOAD-FACTOR 100%.—Revenue, £27·65; costs, £16·95; surplus to meet capital charges, £10·7.

Thus there is an increase in revenue of 50%, in expenditure of 100%, and in surplus of only 6½%.

Were these figures absolutely reliable, and conditions unchanging, the extra load would be desirable; but with the unsteady conditions normally prevailing, a business man may well say that the extra profit is not commensurate with the risk entailed. A 10% increase in costs due to rise in price of fuel, would make the new conditions poorer than the old, as would an increase of 7% in capital expenditure, entailed perhaps by the need for increase of standby plant with the high load-factor.

These figures are based upon the load-factor being brought close up to 100%. Any smaller sale of off-peak electricity at this price will have correspondingly smaller effect upon gross revenue, costs, and surplus; but the same fact still holds, that the increase of surplus is very small compared with the increase in expenditure.

Load Factor of 40%.

But suppose it is decided that, load-factor being of minor importance and sale of electricity whether by-product or otherwise at rates to show adequate profit being the object of the undertaking, electricity for night water heating shall be offered at 0·5d. instead of at 0·375d. per unit; and suppose also that with this higher tariff only one-fifth of the possible business is secured. There will now be sold 1 200 extra units per kW, which at 0·5d. bring in £2·5. Their cost, at 0·35d., is £1·75, and we have total revenue, £20·75; costs, £9·95; surplus, £10·8.

Thus, the surplus is greater for this load factor of about 40%, than for the former load-factor of almost 100%, while the comparative figures with the station before securing the heating load are: Revenue, increased by 14%, costs by 21%, and surplus by 7½%. The margin against increase in fuel costs is much greater; while the moderate load-factor means that the extra units sold for water heating may be kept well away from the peak loading, so that risk, either of increase in peak load or of station plant to carry it, will be very small.

Electricity for water heating conforms with all other commodities, in that *caeteris paribus* the demand depends upon the price. The assumption that at 0·5d. per unit one could obtain at least one-fifth of the business procurable at 0·375d. seems reasonable. The general conclusion to be drawn is that one has more prospect of being able to reduce the tariff for other supplies of electricity if one sells energy for water heating at a price to show reasonable profit, and is content with a moderate load-factor, than if one cuts the price of such energy to a figure which gives hopes of bringing the load-factor to the neighbourhood of 100%.

* THE ELECTRICIAN, Vol. XCIX., page 745.

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It may be said that it is better for the community that electricity for water heating shall be sold at 0·375d. than at 0·5d. This, however, is open to question. Some hot water is a necessity in every household. A large supply is a luxury. Where hot water costs trouble as well as money to procure, it will be used sparingly. Where it is on tap, it will be used more freely. Whether it is best that a section of the community shall pay £9·4, and invariably indulge in hot baths; or £2·5, and have four cold baths to one hot one; or pay nothing and always have cold baths, it is outside the province of the engineer to decide. This matter is only referred to, because of the frequent assumption that reduced prices of commodities are necessarily beneficial to the community, irrespective of whether they are necessities or luxuries.

Importance of Diversity Factor.

There is a fundamental fallacy in the idea that electricity for water heating can be supplied at the lowest price to a consumer who brings his load-factor nearly to 100%, as by providing automatic switches which cut in heater elements as lamps, etc., are cut out; and this lies in ignoring the importance of diversity factor. Actual figures are hard to arrive at; but the diversity factor between domestic lighting consumers must be quite appreciable, apart entirely from any other apparatus they may use. The magnitude of the diversity factor, considering domestic lighting only, will depend upon the variability of the consumers' ways of living; and by considering the different hours and magnitudes of the daily peaks in a single house, it seems safe to say that the diversity factor of a number of houses of the same class will be at least 1·5; and probably from 2 to 2·5 where houses of very different kinds are supplied, these figures being based not on very occasional peaks, caused by abnormal domestic festivities, but upon the normal peak such as would be adopted as appropriate in any attempt to bring the load-factor of lighting plus water heating up to nearly 100% in a particular house. One is probably erring on the side of conservatism, then, if one assumes that those houses which would adopt water heating have a diversity factor *inter se* in their lighting loads of 1·5.

The effect of diversity factor is best considered by regarding it as producing a virtual reduction of individual peak loads. A thousand consumers, each averaging a peak load of 600 W, with a diversity factor as regards station and distribution of 1·5, will combine to put a peak load of 400 kW upon the system; and the capital charges of the undertaking are adequately met if each consumer is assessed as contributing 400 W to the peak load, due to his lighting.

If, however, his load-factor is brought up to something near 100%, evidently this consumer can contribute nothing to diversity factor; and hence must be assessed with the capital charges on 600 W, 400 W being attributable to lighting, and the rest to water heating. The latter is, therefore, by no means an entire by-product, and hence cannot be supplied at the lowest by-product rates.

This is the most favourable case, where the station peak occurs during the evening, being mainly due to domestic lighting. In many systems nowadays, the maximum peak occurs at about 4.30 p.m., during winter afternoons, and is due to the growing lighting load—especially shop, office, factory, and street—upon the waning industrial power load.

The diversity factor of domestic lighting being still 1·5 *inter se*, it is, nevertheless, much greater with respect to the peak upon the station, and is probably of the order of 3 at least. That is to say, 1 000 houses each with a peak load averaging 600 W, will combine to produce a joint load of 400 kW at about 7.30 p.m., when the station load is well past its peak, but will only give a joint load of 200 kW at 4.30 p.m., when the station peak is at its height.

The hour of station peak will not in general affect the tariff for lighting; for this being intrinsically the most valuable use of electricity, it will naturally carry the whole of the capital charges upon its combined peak, industrial power being still regarded as a partial by-product. But, despite this, the water heating load on a typical house means that an extra 400 W is added to the station peak, and something between 400 and 200 W to the peak on its section of the distribution system; and current for water heating will be supplied at a loss if these capital charges are ignored.

On the other hand, if, ignoring load-factor and concentrating on diversity factor, one arranges to supply electricity for water heating by means of a time switch, one may readily ensure that the peak load is not increased, and hence supply these extra units at a price which includes nothing for capital charges, other than on the time switch itself.

A house with a peak lighting load of 600 W, if bringing its load-factor to nearly 100%, by means of water heating, would use about 4 800 units per annum, with elements rated at 600 W. If operating upon a time switch, and relying upon night heating, its heater elements will be rated at about 1 700 W, to give the same supply of hot water, and the load-factor of the house will be about 30% only; and this arrangement will give appreciably more profit at the same rates for lighting and water heating.

There is a theoretical blemish on this method of supplying cheap current for water heating, in that if enough consumers adopt it one might find that the peak load upon the station or on sections of the distribution system occurred at about midnight, being attributable directly to the water heating. This possibility is, however, very remote in any ordinary undertaking; and should these conditions be imminent, the fact will be quite evident to the engineers, who will naturally relax their canvassing for this type of load.

In this discussion, no consideration has been paid so far to other domestic appliances—toasters, irons, and radiators—but these affect the problem only to a minor extent. Where water heating is carried out by means of automatic change-over switches, the elements are naturally arranged to be cut out whenever domestic power is used in quantity. The load-factor of the consumer will be appreciably below 100%, since the peak load will occur when one or two radiators are used at times of lighting load, and a water heater to keep the load constant at this level will be far too costly for the ordinary household.

The appropriate charge for water heating, however, will be slightly less than where other power is not used, since the lighting load plus water heating load will not necessarily be 600 W in the typical house at time of station peak. It would appear, nevertheless, that the reduction will be trivial; though one cannot arrive at any estimate without sundry assumptions concerning the use of these auxiliary appliances. Where water heating is limited to the night hours, the use by the consumer of other apparatus makes no difference to the appropriate charge.

"Change-Circuit" System.

The "change-circuit" system of water heating aims at raising the load-factor of each distributing transformer to the neighbourhood of 100%; and the extent to which it will suffer from the defects of attempts to bring the load-factors of individual consumers up to 100% will depend very largely upon the nature of the area being supplied, since this system takes duly into account the diversity factor of all premises connected to the one transformer, but disregards that between different transformers. It will be at its best where each transformer supplies a composite area which is typical in miniature of the whole area of supply, giving current to shops, houses of various types, and industrial loads as well. It will be at its worst in the case of a model city built in accordance with one of the many town planning fads, with one area set apart for shops, another for factories, another for small houses, and another for large. But, in any case, and particularly if the industrial load in the district is large, one may predict that before the "change-circuit" system has developed very much, it will be found desirable to incorporate some form of clock mechanism controlling the voltage of the "change-circuit," in conjunction with the current control, to ensure that transformers supplying what are essentially domestic loads shall not maintain their full output during the hours when the industrial loading is at its height.

Hitherto, most supply undertakings have been self-contained, comprising both generation and distribution. The difficulty in assessing the cost of a particular supply of electricity, no matter for what purpose, has been great, since the division of total costs into standing charges and running costs is at best but an approximation, and capital charges increase in jumps as each extension of plant takes place, without any direct connection with the peak load. But, in future, when bulk supplies become general, and the tariff for such supplies is known in advance, the position will become much clearer.

With a definite two-part tariff of £x per kW or kVA, plus y*d.* per unit, no matter whether x and y are constant or upon a sliding scale, the engineer in charge of a distribution system will be in a better position to realise what each supply he gives is costing him; and hence one may surmise that diversity factor will receive much more direct consideration than hitherto.

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TRANSFORMER BREAKDOWNS.

Shorts Between Turns—D.C.C. Conductors—Effects of External Faults—Core Type Transformers—Excessive Overloads and Internal Cooling Facilities—Eddy Currents.

AT a meeting of the London Local Technical Group of the Electrical Power Engineers' Association on December 11th, Mr. S. Austen Stigant read a paper on "Transformer Breakdowns." Mr. W. J. Oswald presided.

The faults that most frequently occur in practice were classified by Mr. Stigant as follows, although he pointed out that they often react one upon another:—(1) breakdowns in the electrical conducting circuit, i.e., in the coils and minor insulation; (2) breakdowns in the magnetic circuit, i.e., in the cores, yokes and adjacent clamping structure; (3) breakdowns in the dielectric circuit, i.e., in the oil and major insulation.

Breakdowns in the electrical conducting circuit are due mainly to (*a*) local short circuits between turns of the windings; (*b*) short circuits external to the transformer; (*c*) transient voltage waves due to switching, lightning or external faults; and (*d*) overloads.

Reasons for Breakdown.

A study of the records of modern transformer breakdowns over a period of years, he said, shows conclusively that between 70 and 80% of them are due finally to a short circuit between turns. Short circuits between turns may result from abrasion of the insulation caused by the dislodging of, or shock to, one or more turns consequent upon an external short circuit or upon repeated unfavourable switching-in operations. In each of these cases large currents momentarily circulate in the windings, and as they produce large forces between the conductors, there is always the risk of considerable mechanical stress to the insulation. In certain cases this may not become apparent immediately, but should the transformer vibrate while on load, due to looseness of the core plates, core bolts, or core clamping structure, the insulation will ultimately break down.

Short circuits between turns may also occur if the copper conductors have sharp edges which chafe the insulation should the transformer vibrate on load, so bringing the copper conductors into contact. It is usual, of course, for the conductors to have rounded edges, but occasionally sharp or abraded edges pass unnoticed.

Another possible source of danger is in the use of square conductors on which the double cotton covering has not been wrapped tightly. If the covering is loosely applied, the wire appears almost round, and during winding of the coils may become twisted, so that at one or more points adjacent turns may be lying edge to edge or face to edge instead of face to face. Should the transformer vibrate on load, or receive (as it often does) severe mechanical shocks during transit, then the insulation becomes chafed at the edge to edge point, and ultimately wears through. The danger is accentuated if there is a considerable weight of coils above the location of the winding fault. Imperfect impregnation of the coils and the introduction of moisture into the insulating fabric are also responsible for short circuits between turns.

The effect of short circuits external to the transformer is to produce enormous mechanical forces in the transformer windings. These large mechanical forces are produced as a result of the heavy currents that flow under short circuit conditions, and which are inversely proportional to the impedance of the transformer plus that of the rest of the circuit up to the fault.

In core type transformers, in which the centres of the h.t. and l.t. coils coincide, the mechanical stress acts in a radial direction, and usually, if the transformer is in good condition, the conductors themselves are sufficiently strong to resist the bursting tendency set up under short circuit conditions. If, however, the centres of the h.t. and l.t. coils do not coincide, an axial component of the stress is introduced which has the effect of forcing the conductors upwards and downwards in an axial direction. This tendency must be combated by providing rigid supports for the windings in an axial direction.

In transformers with sandwiched windings the mechanical forces are normally set in a radial direction, and horizontally between high and low tension coils, while if the centres of the h.t. and l.t. coils do not coincide, distorting forces are introduced. The older designs of transformers were built with a very low impedance, of the order of 1½ to 2%, so that with a dead short circuit on the secondary side of such transformers the short circuit current would be from 67 to 50 times the normal full load current, while the mechanical forces would be 4 500 to 2 500 times those existing under normal service conditions. Nowadays the impedance averages from 3½ to 6%, according to the size of transformer and the system; in large transformers of thousands of kVA's it is not less than from 8 to 12%.

Breakdowns due to transient voltage waves were then discussed, and diagrams were also exhibited to illustrate how the reflected and transmitted wave phenomena is modified by the insertion of a protective condenser or a protective choke coil placed before the transformer. They showed steps in the progress of the transmission and reflection of finite rectangular electric waves travelling from an overhead line to a transformer past a protective condenser shunted at the transition point, and past a protective choke coil in series with the overhead line and transformer. The fronts and backs of the transmitted waves were much more sloping than if no protective device were inserted, and consequently the stress on the transformer insulation was very much reduced.

So far as the transmitted waves were concerned, there was no difference whatever between the characteristics of the choke coil and the condenser as protective devices, the only difference being in the signs of the reflected waves. As a result of the appreciation of the concentration of pressure, the end turns of transformer windings are usually reinforced from an insulation standpoint. Generally speaking, the end turns mainly are subject to these high transient pressures, and then only for extremely short periods of time, but cases have been known where transient pressure waves have penetrated the windings, being reflected at open ended tappings, so causing a breakdown of the insulation at those tappings.

With regard to overloads, the author said that continuous excessive overloads always result in complete breakdown sooner or later. The general characteristic of such breakdowns is the charring and carbonisation of the insulating fabric and the formation of hydrocarbon sludge deposits from the oil. The question of overload is intimately connected with the proper design of the internal cooling facilities (the oil ducts, etc.), and a case is on record of a transformer which, being badly designed from this point of view, burned itself out, even though subjected to quite a small overload for only a short period of time. In the case of a complete burn-out due to continuous heavy overloads there is the added danger that the magnetic circuit may be so badly damaged as to need replacing or at least entirely dismantling, re-insulating and re-building. Photographs were shown of a 3-phase, 125 kVA, core type transformer, the low tension winding of which was burned out, due to the employment of unskilled labour when drying out the transformer on site. The man employed had switched on an excessive drying-out current and had left the transformer for several hours.

Insulation of Bolts.

Discussing breakdowns in the magnetic circuit, Mr. Stigant referred to the breakdown of the insulation of the bolts inserted through the core of core-type transformers for the purpose of clamping the laminations together. This type of fault has the effect of short circuiting the laminations themselves, producing in them local eddy currents; if, in addition, two or more of the core bolts break down, heavy currents circulate in the bolts themselves, as they form a short circuited turn through which magnetic flux passes. The path formed by the bolts and the thick outer clamping plates is one of low impedance, and the amount of heat generated in breakdowns of this type is sometimes sufficient to distort the whole core to a very considerable extent. Occasionally it may happen that the thin layer of insulation on each separate plate for the purpose of reducing eddy currents deteriorates, with the result that the whole core structure becomes semi-solid. This also produces very heavy eddy currents and a large amount of heat, with the same distorting effects as in the case of a breakdown of the core bolt insulation. Again, if the core bolts are not tightened and locked efficiently, they will in time become slack and vibrate when the transformer is on load. This tends to weaken the insulation round the bolts, and will in time lead to breakdown.

Dealing with breakdowns due to magnetic circuit character-

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istics, Mr. Stigant discussed the switching-in current rush, which is dependent mainly on the point of the pressure wave at which the transformer is switched in. If the transformer is switched in at the instant when the voltage is passing through zero, the maximum current rush is obtained. Under certain conditions it is theoretically possible to switch a transformer in at the instant of zero voltage without any current rush occurring; i.e., if the core possesses residual magnetism equal to and of the same polarity as the normal induction, the initial flux waves will follow their normal course and there will be no current rush. If, however, the residual magnetism in the core is less than the normal maximum, a transient component of the flux is introduced and the initial flux waves are unsymmetrical about the zero axis, and a corresponding current rush occurs. If the transformer is switched in when the voltage is at its maximum value, the flux would normally be zero, and therefore, with no initial flux in the core, there would be no current rush whatever; the current taken would be the usual small magnetising current, which is of the order of from 5 to 10% of the normal full load current. If there is any remanent magnetism in the core, the current rush is diminished or augmented, according to the relative polarity of the remanent magnetism and that resulting from the applied voltage.

The current rush may, under unfavourable conditions, produce relative movement of adjacent turns in the windings, which again may chafe or flake off the insulation round the conductors and cause a short circuit between turns. Transient switching-in current rushes may be minimised by switching the transformer in through buffer resistances which are connected to auxiliary contacts on the main switch. There is no real need to equip switches with these resistances indiscriminately, but where trouble is experienced with switching-in their use may be justified.

BOOK REVIEWS.

Alkaline Accumulators. By J. T. CRENNEL and F. M. LEA. (London: Longmans Green and Co.) Pp. x+132. Price 10s. 6d. net.

The authors are to be congratulated on having compiled the first comprehensive treatise on the chemistry of the iron nickel and iron cadmium cell (not alkali cells in general), a treatise of a historical and technical chemical nature with copious references to previous investigations on the subject.

Chemically (Chapters 3 and 6) the reactions expressed may be taken as satisfying to the chemist and scientist, also to the manufacturing chemist, as to the preparation of flake nickel, etc. The references to maintenance, however, hardly go beyond "makers' instructions," and there are unfortunately cases of importance which the authors have left in the "air." For instance, under "renewal of electrolyte," page 69, it is stated that "less lithium is used because during the working of the cell this becomes bound *in some way* with the active material of the positive plate, and the concentration of the lithium in the electrolyte is thus normally lower than in the new electrolyte." This, it would seem, indicates that the plates are not fully formed until they have been in service for some time, and absorbed some of the excess of lithium from the electrolyte; this is not very convincing, although Foerster's explanation as quoted may be accepted, even if not fully confirmed by analysis. Further on—the same subject, page 103—it would seem that the electrolyte is changed because the excess of lithium is exhausted, as it undoubtedly is *together with the potassium* as carbonate.

Again, on page 104, "qualitatively, its (carbonate) presence is stated to cause a loss of capacity and a decline in voltage; the evidence, however, is not very definite." Carbonate, to the battery man, is the "bête noire" of the alkali cell, involving, as it does, the complete change of electrolyte yearly, a costly item, and one frequently involving difficulties if the battery has to be put out of commission for the purpose; and, of course, the percentages of lithium and potassium carbonate in an exhausted electrolyte have been well established.

An investigation as to permissible impurities in the electrolyte would have been of great value, not only as to capacity and life, but also commercially, as there is an enormous difference in price between commercial and the various more or less purified forms of the article; there is also the presence of the hydrated oxides of iron (ferrous and ferric) found in suspension, and it is interesting also to see that distilled water is convicted as a guilty party in the contamination by carbonate.

An evidently studied and successful effort has been made by the authors to hold the scales evenly between lead acid and iron nickel, etc., alkali cells (lead hydrate are not referred to), but in the iron nickel cell the generation of heat involving even incandescence of the plate if not completely covered with electrolyte and the renewal of electrolyte annually in both the iron nickel and iron cadmium might have been placed in the correct pan of the scale; also, although costs have not been specifically dealt with, it must be remembered that the balance sheet is the *cost per annum*, and this involves not only the cost price divided by the number of years' life, but also interest on outlay.

The appendices are useful and interesting, but would not show such great differences in weight had it been pointed out therein that in making the comparison it is the weight per cell multiplied by the number of cells, for the required voltage, which gives the weight of the battery.

Whilst realising the scientific, technical, and comprehensive nature of the work, it is a matter of regret that the investigations made do not lead to any new conclusions as to maintenance. It is to be hoped that the authors may feel justified in continuing the subject with this point more especially in view.

L. W. DE GRAVE.

Grundlagen der Wechselstromtheorie. By Dr. P. B. ARTHUR LINKER, Hanover. (Berlin: Georg Stilke). Pp. 245. Price 16 Reichmarks.

This is yet one more German publication on the theory and application of alternating currents. The work is divided into four sections, the first of which commences with the Faraday–Maxwell formula for the generation of a volt. This is illustrated in the conventional way by means of a closed loop rotating in a two-pole field. This is followed by an illustration of a sinusoidal sine wave, and the projection of the latter on to a circle which, by means of vectors, shows the derivation of the formula $. - y = \sin . \phi$; where y is any ordinate and ϕ the angle which the coil makes with the horizontal line. This is mentioned to show how thorough is the commencement of this work. Other parts of the first section deals with polyphase currents, lead, lag and phase angle, etc. An interesting portion of this section is that dealing with the mutual effect of inductance and capacity, and the effect of resonance on current. The second section deals with star and delta connections and their relative values; current values in unbalanced systems with star-star and star-delta connections are clearly shown by means of vectors. The third section deals entirely with vectors, their addition, subtraction, multiplication, division, differentiation, integration and inversion. Various phases of the circle diagram are also given. The last section is devoted almost entirely to considerations of circuits containing inductance, capacity and resistance. Many examples are worked and the derivation of formula is given. The mathematics in this section are extremely intricate and difficult to follow. It would be very difficult to say for what purpose this book would be used. It commences, as I have shown, with matter taught to second year electrical engineer students in our technical schools, and it ends with matter of a standard rarely attained outside a University. The work would, perhaps, be more valuable if it were supplemented with the application of its contents to the essentials of the design of electrical machinery. At the end of the work is an excellent reference to the equivalents used in formula, and an excellent index completes the work.

CYRIL SYLVESTER.

BOOKS RECEIVED.

"Journal of the Institution of Electrical Engineers." Vol. 66, No. 382. October. (London: E. and F. N. Spon.) 10s. 6d. net.

"Creative Education at an English School." By J. Howard Whitehouse. (Cambridge: University Press.) Pp. xi+167. 16s. net.

"Electrical Transmission and Distribution." Edited by R. O. Kapp. Part I. (London: Sir Isaac Pitman and Sons.) Pp. 64. 1s. net.

"Elements of Alternating Currents and Alternating Current Apparatus." By J. L. Beaver. (London: Longmans, Green and Co.) Pp. xii+393. 18s. net.

"Ultra-Violet Radiation and Actinotherapy." By Eleanor H. Russell and W. Kerr Russell. 3rd edition. (Edinburgh E. and S. Livingstone.) Pp. 648. 21s. net.

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MARINE ELECTRICITY—FURTHER PROGRESS.

The Increasing Attention of the Shipping World towards Electricity for Propulsive and for Auxiliary Purposes is Reflected in Recent Developments and Contracts—The Lesson of the "Celtic."

By A. C. HARDY, B.Sc., A.M.I.Mar.E. (Author of "Merchant Ships Types," etc.)

IT is gratifying for those interested in marine electricity to note that whereas even two years ago, an electrically-propelled ship was regarded as a somewhat rare specimen, orders are being placed fairly frequently to-day for such ships. It is customary always to suggest that America is the home of marine electricity. This is a platitude which close examination shows to be justified on only two counts. The first is that electricity is being applied in America to some spectacular ships (i.e., to ships of the large liner type which necessarily attract notice). The second is that the large number of harbour and shallow water craft so necessary to American domestic navigation are, in many cases, essentially adaptable to electric propulsion.

Conditions in Europe.

In Europe, and particularly in Great Britain, we have fewer harbour craft of the ferryboat type and even our tugs have less broad duties to perform, when contrasted with the myriad duties that a New York harbour tug carries out. And, in order further to kill our platitude, we may mention that the proportion of electrically-propelled tugs in the big American harbours, in proportion to the total number of all propulsive types, is not high. There are some large well-equipped railway-owned vessels, and these have naturally attracted a great deal of attention.

America is a fruitful, or rather a potentially fruitful, source for the man who is marketing electric propulsion by reason of the fact that the marine world in America is definitely receptive to the electrical idea. The marine electrical firms, too, are in that country very closely in touch with the shipping interests.

Signs are not wanting, however, that a similar state of affairs is rapidly coming into being in Europe. The trials of the big P. and O. ship "Viceroy of India," will unquestionably rivet the attention of the shipping world upon electrical propulsion. In many ways the "Viceroy of India" will attract more attention in this country than the recently completed electric tanker "Brunswick," because the latter being an American ship, will not have such a personal contact with British ports. She has, it may be mentioned, proved remarkably successful in operation.

It is, perhaps, significant of the more general acceptance which is being given to electrically-propelled ships in this country that in very few cases was the "Brunswick" hailed as anything out of the ordinary.

Also we may recall that there is at present building in a European shipyard an electrically-propelled ship which is of epoch making importance. This ship is being constructed at Trieste for the Italian State Railways for their service across the Straits of Messina between Messina and Reggio. She is important because she is the first large electrically propelled railroad (as contrasted with vehicular) ferryboat, and because, dimensionally, she will be comparable with a series of direct Diesel driven ferries in various parts of the world—on the Parana River and on the Danish main line route between Esbjerg and Copenhagen.

This electrically-propelled ferry is a large ship—of more than 4 000 tons load displacement. She has a length of 362 ft., a beam of 55·5 ft., and a draught of 12·4 ft. A loaded service speed of 15½ knots is to be given by twin screw electric propulsion, each propeller being driven by a 2 250 H.P. electric motor. The motors take current from three generator sets, each driven by a 2 000 H.P. four-cycle single Burmeister and Wain Diesel engine. Each of these engines, of course, drives a generator and an exciter, which arrangement enables power to be obtained for auxiliary purposes—lighting, steering, etc. For port use there is a standby generating set driven by a 250 H.P. engine.

What are the advantages of such an electric ship? In the first place, standby losses, when the ship is tied up in her slip at either end, are almost eliminated. In the second place, maximum manœuvrability is secured and a fine range of propeller revolutions made possible by the electrical controls. This is always possible with electrical ships. I have seen the pilots of New York electrical ferryboats handling their ships just as a tram driver handles his vehicle in a traffic jam. The *sine qua non* for such a service is, of course, an engine of maximum reliability to drive your generator. The majority of Diesel engines give this service.

To American shipping we can turn again for the moment for an example, the only example in existence, as it happens, although it will soon be followed by two sister ships—of an electrically-propelled cargo vessel of 10 000 tons deadweight and of the shelter deck type. This is the "Courageous" of the U.S. Shipping Board. She has recently been converted from steam power to all-electric power. This fact, coupled with the fact that the bow portion of the vessel has been lengthened and remodelled and the stern redesigned and rebuilt, has caused a great deal of interest to be displayed in the conversion work.

Now, it is beginning to become an accepted fact that while electricity is to-day a necessity on all ships, except tankers, for auxiliary purposes, there are certain ships to which it does not specially lend itself for main propulsion. The ordinary freight-carrying ship is one of such ships. Her auxiliary load is not high, and there are perfectly suitable prime movers—both steam and Diesel—which make direct propulsion a more economical proposition. Where high auxiliary loads are the rule and where it is desired to apply the economies of the Diesel engine to total powers of above about 27 000 H.P., then electrical powering is a necessity.

There has, therefore, been levelled against this latest Shipping Board conversion a good deal of criticism—on grounds of first cost, and on grounds of impracticability. Because, at face value, both criticisms are justified, it is not without interest to mention two contributory causes to the scheme adopted. Marine electrical engineers will regard it as a good testimonial to the type of prime mover they are marketing, that Mr. Wm. Francis Gibbs (naval architect in charge of the work) considered the electric motor as the most suitable form of prime mover to turn at the necessarily slow r.p.m. the single propeller used in conjunction with the redesigned stem.

The required r.p.m. were between 70 and 80 and the propeller shaft is driven by a double armature motor of about 4 000 H.P. The speed of the ship, as converted, it should be mentioned, is in the neighbourhood of 13½ knots loaded. This increase from 11 knots has been made possible by the structural (hull) alterations, and on that count the money spent is justified. The motor, it may be noted, is located in the main engine room, and not aft in the hold with the consequent elimination of the shaft tunnel.

Cargo Space.

It is found that the elimination of the shaft tunnel in electrically propelled ships does not, as was at first anticipated, contribute greatly to the cargo carrying space. Also the inconvenience of having the motor room isolated from the generator room and only accessible the one to the other by means of a walk along deck is, in times of bad weather, considerable. This, I have always understood, was especially found to be the case on the United Fruit Co.'s "La Playa," the first large Diesel-electric ship built in Great Britain.

It was considered also that the adoption of electric drive in the "Courageous," would enable the manufacturers of the main engines to mass-produce twelve units (four per ship for three ships) instead of unit-producing three units of big long stroke type. The cost of doing this in America is almost prohibitive.

So that, first and last, it should be realised that these Shipping Board electric conversions are special cases, although classical cases in their way. In line with modern practice, of course, their auxiliary deck machinery has been electrified also. This latter point is one with many advantages. Quickness and deftness of cargo handling left aside, another great advantage accruing from electricity for deck auxiliary purposes was sharply outlined by the recent fatal stranding of the White Star liner "Celtic." The engine room was flooded, which naturally left the ship without power. Before power could again be applied to the ship's winches to discharge cargo

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over the side of the stranded hull into coasters, big boilers had to be transported from Liverpool in salvage ships, laboriously hauled on board and fired. Emergency oil engine generator sets on deck high above the water line would have enabled power to be transferred to the winch circuits, and cargo discharge to begin as soon as the coasters were ready.

This is a ready illustration of the ubiquity of marine electricity, as well as of its flexibility. It seems unquestionable that within the next few years, all but the cheapest and most conservative of ships will have electric deck auxiliaries, and many of them probably electrical steering too. Apropos of which it was gratifying to note that Sir Alan Anderson, chairman of the Orient line, trading between London and Australia via Suez, was warm in his praises of electricity for auxiliary purposes at the recent annual meeting of the company. He stated that his company had always sensed its possibilities, and, incidentally, they were among the first to use electricity for actually steering ships.

Since I contributed my last review of marine electrical progress, definite confirmation has been made of the fact that the new White Star mammoth will be electrically propelled, the ordering by Grace Lines of a ship for the South American service, the building of a big electric train ferry for Italy, and the approaching completion of the " Viceroy of India," . . . all these facts tend to show that marine electricity has passed beyond the embryo stage. These further notes show, in general terms, something of the far reaching effects of this development. Marine electricity is a new industry with great potentialities.

HIRE AND HIRE-PURCHASE.

Interesting Discussion at E.D.A. Conference—Better to Sell Than Hire Domestic Appliances—Extensive Business Done in Beckenham—Importance of Maintenance.

THE discussion at the London E.D.A. Conference on December 21st, related to hire and hire-purchase in electrical development schemes, a paper on the subject being presented by Mr. J. E. Tapper. Mr. A. C. Cramb presided.

Mr. Tapper said that with the exception of such apparatus as water heaters and cookers, it was better to sell, by cash or hire-purchase, than to hire domestic electrical appliances. In Beckenham 3 200 irons had been put out among 6 200 consumers without the necessity for hire, and when it was realised that on an average of three hours' use per week, these consumed 250 000 kWh a year, it was obvious that the business should be secured by any means.

Hire-purchase had become such a recognised method of purchasing that we were more or less driven to it. A man who had bought a new house and new furniture on the deferred payment system generally found that after he had paid his deposits and lawyers' fees he could hardly afford electrical fittings even of the plainest possible type. The electricity supply authority could not permit a brand new house, with brand new furniture, to be ruined by the fixing of hideous plain pendants and opal shades, nor would the authority's canvasser fail to draw attention to the advantages of electricity for heating, the use of a vacuum cleaner, a floor polisher and a refrigerator. It was quite beyond the capacity of the consumer to purchase outright, and the only way to secure the business was for the supply authority to assist. Whatever one's views as to the ethics of this method of conducting business, there was not the least doubt that it assisted in selling electrical goods and units. If no deposit, or only a very small one, was asked for in respect of goods sold on hire-purchase there was danger of the goods being returned considerably the worse for wear, having been kept probably only three or four months, with only an insignificant amount paid thereon. In the case of such goods as vacuum cleaners, he did not enter into a hire-purchase agreement, but dealt with the transaction as a definite sale, allowing the consumer to pay by instalments over an agreed period. This was best described as a " deferred payment " system. Whilst the authority could exercise discretion as to the acceptance of the return of goods, this method enabled them to refuse the return of badly used apparatus and to sue the purchaser for payment in full.

The Discussion.

The CHAIRMAN said his experience was that when consumers hired apparatus they did not take care of it.

Mr. BRYANT submitted that the present method of charging for the hire of cookers and for energy consumed was wrong. Hire rates were cut to a low figure and the supply authority hoped to recoup itself by the surplus on the sale of energy. In a fairly representative case a standard size cooker would rent at 10s. per quarter and energy would be sold at 1d. After making due allowance for overhead charges and maintenance, that boiled down to about 0·6d. per unit for energy. It would be more satisfactory to charge 0·6d. for energy and to increase the hire charge, perhaps to £1 per quarter. That might hold up the cooker business to an extent, but he believed the present position of the industry to be strong enough to enable such an arrangement to be adopted ; when the consumers appreciated the benefits of the lower price of energy, the cooker business would progress more quickly than ever before. The present system introduced a gambling element, for if the consumer did not use the amount of energy anticipated, the supply authority lost, but if more energy were used, the consumer paid through the nose.

Mr. J. LEADBEATER pointed out that if a cooker had been hired for a year and was thrown back on to the hands of the supply authority, difficulties arose, because no one wanted a second-hand cooker. He had found it advantageous to introduce a free maintenance scheme, even for cookers on hire-purchase, for a period of, say, three years. In fixing a price for hire, many engineers debited the revenue from the consumer first with the cost of maintenance and interest charges, and took what was left for energy, but he considered it was more correct to debit the consumer with the cost of the units first, and see what was left over for maintenance and interest.

Attractive Tariffs.

Mr. F. SELLEY said that in regard to hire and hire-purchase, the electrical industry could not do better than follow the lead of its competitors, who installed apparatus either on hire or hire-purchase and had built up a big business thereby The first essential to a successful hire and hire-purchase scheme was an attractive tariff.

Mr. L. E. BUCKELL urged the importance of maintenance of apparatus, whether hired, bought by hire-purchase, or bought for cash.

Mr. MORTON said that the trader was well advised to push hire-purchase sales, because that was often the only means of getting cash. Hire-purchase, coupled with good selling methods, produced business.

Mr. W. RITCHIE saw no reason why a supply authority should take the responsibility of third party risk in respect of hired apparatus ; surely it could safeguard itself in its agreements. The initial payment on hire-purchase apparatus should on no account be less than the amount of the salesman's commission ; the period of repayment should be within a year, if possible, because that was the guarantee period, and the supply authority was relieved of maintenance.

Lieut.-Col. W. A. VIGNOLES, drawing attention to the immense business that could be done by means of hire and hire-purchase schemes, said that between 1925 and 1928 the rate of increase of consumers connected and of units sold in Beckenham was greater than in the previous years, and that increase in the latter years had coincided exactly with the adoption of hire-purchase.

The CHAIRMAN deprecated the smug satisfaction of some electrical people who held that electricity would sell itself ; that view, he said, was perfectly ridiculous. If supply authorities had not an outside staff, it was time they handed over the electricity supply to someone else. He emphasised the value of proper service, particularly in regard to cookers. At his works a man was on duty until 1 o'clock on Sundays, ready to go out at once on receipt of a telephone message that a breakdown of a cooker had occurred. In the afternoon the mains department took over that work.

Mr. TAPPER, in his reply, said he did not consider it advisable to sell cookers by hire-purchase, because they must be maintained properly, and the only way to carry on the cooking business satisfactorily was to maintain throughout. He saw no reason for hiring irons or even radiators, for they could be bought at quite low prices. Hired apparatus could be bought subsequently at Beckenham either by hire-purchase or for cash, and quite a number of installations originally hired had been sold.

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THE MAINTENANCE OF MECHANICAL OSCILLATIONS BY MAGNETOSTRICTION.

Further Investigations of the Longitudinal Vibration of Ferro-magnetic Bars—Directions for Performing the Isolated Peak Experiments.

By J. H. VINCENT, M.A., D.Sc., M.I.E.E., F.Inst.P.

(*Concluded from Vol. CI, page* 731.)

EXPERIMENTS IN WHICH BAR IS IN THE FIELD OF A COIL WHICH IS IN SERIES WITH THE MAIN INDUCTION COIL.—A very flexible and useful method of experimentation is to insert the coil surrounding the bar in the circuit of the main oscillator in series with the induction coil, that is between points *B* and *C* in Fig. 2 (see THE ELECTRICIAN, Vol. CI, page 729). It should be arranged that the coupling of the grid coil with the induction coil is variable over a wide range. The polarising field may as before be due to a separate polarising current, the permanent magnetism of the specimen, or to an electromagnet. The last arrangement is probably the most convenient.

A bar of iron or steel or nickel long enough to produce an audible note when vibrating longitudinally will give an intense sound if the alternating current of a carefully tuned valve set be sent round a couple of turns of insulated wire wrapped round the middle of the bar.

The variations of the grid current as the set is tuned through resonance depend very greatly on the grid coupling, and the ratio of the inductances of the main coil and the coil surrounding the bar. If the coupling is not very small and the above ratio large, the grid current curve dips as the set is tuned through resonance. With very loose grid coil coupling and few turns round the bar a curve giving the deflections of the grid galvanometer as a function of the main condenser shows a high peak at resonance flanked on the high capacity side by a very sudden fall to a minimum which is followed by a slight and gradual rise until the set ceases to swing when the capacity has been increased sufficiently. Over the steeply falling part of the curve only the bar vibrates with its own frequency.

But with the same main induction coil when the grid coupling is reduced and the number of turns round the bar is increased, the passage through resonance is shown by a peak which may, by cautious reduction of the grid coupling, be quite isolated, being flanked in either capacity direction by a region in which the set does not oscillate. In the immediate neighbourhood of this peak on the grid current curve, if the bar is long enough to make the experiment practicable, a slight blow on the end of the bar will cause oscillation which is indicated by the grid galvanometer and by a slowing fading sound if the observer can perceive the frequency of the sound evoked.

With the arrangement described above, if the fundamental of the bar is in the limits of audition, momentarily switching on the high tension battery or joining the connection of the induction coil produces a surprisingly loud note as if the end of the bar had been struck a hard blow.

Frequency of Oscillations.

Starting with the grid galvanometer at its maximum deflection if the capacity be slowly increased the intensity of the sound decreases until the oscillations cease. For higher capacities the assemblage will not oscillate. If starting again at the top of the peak one decreases the capacity the oscillations also die out provided the grid coupling is small enough. If, however, the capacity be further reduced the set will finally oscillate again and the bar will either oscillate under forced vibration or will, at the appropriate settings of the condenser, resonate to those higher modes in which the mid-point of the bar coil is a node. Three points about this method of maintenance are of particular interest

(*a*) The frequency of oscillation throughout the peak region is that dictated by the bar. It is independent of the setting of the condenser.

(*b*) Clamping the bar renders the set incapable of oscillation.

(*c*) Cutting off the polarising field has the same effect.

If the number of turns surrounding the bar be slightly less than the number required to exhibit (*a*) then the peak is flanked by two ranges in which the set and bar will oscillate with slightly different frequencies from that of the top of the peak. In this case on switching on the high tension battery beats are heard.

Similar effects are produced if the polarising field is sufficiently intense.

It may not be out of place to give a few directions to anyone wishing to perform these isolated peak experiments for the first time. Use a round bar of nickel of from a half to three cms. diameter and from a half to a metre long. It is a great help at first to work at audio frequency. The coil which surrounds the middle of the bar should be wound on a former a few cms. long having an aperture through which the bar can slide easily. This former supports the bar which is not clamped and is wound with the highest number of turns of wire which will allow the valve set to oscillate when the coil is placed in series with the induction coil of the set with the bar in position and the polarising field on. This field is conveniently provided by an electromagnet with bored pole pieces. The former of the bar coil rests on a stand between the arms of the magnet and the bar passes through the holes in the poles, ample room being provided in order that the bar shall not approach anywhere too closely to the pole pieces.

Approximate Tuning.

A rough calculation of the fundamental frequency of the bar enables the set to be approximately tuned by means of a wave meter. It is necessary to have the coupling between the grid coil and the main induction coil finely adjustable. The coupling is reduced until the grid current is measured in micro-amperes when using a 20 W bright emitter valve and no grid bias. If all is well the set will cease to oscillate before the capacity has been increased enough to tune in to the frequency of the bar. On further increasing the capacity the set will oscillate and the bar sing with its own frequency. When near the right conditions tapping the end of the bar will produce a temporary deflection of the grid galvanometer which increases as the tuning is changed in the right direction.

With the nickel bars used for Table 2, the following results for frequency were obtained :—

TABLE 3.

Length.	Frequency.
100 cm.	2 520
50 „	5 010
25 „	10 050
12·5 „	19 800

A pair of conical pole pieces were bored to take an ebonite tube in which nickel bars 1·26 cm. in diameter fitted loosely. The central part of this ebonite tube carried the former of the bar coil. With this arrangement the following results were obtained for the frequency of nickel bars 1·27 cm. in diameter :—

TABLE 4.

Length.	Frequency.
100 cm.	2 570
50 „	5 140
25 „	10 250
12·5 „	20 400

It will be noticed that the frequencies are higher than those corresponding in Table 3. This is due to some difference in the constitution of the material. It was found on testing that the nickel bar of smaller diameter was distinctly sharp on the thicker bar.

Using nickel bars of 1·27 cm. diameter with a smaller main induction coil and a bar coil of more turns the readings shown below were obtained.

TABLE 5.

Length.	Frequency.
25·5 cm...	10 250
12·5 „	20 350
6·25 „	40 700
3·125 „	80 200

The bars were in the condition as bought and not turned up true. It was found that the frequency was to a close approximation independent of the number of turns in the bar coil and of the polarising field provided that the ends of the bar were well within the tubes in the pole pieces. Keeping all else the same, the frequency as found by the wave-meter

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was inversely as the length, as shown below. The bars used were cut from the same rod of nickel.

TABLE 6.

Length.	Frequency.	Product.
3·135 cm. ..	80 000 ..	250 800
3·000 ,, ..	83 600 ..	250 800

In order to continue these experiments towards higher frequencies a pair of conical bored pole pieces were made of mild steel with the holes through them large enough to admit freely a certain piece of glass tubing. This tubing was chosen so as to be an ample fit for nickel rod of diameter 0·635 cm. Each pole piece had a flat worked on it which was in contact with the core of the electromagnet and a longitudinal slot was cut through the wall of each pole piece with its plane at right angles to the flat. These slots enabled the little nickel bars to be seen in position in the glass tube and also served to lessen loss from eddy currents. Coils wound on separate formers were tried and worked well, but these were soon abandoned in favour of a coil of 140 turns of No. 38 D.W.S., wound on the middle of the glass tube by hand, which worked better. Short bars of nickel were readily maintained in oscillation in the glass tube. The specimen is simply put into the tube and due to the residual magnetism in the electromagnet or to the effect of the field when the current is switched on, it slips into a symmetrical position. The pole pieces are adjusted at such a distance from each other that the ends of the vibrating bar are well within their axial tubes. Two points may be mentioned as likely to save a little trouble to anybody repeating these experiments. The shorter the bars are the less must be the polarising field. Calculations of the expected frequency will be found very unreliable unless care is taken to prepare specimens of uniform cross section. For example, a frequency much greater than that calculated from the length will be given by a bar which during preparation has been inadvertently given a diameter slightly less at the ends than at the middle.

Using this method and employing parts of a rod of nickel 0·635 cm. in diameter not specially turned up true as vibrators, higher frequencies were obtained. It was found that the frequency for a bar 3 cm. long was the same as given by employing the 140 turn coil as when using a coil of 450 turns on an ebonite former. The frequency in this case was also sensibly independent of the polarising field, which, in order to get the characteristic isolated peak, had to be small.

Other results are shown in the following table :—

TABLE 7.

Length.	Frequency.
3 cms.	86 500
2·5 ,, ...	104 000
2·0 ,, ...	126 000
1·5 ,, ...	167 000

It will be noticed that the products of the numbers in the two columns are not constant. This is probably due to the specimens not being truly cylindrical.

Working with Shorter Bars.

In order to work with shorter bars it was found necessary to decrease the inductance of the main induction coil. When this was done a bar of the same section 1 cm. long gave the isolated peak effect quite well, the corresponding measured frequency being 257 000, which was higher than that to be expected for a cylinder of this length. It was found to be thicker at the middle than at the ends.

The effect of clamping these short rods, while showing the isolated peak effect, is, as with those of audio-frequency, to stop the electrical as well as the mechanical vibrations. These short nickel rods will vibrate at their old frequencies after being annealed by boiling in oil.

If the distance between the narrow ends of pole pieces is equal to, or is only a little less than, the length of the bar so that the pole pieces either do not overlap the ends of the bar or the overlap is very small, then the frequency is not even approximately independent of the field, the frequency being higher for greater field intensity.

An accurately cylindrical bar of "silver steel" 2·99 cm. long and 0·635 cm. in diameter was used in similar experiments. With much stronger polarising fields than those used with nickel a distinct peak was shown on the grid current curve. The velocity of propagation of longitudinal waves in this bar was approximately 5 160 m. a sec. and was sensibly independent of the polarising field. The effect was not so distinct as with nickel and the complete isolation of the resonant peak was not effected.

A nickel bar of about the same length, accurately cylindrical and of the same diameter, gave a velocity of 5 000 m. a sec. in a field in which the isolated peak was obtained.

Short bars of nickel and of "silver steel" will vibrate in higher modes. Accurately round bars of both these material 0·635 cm. in diameter and about 3 cm. long were found to give peaks on the grid current curve at frequencies three times as high as the fundamental. The resulting factor was accurately three within the limits with which the frequencies could be determined by the wave-meter. The tuning was in each case to the top of a peak the complete isolation of which was not possible. The bar coil was kept in the centre of the bar so that the bar vibrated first in its fundamental mode and then in its mode with three nodes. The experiment was not difficult with the nickel bar but the effects with the steel bar were very much less marked. With the same apparatus a nickel cylinder 0·9 cm. long and 0·638 cm. in diameter resonated well at a frequency of about 270 000. Probably much higher frequencies could be obtained from thinner and shorter bars by modifying the apparatus.

I have great pleasure in thanking my students Messrs. Lloyd, Hoban and Morris and also Messrs. Clements, Alexander and Sutton of the L.C.C. Paddington Technical Institute, London, for assistance. In particular I am indebted to Mr. Sutton, who has helped me in making all the observations.

[NOTE BY AUTHOR.—The above paper was written before seeing Prof. Pierce's memoir entitled: "Magnetostriction Oscillators: An Application of Magnetostriction to the Control of Frequency of Audio- and Radio-Electric Oscillations, to the Production of Sound, and to the Measurement of the Elastic Constants of Metals," published in the Proceedings of the American Academy of Arts and Sciences for April, 1928. This is a magnificent paper of fifty pages giving accurate data obtained by the detailed study of the behaviour of many metals and alloys when used as magnetostriction oscillators, the application of these methods to the frequency measurements of the highest refinement and a mathematical treatment of the propagation of longitudinal vibrations in a viscous magnetostrictive medium.—J. H. V.]

THE JOHN BENN HOSTEL.

Christmas Celebrations in the East End.

THE real Christmas spirit of gay festivity and active service prevailed at the John Benn Hostel for East End lads, a number of whom had never before enjoyed a real Christmas. Some 60 boys were in the Hostel over the holiday and, together with residents, they went through a programme that left little time for anything but eager activity. The first corporate act was attendance at early service, and later followed inspection of the "dorms," with attractive prizes for the winners. Christmas dinner was served with full ceremony and not a little fun. It was particularly pleasing that the expenses of the day were materially contributed to by the lads themselves, entirely on their own initiative. There were useful gifts for all, countless competitions, and the full fun of the typical family party. The staff were responsible for the complete production of the play staged in the Milner Hall, and later, at the sing-song, individual talent among the lads was encouraged. The close of a long day was a short voluntary service which secured a most gratifying attendance.

Boxing Day gave opportunities for further games, sports, and festive meals in which staff and lads gave equally willing service.

POINTS OF VIEW.

"We are in the midst to-day of an industrial revolution as important as that which occurred a century ago."—*Mr. Baldwin.*

* * *

"Our task must be to see to it that human conditions do not suffer because of invention, or development remain uncontrolled."—*Mr. C. T. Cramp.*

* * *

"From an economic point of view electricity has either to be very much cheapened or yield to the less vaunted but cheaper gas power."—*Mr. Alexander Leith.*

* * *

"Every favourable comment on the enterprise and up-to-dateness of a gas undertaking is a nail in the coffin of the idea that gas is a declining and doomed industry."—*Mr. H. E. Bloor.*

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NEWS IN BRIEF.

Barton Power Station—Commemoration Dinner of Whitworth Society—Paisley Engineers—The P.M.G. and Telephone Poles—Assisted Wiring Schemes—Tramway Salesmanship

IT is proposed to floodlight Edinburgh policemen on point duty.

Stretford Electricity Committee is seeking a site for an electricity showroom in the Old Trafford district.

The magistrates of Glasgow have decided to carry out an experiment in automatic traffic control in the streets.

The Ericsson telephone factory at Vysocan, near Prague, has been damaged by fire to the extent of 6 000 000 kroner.

Axminster Board of Guardians has accepted a tender amounting to £112 for the electric wiring of the institution.

On December 17th a Christmas entertainment to 550 poor children took place at the Carisbrooke Road depot of the Liverpool tramways department.

It is proposed to instal several automatic telephone exchanges in Bucarest. One is already in use.

South Shields Electricity Committee has decided to borrow £5 000 for its assisted wiring scheme.

An extension of the electric lighting facilities in the King's estate at Balmoral is at present being carried out.

Stone (Staffs) Board of Guardians has decided to have the institution equipped for electric light, at an estimated cost of £200.

Glasgow Corporation Health Committee has asked a sub-committee to consider and report on a proposal for an electric lighting installation at Shieldhall Hospital.

Four charge engineers, four boiler-house engineers, four switchgear control room operators and four assistant switchgear control room operators are required by the London Power Co., Ltd.

Salford Corporation has been recommended to place a contract amounting to £2 275 for foundations and flooring and erection of structural steelwork for No. 4 turbo-alternator at Agecroft power station.

Contracts have been placed for alterations and extensions to Burnley electricity offices and the construction of electricity workshops and stores. An expenditure of £7 860 is authorised for these works.

There is a vacancy for a chief repair shop and maintenance foreman at the power station of the Great Indian Peninsula Railway, Kalyan, near Bombay.

At the meeting of the Midland Branch of the Association of Mining Electrical Engineers at Nottingham, on December 22nd, a paper was read by Mr. G. W. Grice on "Heating Troubles Encountered by the Colliery Electrician."

The sixth annual commemoration dinner of the Whitworth Society was held at the Holborn Restaurant, London, on December 21st, Mr. F. H. Livens in the chair. Mr. W. H. Fowler was elected president for 1929, and will take office at the summer meeting to be held in Manchester in July. The date of the next annual commemoration dinner will be in March, 1930.

A meeting of the members of the Paisley Association of Electrical Engineers was held on December 18th, Mr. J. R. Bisland, president, in the chair. The lecturer was Mr. A. W. Johnston, and he took as his subject, "Some Notes on Pulverised Fuel." A discussion was entered into by Messrs. Murray, Steel, MacLean, Thom, Bruce, Heys, Kerr, Bisland, May, Brown, Kayes, Hutchison and Hamilton.

A rural telephone exchange has been opened at a farmhouse at New Craig, near Wartle, Aberdeenshire.

Stoke Newington (London) Electricity Committee recommends the supply of electric cookers on the hire system.

Seaham Harbour Electricity Committee has received sanction to borrow £3 000 for its assisted wiring scheme.

Weymouth Electricity Committee is obtaining sites for substations in connection with the supply to Upwey and Wyke Regis.

The Commissioners of His Majesty's Works, etc., have invited tenders for the erection of a telephone exchange at Sunbury, Middlesex.

A new hire-purchase system in connection with wiring installations for private houses and other premises is to be put into force at Hereford.

Bedford Electricity Committee has reconsidered the question of the appointment of a lady demonstrator to give instruction on electric cookers.

The Postmaster-General denies the report that the G.P.O. intends buying 300 000 telegraph poles direct from the Polish State forests, instead of through intermediaries.

In his annual letter to the staff of Glasgow tramways department, Mr. L. Mackinnon, general manager, says they should adopt every desirable improvement in the means of transport and cultivate the art of salesmanship.

The Borough Electrical Engineer of Barnsley has submitted to the Electricity Committee a plan showing proposals for floodlighting an advertisement on the cooling tower at the electricity works as a cost of £85, and the Committee recommends that it be approved.

The Postmaster-General announces that a new issue of the London Telephone Directory is in course of preparation. Anyone contemplating the installation of a telephone and wanting a place in the new directory should give his order before January 9th.

Shipley Electricity Committee has received a claim on account of wireless apparatus rendered useless by the change-over from d.c. to a.c., and has referred it to a sub-committee, with power to settle.

With reference to our comments in last week's issue on page 728 under the title "Smoke and Electricity," Mr. H. C. Lamb has pointed out that the paragraph may convey a wrong impression. In order to make certain that there shall be no misunderstanding however, we would point out that the smoke alluded to was, of course, the sulphurous fumes referred to in the legal column in the same issue and not to coal smoke.

At a meeting of the Institution of Civil Engineers, on January 6th, Mr. H. H. Dalrymple-Hay will give an address entitled "Merits and Demerits of Alternative Methods of Taking Water for Modern Power Stations from Tidal Waters." At a students' meeting on January 9th, Mr. Archibald Page will deliver a lecture on "The Development of the Generation and Distribution of Electric Power in the British Isles." A students' visit to Deptford power station has been arranged for January 12th.

ONE of the greatest engineering works now in progress in Great Britain is the water power scheme for the British Aluminium Co.'s new factory near Fort William. The scheme has involved the construction of a tunnel through Ben Nevis, through which water will be conveyed from Loch Treig to a point 600 feet above Fort William, and thence in pipes 5 feet 9 inches in diameter to the power house.

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LEGAL INTELLIGENCE.

S. G. Brown *v.* Lektophone in Loud Speaker Litigation.

MR. Justice Tomlin, on December 19th, resumed the hearing of the action by the Lektophone Corporation against S. G. Brown, Ltd., for an injunction restraining alleged infringement of the Hopkins patent for sound reproducing machines.

Mr. W. H. Ballantyne, witness called for the defence, said the plaintiffs' patent was indexed at the Patent Office under "phonographs, gramophones, and the like sound-producing and reproducing instruments," and not under the headings where loud speakers were generally found.

In cross-examination, Mr. Trevor Watson suggested that the "Mascot" loud speaker was first shown at the wireless exhibition in 1927.

Sir Duncan Kerly, K.C. (for defendants), said it was put on the market at Christmas, 1925.

Mr. Ballantyne said he might have heard of the Hopkins patent before 1927, but he remembered that in 1927 the campaign of advertising in regard to licences began. He knew that the plaintiff company had a working arrangement with Standard Telephones and Cables, Ltd.

Mr. Stafford Cripps, K.C., summed up the case for the defence. He said Hopkins's patent, and the tests which had been made, had no bearing whatever upon whether these loud speakers were useful for the purpose for which they were designed, viz., the reproduction of music. There was no suggestion that the form of cone shown in Hopkins's specification was more advantageous than any other.

Mr. Whitehead, K.C., replied on behalf of the plaintiffs. He said the case against him had proceeded from beginning to end on the fallacy that a patent could be destroyed by agglomerating bits from a number of other documents. The law did not allow a patent to be destroyed in that manner. He contended that Hopkins had described and claimed an article which was incontestably new.

His lordship on December 21st reserved judgment.

Electric Signs.

In the King's Bench Division, on December 17th, Mr. Justice Humphreys heard an action in which the Empire Palace of Varieties, Middlesbrough, sought to obtain a declaration that two electrical numerical signs erected by the Electrical Name and Numerical Sign Co., Ltd., of Little Newport Street, London, were the property of plaintiffs. Further, they asked for the return of £130, money paid to the defendants by mistake.

Mr. Fredk. Grant, for the plaintiffs, said the two signs were erected on either side of the stage in the theatre, and indicated to the audience the number of the next "turn."

Giving judgment, Mr. Justice Humphreys held that there had been no acceptance by the plaintiffs of the contract, and they were not entitled to a declaration. The plaintiffs had also failed to satisfy him that the payment of £130 was made by them in mistake. Judgment was entered for the defendants on the claim and counter-claim—£3 5s. for repairs.

Mr. Justice Eve, in the Chancery Divison, on December 10th, confirmed the reduction of capital of the Tungsten Manufacturing Co., Ltd., from £150 000 to £39 330.

Mr. Gedge, for the company, said the reduction was necessary because of a loss in the value of certain assets. The shares which were to be reduced were really founders' shares.

His Lordship: "I think it is all in order."

Mr. Justice Eve, in the Chancery Division, on December 10th, confirmed an alteration of the articles of association of Falk, Stadelmann and Co., Ltd.

Mr. Farwell, K.C., for the company, said they wished to extend their objects. The company was incorporated in 1887, and began in a modest way, with a capital of £10 000; it was now £1 100 000. The only extension asked for was with regard to wireless apparatus. The company wanted power to carry on a wireless business, which could be conveniently carried on with its existing business.

His Lordship: Take your order.

Mr. Justice Clauson, in the Chancery Division on Tuesday, December 11th, granted to the British Thomson-Houston Co., Ltd., an injunction restraining J. Solomon and Sons and S. Solomon, of Clarence Road, Gorleston-on-Sea, Yarmouth, from infringing the plaintiffs' patent for gasfilled electric lamps, an inquiry as to damages, costs, and delivery up or destruction of the infringing lamps.

There was no defence.

PERSONAL.

MR. J. T. Mould has been elected chairman of the R.M.A. Executive Council and Mr. R. B. Weaver vice-chairman.

Ald. G. B. Brooks has been appointed chairman of Marylebone Electricity Committee.

We congratulate Captain Wedgwood Benn, M.P., brother of Sir Ernest Benn, upon the birth of a son on December 30th.

Mr. J. F. Edgecombe has been promoted to the rank of Commander in the W Division of the Metropolitan Special Constabulary Reserve.

Mr. W. Forbes, manager of Aberdeen Tramways Department, has been recommended for appointment as manager of Cardiff tramways at a salary of £1 150, in succession to Mr. R. L. Horsfield.

Estate of the gross value of £2 153, with net personalty, £1 565, was left by the late Mr. Charles Guthrie Conradi, managing director of Electromobile (Leeds),Ltd., who died aged 50 years.

Edinburgh Transport Committee has recommended that Mr. F. A. Fitzpayne, assistant transport manager, be appointed manager of the Transport Department, in succession to Mr. R. Stuart Pilcher.

Mr. H. C. Parsons, sales engineer, with Newtons, of Taunton, is leaving after over 20 years' service, to take up an appointment with the British Electrical and Allied Manufacturers' Association. He has been presented by the staff at Taunton and the London office, to which he was recently transferred, with an eight-day clock.

At their meeting on December 19th, Blackpool General Purposes Committee approved a recommendation of the Salaries Committee that the suggested increase in the salary of Mr. C. Furness, electrical engineer, from £1 250 to £1 600 per annum, be deferred until the transport policy of the Corporation was finally decided.

Estate of the gross value of £90 909, with net personalty, £90 103, was left by the late Sir Alexander Blackie William Kennedy, F.R.S., for some years Professor in Engineering in University College, London, afterwards consulting electrical engineer to various railway companies and municipal undertakings (acting in that capacity for the London County Council in the founding of the electric tramway system), chairman of the Electric Railway Advisory Committee of the Ministry of Transport, who died on November 1st, aged 81 years.

Mr. W. J. Jones has been appointed manager of the E.L.M.A. Lighting Service Bureaux in succession to Mr. W. E. Bush. Mr. Jones was trained at the Technical College, Finsbury, under Dr. Sylvanus P. Thompson, taking the college certificate and Associateship of the City and Guilds Institute, and became senior student at the college. He joined the staff of Siemens Brothers and Co., Ltd. in their X-ray and appliances department, and later entered the electric lamp department of the same company. After having experience in charge of the works of A. C. Cossor, Ltd., he finally joined the staff of the E.L.M.A. Lighting Service Bureaux under Mr. W. E. Bush. He is an associate member of the Institution of Electrical Engineers and is on the Council of the Illuminating Engineering Society.

Obituary.

MR. JOHN LEE, on December 24th, aged 61 years, on board s/s "Laconia," east bound. He entered the Post Office service at Liverpool as a telegraphist in January, 1883, reached the grade of assistant superintendent in May, 1901; was transferred to headquarters as assistant traffic manager for telephone purposes in October, 1907; and rose by successive promotions to be deputy chief inspector of telegraph and telephone traffic in April, 1916. A short term as Postmaster of Belfast followed, and in 1919 he was brought back to headquarters as Controller of the Central Telegraph Office.

MR. ALEXANDER T. HOLLINGSWORTH. The world of technical publishing is a good deal the poorer by the death, which took place on Monday, of Mr. Alexander T. Hollingsworth, chief proprietor, and for many years the mainstay, of our contemporary "Engineering." Mr. Hollingsworth, who had reached his eighty-second year, is rightly regarded as a leader in the world of publishing. Entering the office of "Engineering" as a young accountant, he quickly achieved success as a journalist and publisher, a success on which he subsequently built other publishing triumphs, for he was chairman of Weldons, among several other concerns in which he was interested. We offer our sympathy to the family, and to the staff of "Engineering."

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BUSINESS ITEMS.

THE address of the Liverpool branch of PHILIPS LAMPS, LTD., has been changed to 25, Stanley Street.

Regarding the electric radiator referred to on pages 745 and 749 of our last issue, DOMESTIC ELECTRIFICATION, LTD., points out that the type reference should be R.C.F. in both cases.

BRITISH INSULATED CABLES, LTD., announce that they have transferred the commercial and counting house staffs at the Helsby Works to the registered office of the company at Prescot.

The ELECTRIC HEATING CO., of Croydon, has appointed The BEDFORD ELECTRO HEATERS, of Howbury Street, Bedford, as sole agents for Lancashire, and would be pleased to hear from other firms desirous of arranging agencies.

Richmond Board of Guardians has appointed Messrs. BREWER, SMITH AND BREWER, architects, to prepare specifications and supervise the work of rewiring the dining hall and laundry blocks of the Institution. Tenders are to be invited.

The WESTERN ELECTRICITY SUPPLY CO., LTD., Cairncross, Stroud, held an electrical exhibition at Dilton from December 17th to 19th as an official inauguration of supplies to the village. The exhibition was organised to enable the public to see demonstrations of electric cooking, ironing, cleaning, etc.

The ENGLISH ELECTRIC CO., LTD., Queen's House, Kingsway, W.C.2, has received an order from the Halifax Corporation Tramways for seven complete double-deck tramcars, with top covers, for mounting on 4-wheeled trucks. The electrical equipment will comprise double 50 H.P. motors, and will include controllers, type DK magnetic brakes, and Maley and Taunton's air-break attachments. In addition, the order includes a further six motors, six controllers and three magnetic brakes.

WILD-BARFIELD ELECTRIC FURNACES, LTD., Elecfurn Works, North Road, London, N.7, announce that by arrangement with Vickers-Armstrong, Ltd., they will be exhibiting a Vickers-Pyramid diamond hardness testing machine at the Physical Society and Optical Society Exhibition. They will also be showing at the Manchester Electrical Exhibition various types of electro-magnetic furnaces, high-speed steel furnaces, and an internally heated carburising furnace fitted with automatic temperature control.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs, have received orders from the G.P.O. for telephone cable between Preston and Blackpool. The distance is approximately 21 miles. This is the second cable that has been laid by this firm between these two points. They have also received an order for approximately 16 miles of telephone cable for the Isle of Man. These cables are to link up Douglas, Castletown and Port Erin with the mainland through the new submarine cable, which is shortly to be laid between Fleetwood and Douglas.

A new departure of great importance in trade journalism is announced by BENN BROTHERS, LTD., which recently acquired the business of William Agnew, Ltd., the publishers of "The British Trade Journal," among other papers. "The British Trade Journal" was the first export trade journal, and has led that field for the last sixty-seven years. Benn Brothers, Ltd., established thirty years ago "The Export World," which has had a highly successful career. It has now been decided that these two publications should join forces under the title of "The British Trade Journal and Export World." The first number of the combined publication, which will be larger, more comprehensive and more influential than any export journal ever published, will appear in February in good time for the business opportunities presented by the British Industries Fair.

Electric furnaces and baking ovens will be among the chief exhibits at the Industrial Electrical Exhibition at Belle Vue, Manchester, from January 7th to 12th. The Lord Mayor of Manchester (Lt.-Col. G. Westcott) will perform the opening ceremony on January 7th. Organised by the E.D.A., in conjunction with Manchester and Salford Corporations Electricity Departments and the Lancashire Electric Power Co., the exhibition will be open daily from 2 p.m. to 9 p.m., admission being free. The exhibitors will include the Metropolitan-Vickers Electrical Co., Ltd.; the Premier Electric Welding Co.; Marryat and Place; Wild-Barfield Electric Furnaces, Ltd.; the Leeds Electrical Construction Co., Ltd.; Birmingham Electric Furnace Co., Ltd.; Electric Furnace Co., Ltd.; Young, Osmond and Young, Ltd.; the British Resister Co., Ltd.; the General Electric Co., Ltd.; Ferranti, Ltd.; and Sulzer Bros.

IN PARLIAMENT.

Discussion in the House of Lords on the Imperial Telegraphs Bill.

IN the House of Lords on December 20th the Earl of Plymouth moved the second reading of the Imperial Telegraphs Bill, which had already passed through the House of Commons. He said that the Bill gave statutory authority for the sale of the Pacific Cable and West Indian Cable undertakings, at present managed by the Pacific Cable Board, and for the sale of the Transatlantic cables worked by the Postmaster-General. It was an essential part of the scheme for the reorganisation of the wireless and cable services proposed by the Imperial Conference last July. The problem the Imperial Conference had to face was how to preserve the cables while at the same time providing the beam service with the fullest opportunity for expansion. The Government came to the conclusion that the only solution lay in the amalgamation of all the wireless and cable undertakings, so as to secure unity of control and direction. The sale had been confirmed by the Imperial Cable and Wireless Conference, and the Government was satisfied that the arrangement was a perfectly fair one.

With regard to the Imperial Advisory Committee, of what benefit could it be in a matter of this kind? Was it in the least likely that such a committee would have anything like effective control? The Government was throwing away the most valuable public property without a single figure being given to justify its action.

The Earl of Plymouth said if this arrangement were not made the cable companies would have been crushed out of existence. The Government had come to the conclusion that it was absolutely necessary for the companies to be carried on.

The amendment was negatived, and the Bill read a second time.

Replies to Questions.

Telephones are installed at 38 rural railway stations in Devon.

The number of rural public telephone call offices in England and Wales is about 6 500.

The surplus on the telephone system was £3 713 379 for the year 1925-6, £3 961 735 for 1926-7, and £4 200 000 for 1927-8.

Main trunk and other telephone cables containing approximately 18 000 and 270 000 circuit miles of wire respectively have been provided in this country during the past 12 months.

On the information before him, the President of the Board of Trade does not think there are at present sufficient grounds for proposing legislation to compel ships to carry certified electricians, in addition to certified engineers.

The Minister of Transport is aware that statements have been made that American capital is employed in purchasing shares of companies interested in the electrical supply industry of this country. He does not contemplate the introduction of legislation on the subject.

The Board of Trade does not propose, at present, to make it compulsory for every passenger boat to carry at least one motor lifeboat fitted with wireless apparatus. The question will be considered next spring at the International Conference on Safety of Life at Sea.

The Electricity Commissioners have received representations from consumers regarding the Clyde Valley Electrical Power Co.'s new scale of charges, which, it is alleged, mean an increase of 33⅓% to some consumers for domestic purposes, and the Commissioners are taking steps to investigate them.

The Prime Minister has informed Captain Wedgwood Benn that the consent of the House of Commons will not be sought before the Postmaster-General leases the beam wireless system. The lease will be granted under the general powers conferred upon the Postmaster-General by the Post Office Act of 1908. There is no necessity to submit for approval of Parliament the details of the contract with the Communications Company in reference to the sale of the cables.

Replying to questions regarding the transfer of the beam wireless service to the new Communications Co., Mr. A. M. Samuel, Financial Secretary to the Treasury, states that the main terms of the arrangement are set out in the White Paper. The agreements for giving effect to these arrangements are being prepared, but he is unable to make any statement until terms have been agreed with the companies and, as far as necessary, approved by the Dominion and Colonial Governments concerned.

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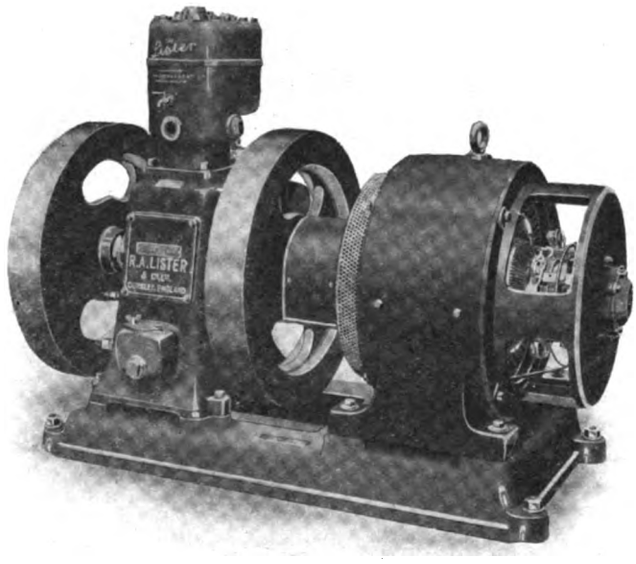
PLANT AND EQUIPMENT.

THE country house lighting plants of R. A. LISTER AND Co., of Dursley, range from 600 W up to 11 kW and over, each set being complete with cells, switchboard, etc. The 600 W set is designed for the direct lighting of 24–25 W lamps, and is



An example of the larger sets for country house lighting made by R. A. Lister and Co.

fitted with a fuel tank capacity to allow of 7 hours' running. The capacity of the 1 kW set on direct lighting is 110-25 W lamps, and that of the 1½ kW set 60 lamps. Of the bigger sets the 11 kW equipment is capable of lighting 440–25 W lamps with a fuel consumption of 1 pint per 12 hours' running. The engine is a twin-cylinder 20 H.P. with a speed of 600 r.p.m. The voltages for the bigger sets are 110/162, while the 2·25 kW set is also made to give pressures from 50–73 V. The 1 and 1½ kW equipments are made with three voltage outputs, these being 32/43, 50/73 and 110/162 V. The 600 W set has an output of 32/43 and 50/73 V.

A comprehensive range of resistances is made by ISENTHAL AND Co., LTD., Victoria Road, London, W.3, and includes tubular and carbon plate types, slate resistances, load and stand-by resistance units, meter calibration resistances, dimmers for incandescent lighting, arc regulators, etc. The same company also offers a portable calibrating set for overload and other protective relays, current transformers, etc. This consists of a combination of transformer, resistances, selection switches and ammeter, which enables the proper resistance section to be interlocked with part of the multiple switch for series connection with the transformer primary. With this unit a current range of 0·4 and 1200 A, which may be extended for a few seconds to 2 600 A, is made available. The range of the set is given as 1 200 A and 500 V, and the weight 60 lb. The same firm also offers a range of vitreous enamelled units with a standard accuracy of ± 5%.

A wide selection of lighting accessories suitable for motor and other yachts, etc., is offered by D. H. BONELLA AND SON, LTD., 46 and 48, Osnaburgh Street, London, N.W.1. Their fittings include a number of attractive berth lights, deck lights, corridor and other fittings. Ceiling lighting fittings suitable for small tonnage craft are included in a number of novel designs, while anti-dazzle bridge and chart-room lights are also offered in a variety of types. Plugs and sockets, flush and surface type switches, searchlights, navigation lights, engine-room and inspection lights are also included in the range, together with lighting plants for house-boats, launches, etc., where 6 to 10 lights are required.

A BOOM YEAR FOR PATENTS.

It is estimated that at least 38 500 patent applications will have been filed at the Patent Office in the past year. This is approximately 2 000 in excess of the existing record of 36 680 of a few years ago. Messrs. Hughes and Young, the patent agents of Warwick Court, Holborn, state that the particulars of this year available on their records show a number of patent applications far in excess of any previous year, and it is estimated that the capital invested this year in inventions is over 35 millions.

ELECTRICITY SUPPLY.

Increase of Capacity of Preston Station—Aylesbury to take Bulk Supply.

MANCHESTER Electricity Committee has obtained sanction to borrow £24 800 for sub-station equipment.

The sub-station at Newton Abbot for supplying the growing suburb of Milber was put into operation on December 23rd.

Shoeburyness U.D.C. has received sanction to a loan of £6 644 for carrying out an electricity supply scheme for the town.

Fulham (London) Electricity Committee is to carry out mains extensions in various roads, at an estimated cost of £577 10s.

The note which appeared in our issue of December 21st, on page 718, relating to West Ham, should have read East Ham, and not as printed.

Weymouth Corporation is to make application for consent to the erection of overhead lines for supplying electricity to the Weymouth Bay Estate.

The Lighting Committee of Barnes U.D.C. has instructed the Electrical Engineer to report on the question of the reduction in the flat rate and rateable value tariffs.

Ilford Electricity Committee is seeking a Fringe Order to supply premises in Epping rural district. The Committee is to seek sanction for a loan of £5 000 for the free wiring scheme.

Oldham Electricity Committee has agreed to receive a deputation on behalf of several cotton mill owners, etc., to discuss the possibility of a reduction in the charges for electricity supplied to them.

Kingston-on-Thames T.C. has received sanction to borrow, for mains, £4 695; plant, £2 401; and works consequent upon change of system, such as changing consumers' lamps, apparatus, etc., £7 251.

Brighton Electricity Committee has agreed to a fee of 800 guineas to Messrs. Kennedy and Donkin and Mr. H. Dalrymple Hay for advising and supervising the circulating water scheme for the Southwick works.

Battersea (London) Electricity Committee is to instal electricity services to 125 premises at a cost of £1 170 15s., and to extend mains for private services at a cost of £866 and mains for public lighting at a cost of £344.

Douglas (Isle of Man) T.C. has presented to the Tynwald a petition for leave to extend the optional area for the supply of electricity to certain districts outside the borough. The Tynwald has referred the matter to a committee.

Col. F. Gordon Tucker held a Ministry of Transport inquiry on December 20th respecting objections to the erection of poles for 11 000 V cables to the Holbeach Long Sutton, and Sutton Bridge districts, by the Boston Electricity Supply Co., Ltd. As a result of the inquiry, several objections were disposed of.

Reigate R.D.C. recently deferred for a month the request of the Dorking Electricity Supply Co., Ltd., for consent to its application for a Special Order. The Council has been informed that the Commissioners have been asked to dispense with its consent or to exclude the parishes of Betchworth and Buckland.

Lichfield T.C. has received sanction to loans of £4 100 in connection with the extension of mains to Whittington and £4 407 for excess expenditure. Twenty public lamps are to be provided at Whittington, at a cost of £4 1s. 6d. each, and a loan of £2 850 has been applied for to cover extension of the mains to Shenstone.

The Commissioners have authorised Preston Corporation to borrow £46 000 for the modification of certain generating plant already installed or under construction, so as to increase the capacity of the Ribble Station from 50 000 kW to 60 000 kW. They have also sanctioned a loan of £3 500 for the purchase of property adjoining the Crown Street works.

Morecambe Electricity Committee has instructed the Electrical Engineer to call the attention of the Borough Engineer to the necessity of any damage to cables or other works being reported immediately.—The Committee is to seek sanction from the Electricity Commissioners to supply the L.M. & S. Railway with electricity for purposes other than traction.

An offer of a temporary bulk supply of electricity from the Central Electricity Board has been accepted by Aylesbury T.C. The Council is to pay for a maximum demand not less than 1 000 kW. The Council has adopted a scheme for carrying out within the next twelve months the provision of h.t. and l.t. lines and other works in the rural areas, at a cost of £16 000.

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THE DAVIS CINEMA.

Interesting Electrical Details of New Installation at Croydon.

THE electrical installation at the Davis cinema, which was opened just before Christmas, has been carried out to the design of Mr. Basil Davis, and the following details give a general outline of the work.

The supply is taken from the Croydon Corporation, who feed into the h.t. room at 2 000 V and transform down by means of two transformers to 230 V single-phase for all supply to the building. From the h.t. room feeds are taken to the main intake room switchboard, which consists of seven panels and supplies the lighting, power, stage and motor generator services. Two sets of motor generators are installed, one acting as stand-by, and each is capable of an output of 250 A at 50/80 V; each machine is controlled by one panel of a d.c. switchboard, also situated in the main intake room. For the auditorium lighting, services are taken to the dimmer room situated behind the lower circle and close to the projector room. The general auditorium lighting, known as "amber" from the colour chosen, is controlled in the dimmer room by motor-driven push-button dimmers, and the coloured lighting in red, blue and green is also actuated from this room, where fifteen sets of dimmers are fixed. These sets—five in all for each colour—control respectively the colour lighting in the proscenium arch, the proscenium flutings left and right, the large and small domes, and pendant fittings. Thus an independent effect formed by any combination of three colours can be set up at each or any of these positions. The proscenium arch, the main dome, and flutings are covered with a broken silver reflecting surface which accentuates the effects. In addition to the auditorium and general lighting, "maintained" and "secondary" systems have been installed. The maintained lighting is fed from the corporation supply on a separate system, while the secondary installation is supplied from two direct-coupled d.c. Crossley paraffin sets of 6 kW capacity. The maintained and secondary lighting systems are controlled from the stage switchboard. In all, some 6 000 lamps have been used in the building on the six sets of lighting. The stage switchboard is of the dead front type and controls the battens, float, dips, and arena with master control for each colour, together with a black-out pilot switch. Each batten, etc., and each colour thereon, has its own dimmer, with master dimmer control for each colour. For exterior lighting 18 floodlights, each of 500 W, are employed, while the marquise is illuminated by means of 150-20 W and 100-60 W opal lamps. Three neon signs, one horizontal and two vertical surrounding the principal façade, give prominence to the name of the cinema. Provision is made for electric cooking in the tea-room, a 50 kW main having been laid, and it is intended to use electrical cooking apparatus throughout. The installation in its entirety has been carried out by TROUGHTON AND YOUNG, LTD., of 143, Knightsbridge, S.W., under Mr. Davis's supervision.

ELECTRICAL WOMEN.

Branch Meetings and Visits of the Electrical Association for Women.

MEMBERS of the E.A.W. Evening Classes were pleased to welcome Lt.-Col. W. A. Vignoles on December 10th, at the E.L.M.A. Lighting Service Bureau, 15, Savoy Street, Strand. His lecture on "Safety in the Electrical Home" described in a simple way accidents which could occur through shock and fire in connection with faulty installations. He mentioned the fact that such accidents could only occur if a certain unfortunate combination of circumstances were present.

The chair was taken by Mrs. Dickenson, of the Bermondsey Electricity Department, and the vote of thanks to Lt.-Col. Vignoles was proposed by Mrs. Hammer.

The Manchester Branch of the Association for Women is continuing its interested and varied programme of lectures on the uses of electricity in the home. At the Manchester Corporation electricity showrooms on November 23rd, Mrs. Flack spoke on "Electric Appliances and their Uses in the Home."

On December 5th a visit was paid to the showrooms of Frigidaire, Ltd., where Mr. F. Jones gave an instructive address on "Automatic Electrical Refrigeration, particularly as applied to Domestic Requirements." Demonstrations were given.

CHURCH LIGHTING.

Successful Lighting Installation at Truro Cathedral.

THE system of lighting by gas electroliers, at Truro Cathedral, has been replaced by electricity. A scheme of concealed lighting has been installed, and the illumination of the whole of the nave, transepts and sanctuary was carried out by means of G.E.C. silvered glass floodlight reflectors. The triforium arches are each sub-divided into four smaller ones, and the floodlights are arranged under each of the first four arches looking east, at a mounting height of approximately 36 ft. from the floor level. The reflectors are arranged to floodlight the nave both forward and across from each side, at the same time avoiding the possibility of spill light producing bright patches on the triforium pillars. Similar methods are employed in the chancel, the units on the north side being grouped together in several of the arches, since a suitable fixing could not be obtained in the first two, due to the presence of the organ pipes. A number of floodlights are employed, the units at the eastern end being directed towards the sanctuary and altar, in order to assist in the lighting of these sections. The illumination of the sanctuary is arranged to produce a graduated contrasting increase of intensity, as the eastern end of the cathedral is approached. In the centre, an intensity of 4-ft. candles is obtained by means of several correctly-disposed floodlighting units installed on the arches of the triforium in the chancel. It was found that the area below the central tower could not be illuminated by projectors mounted high up and adjacent to the upper walls and gallery of the tower without a large proportion of spill light illuminating the upper walls to a high intensity. It was, therefore, decided to illuminate the area under the tower by means of floodlights concealed in the triforium arches of the transepts, and the units were so disposed and directed to illuminate the transepts effectively in addition to the central tower area. The equipment for lighting the altar and sanctuary was designed to provide the maximum amount of vertical rather than horizontal illumination, and although light was obtained from the floodlighting units in the chancel, it was decided that the main lighting of the altar could be effected more advantageously by means of 12-lamp lengths of striplite reflector arranged vertically on either side, and concealed in the recesses of the stone columns. The north and south choir aisles are also illuminated by G.E.C. silver glass distributing reflectors, each mounted in the apexes of the truncated arches, and directed eastwards. Similar reflectors are used for the lighting of the north and south main aisles. The area under the west gallery is illuminated by means of reflectors recessed into the underside of the gallery forming the ceiling.

Some idea of the effectiveness of the lighting at Truro Cathedral is given by this illustration.

The main switchboard is installed in the north transept. The wiring for the main floodlights illuminating the nave and chancel is concealed inside the triforium, whilst the wiring to the units in the aisles, etc., is carried out in lead-covered cable. J. H. DEEBLE AND SONS, Falmouth, were responsible for the whole of the wiring and installation of the fittings, etc., while the scheme was designed by the GENERAL ELECTRIC CO., LTD., acting in collaboration with Mr. F. L. Pearson, Mr. Oswald Swete, and the Diocesan Authorities.

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SCOTTISH LIGHTING.

Third Annual Report of the Scottish Electric Lighting Service Bureau.

ACCORDING to the third annual report of the Scottish Electric Lighting Service Bureau, the activities of the bureau have been well maintained. The free use of premises at 20, Trongate, has again been granted by Glasgow Corporation Lighting Department, and the equipment has been added to from time to time, when new developments have occurred. In addition to the apparatus for demonstrating correct principles of lighting, lent by the manufacturers, there has been added a number of ancient lighting devices, which give further interest to the exhibits. The Electric Lamp Manufacturers' Association contributes to the bureau the services of the District Engineer. The eight months which constitute the "lighting season"—September to April—naturally coincide with the period of greatest lecturing activity, and during the past year all except four of the total of 57 lectures fell within this period. The policy heretofore has been to obtain Press notices, etc., without insertion of any advertising matter. This year, however, a slight change has been made, and a full-page advertisement has been inserted in the Year Book of the Electrical Contractors' Association of Scotland.

The Royal Technical College Electrical Engineering Class have made their visit to the bureau for two lectures on Illumination Principles and Design, a regular annual feature. Several rotary clubs are on the list, as also are various trade associations, co-operative guilds, clubs, societies, etc., having many different interests. Co-operating with the various electrical committees, demonstrations and lectures have been given at four exhibitions during the year, viz., at Helensburgh, Wishaw, Aberdeen and Cumnock, and an exhibit was also made at the Educational Exhibition at Kelvin Hall, Glasgow. The publication of a brochure, fully illustrated and descriptive of the bureau and its work, was completed in the spring, of which 11 800 have been distributed to date at lectures, and from manufacturers' showrooms and through the post, a card index system of industrial and electrical establishments, etc., which has been prepared, being used for mailing purposes. Another interesting publicity development has been the writing of articles dealing with "Shop Window Lighting," and these have appeared in a large number of the Scottish trade papers.

For the year now entered upon there has been arranged a considerable number of lectures, and several of these have already been given. Included in the number are those arranged in connection with the "Factory and Workshop Lighting Campaign." Another Illumination Design Course, consisting of weekly lectures, and given principally by lecturers from the London Lighting Service Bureau, is now being conducted, and promises to be of considerable value to members of the electrical industry.

TRADE PUBLICATIONS.

BRITISH INSULATED CABLES LTD., Prescot, have published leaflet P. 243 dealing with single-phase meters. P. 221 has been withdrawn.

THE WHOLESALE FITTINGS CO., LTD., 23-37, Commercial Street, London, E.1, has published list No. 223 dealing with this season's "Alto" model electric fires.

A questionnaire in the form of a postcard has been received from HERBERT MORRIS, LTD. Loughborough, dealing with the company's conveyors, and inviting further information from potential clients so that a representative may call.

THE BENJAMIN ELECTRIC, LTD., Brantwood Works, Tariff Road, London, N.17, has sent us a special booklet explaining the Benjamin lighting service. The issue is well illustrated and gives full particulars of both the company's service and the advantages gained from good lighting.

Bulletin No. 54, published by ALLOY WELDING PROCESSES, LTD., 14-16, Church Street, London, N.1, gives applications of electric arc welding to the repair and maintenance of machinery on board ship. The company's Bulletin No. 57 deals with a new electric dynamo for welding purposes.

We have received from HOBDAY BROTHERS, LTD., 21-27, Great Eastern Street, London, E.C.2, a supplementary catalogue to the main radio publication No. 70. The purpose of the supplement is to include the outstanding features of the 1928 Radio Exhibition and wireless picture receivers. There is also incorporated a special chart to direct telephone calls to their correct department.

TRADE CALENDARS.

THE 1929 calendar of BRITISH INSULATED CABLES LTD., Prescot, Lancs, takes the form of a desk or wall type refill with white letters on a black background.

The 1929 calendar of the KEY ENGINEERING CO., LTD., 4, Queen Victoria Street, E.C.4, has been received. As in past years, this has been produced in pocket size.

In presenting their calendar for 1929, C. A. PARSONS AND CO., LTD., Heaton Works, Newcastle-upon-Tyne, have combined a selection of their various products with illustrations of places of local and historical interest.

A bold looking calendar suitable for office use is that of CROSSLEY BROTHERS, LTD., Openshaw, Manchester. Above each calendar month is shown a large picture of some of the company's products, with brief descriptions.

The 1929 calendar of the A.E.G. ELECTRIC CO., LTD., 131, Victoria Street, London, S.W.1, is a bold production, illustrated by various pictures of power stations, transmission lines, electric traction designs, domestic appliances, etc.

We have received from the DUBILIER CONDENSER CO. (1925), LTD., Ducon Works, Victoria Road, Acton, W.3, two block calendar refills for 1929, for the "Business Desk-Memo Kalendar," supplied by the same firm some years ago.

The calendar of the MARCONIPHONE CO., LTD., Tottenham Court Road, London, this year takes the form of a gilt disc edged with green laurel leaves. In the centre is shown the globe with the signature of G. Marconi across it. The daily calendar portion is in large block figures.

This year's calendar of the MULLARD WIRELESS SERVICE CO., LTD., of Denmark Street, London, W., again takes the shape of a P.M. valve containing the head and shoulder portrait of an unknown but charming lady. The calendar is of the block type in red and black.

We have received from the D.P. BATTERY CO., LTD., of Bakewell, Derbyshire, a calendar for 1929 which illustrates in colour "The Surprise," Hathersage, Derbyshire, by E. A. Chadwick. The publication is mounted on strong board, while the calendar numerals are bold and clear.

The 1929 calendar of the NORTH METROPOLITAN ELECTRIC POWER SUPPLY CO., Broadway Buildings, Westminster, S.W.1, is made up with 52 week panels bearing large figures, mounted on a gilt-edged board, depicting a figure representing Electricity. The background of the board is blue, while the figure is in bronze.

A reproduction of a crayon drawing of the old Parish Church, Church Road, Leyton, lends interest to the calendar of the LONDON ELECTRIC WIRE COMPANY AND SMITHS, LTD., of Leyton, London, E.10. The board upon which both picture and calendar are mounted is stiff and the publication makes an attractive wall decoration.

A delightfully coloured picture entitled "The Sleeping Beauty," reproduced on silk from the original water colour by W. H. Margetson, forms the illustration for this year's calendar of MAWDSLEY'S, LTD., Zone Works, Dursley. The story in abbreviated form is given on the back of the calendar, the whole making a very pleasing wall decoration.

As is customary with the VEREENIGING VAN DIRECTEUREN VAN ELECTRICITEITSBEDRIJVEN IN NEDERLAND, of Arnhem, the association's 1929 calendar is designed to bring home to the public the advantages of electricity. This year the pictures chosen show the developments of lighting from the early ages. Explanations are given on the back of each picture, while the colourings are, as usual, particularly attractive.

We have received from Mr. GEORGE BARNARD, of 1, Nile Street, Birmingham, a desk-type calendar for 1929 in leather finish. Each of the twelve months is arranged on a metal sheet, while the date indicator is of magnetised iron, with the result that the latter will stay in any position without any support other than that given by magnetic attraction. The subject matter surrounding the calendar is neatly printed, and deals with Vinculum electrical concrete for cable covers, posts, boxes, etc.

The LIVERPOOL ELECTRIC CABLE CO., LTD., Linacre Lane, Bootle, Liverpool, has sent us a very attractive calendar illustrating the Gladstone Dock. The well-printed colours of the picture, showing a number of vessels alongside the dock, make a pleasing setting.

The 1929 calendar of CALLENDER'S CABLE AND CONSTRUCTION CO., LTD., Hamilton House, Victoria Embankment, London, E.C.4, takes the form of a large portrait of Sir Tom O. Callender, mounted in a gilt "frame."

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BUSINESS OPENINGS.

Latest Particulars of Electrical Engineering and Wiring Installation Contracts for which Tenders are being Invited at Home and Abroad.

WE give below the latest particulars of contracts for which tenders are invited. The closing date is given, when available.

CASTLEFORD URBAN DISTRICT COUNCIL.—Electric light installation at Barnes Road Maternity Home. Particulars from Mr. Fred Scatchard, architect, Midland Bank Chambers, Castleford.

DIRECTOR OF ARMY CONTRACTS.—Manufacturers who are not already on the War Office list of tenderers are invited to apply to the Director of Army Contracts, Caxton House (West), Tothill Street, Westminster, London, S.W.1, for form 1, on which application for inclusion in the list may be made. Among the goods for which tenders are invited from time to time are electric cables, electrical plant, electrical and wireless stores, scientific instruments, various machinery, metals, earthenware, etc. Applicants must be on the King's National Roll, and must comply with the fair wages resolution of the House of Commons.

RICHMOND-ON-THAMES GUARDIANS.—Rewiring 15 circuits at the Infirmary, dining hall and laundry blocks. Particulars from the architects, Messrs. Brewer, Smith and Brewer.

CENTRAL ELECTRICITY BOARD, January 4th.—Supply and erection of 132 000 V transformers, under the South-East England Electricity Scheme, 1927. Specification (No. S.E.E. P.T.1) and form of tender from Mr. J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

COLWYN BAY URBAN DISTRICT COUNCIL, January 4th.—Wiring houses under assisted wiring scheme. Specifications, etc., from the Electrical Engineer, Council Offices, Colwyn Bay.

NORTHERN IRELAND MINISTRY OF FINANCE, January 4th.—Electric lighting and bell systems and mechanical ventilation in the Custom House, Belfast. Specification can be seen at the offices of the Ministry, 15, Donegall Square West, Belfast (Room 34).

SALFORD CORPORATION, January 4th.—Supply of e.h.t. and l.t. paper insulated, lead covered and armoured cables. Particulars from the City Electrical Engineer, Frederick Road, Salford.

BELFAST CORPORATION, January 7th.—Manufacture, delivery, and erection of h.t. armour-clad switchgear. Specification (No. W. 76) and form of contract from Mr. F. H. Whysall, city electrical engineer and general manager, Electricity Department, East Bridge Street, Belfast; deposit £2 2s.

GOVAN DISTRICT BOARD OF CONTROL, January 7th.—Electric lighting installation in the Solarium at Hawkhead Asylum, Crookston, Glasgow. Schedules from the clerk, Mr. Angus Baillie, 51–52, Carlton Place, Glasgow, C.5.

GRIMETHORPE MINERS' WELFARE COMMITTEE, January 7th.—Electric lighting and heating of pavilion. Particulars from the architect, Mr. C. L. Goddard, Royston Road, Cudworth; deposit £3.

MANCHESTER CORPORATION, January 7th.—Supply of single-phase electricity meters for period ending September 30th, 1929. Specifications, etc., from Mr. H. C. Lamb, Electricity Department, Town Hall, Manchester; deposit £1 1s.

GLASGOW CORPORATION, January 8th.—Supply of steel poles and bases, for street lighting. Specifications, etc., from the Inspector of Lighting, 20, Trongate, Glasgow.

NORTHERN IRELAND GOVERNMENT, January 10th.—Electrical supplies to various Government estabslishments during twelve months ending January 31st, 1930. Forms of tender, etc., from Ministry of Finance, 15, Donegall Square West, Belfast; deposit £1.

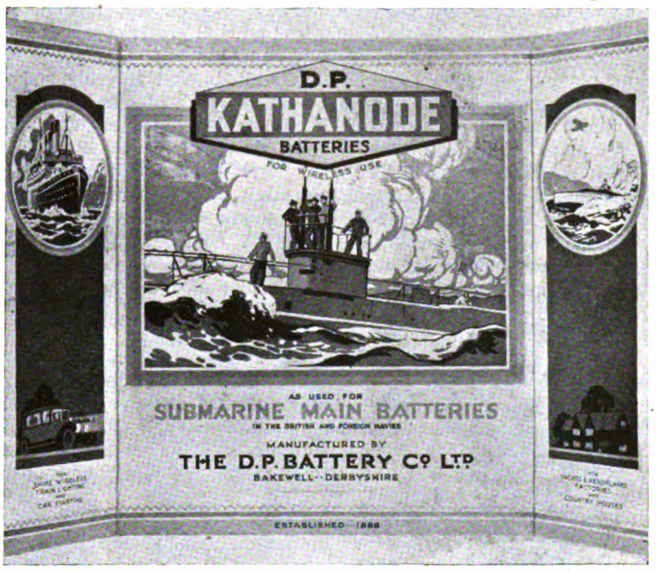
SHEFFIELD CORPORATION, January 11th.—Supply of 1 000 tons of tramway rails, copper bonds, etc. Specifications, etc., from Mr. A. R. Fearnley, General Manager, Tramways and Motors Department, Division Street, Sheffield.

ASHFORD (KENT) URBAN DISTRICT COUNCIL, January 14th.—Heavy-oil engine, to drive 600 kW three phase 50 period alternator, with starting air bottles, piping, fuel service tank, etc.; also supercharger silencer, centrifugal pump and fuel oil tank. Further particulars from the Clerk.

BETHNAL GREEN (LONDON) BOROUGH COUNCIL, January 14th.—Electric lighting and power and telephone installations at Public Baths and Washhouses in course of erection in Old Ford Road. Specification, etc., from the Borough Engineer, Town Hall, Bethnal Green, E.2; deposit, £3 3s.

CAMBERWELL (LONDON) BOROUGH COUNCIL, January 14th—Maintenance of electric lighting, heating and power installations (section L) and supply of electric lamps (section S) for twelve months. Forms of tender from Borough Engineer and Surveyor, Town Hall, Camberwell, S.E.5.

EDINBURGH CORPORATION, January 14th.—Boiler feed-water de-aerafing plant for Portobello power station. Specification (No. 96) from Mr. Edwin Seddon, electrical engineer and manager, Electricity Department, Edinburgh; deposit 10s. 0d.



A new window card by the D.P. Battery Co., Ltd. It is treated in colours and makes an attractive background for display purposes.

HUDDERSFIELD CORPORATION, January 14th.—Electrical work for new baths. Particulars from the borough architect, Mr. L. Smith, 26, Ramsden Street, Huddersfield.

STOKE-ON-TRENT CORPORATION, January 16th.—Supply and erection of an electrically-driven air compressor at the central power house, Hanley. Specification, etc., from the City Electrical Engineer, St. George's Chambers, Kingsway, Stoke-on-Trent; deposit £2.

STOKE-ON-TRENT CORPORATION, January 16th.—Wiring and fitting of eight electric houses in Avenue Road, Hanley. Specification, etc., from the City Electrical Engineer, St. George's Chambers, Kingsway, Stoke-on-Trent; deposit £2.

STOKE-ON-TRENT CORPORATION, January 16th.—Supply of low tension d.c. switchboard, for electricity sub-works, Bagnall Street, Stoke-on-Trent (contract 2 836); and supply of e.h.t. ironclad type switchgear at Central power house, Hanley (contract 2 839). Specifications from the City Electrical Engineer, St. George's Chambers, Kingsway, Stoke-on-Trent; deposit £2 for each.

KEIGHLEY CORPORATION, January 17th.—Supply and erection of water-tube boiler, to evaporate 30 000 lb. of water per hour, for the Electricity Department. Specifications from Mr. H. Webber, borough electrical engineer, Coney Lane, Keighley; deposit, £2 2s.

ISLINGTON (LONDON) BOROUGH COUNCIL, January 18th.—Manufacture and supply of one 5 000 kVA Scott-connected transformer, for three-phase system, 6 600 V and 2 000/2 300 V per phase, with voltage regulator; and 375 kVA and/or 750 kVA Scott-connected transformers, for three-phase system, 6 600 V and 2 000/2 300 V per phase. Specification, on and after December 1st, from the Borough Electrical Engineer 60, Eden Grove, Holloway, N.7.

ISLINGTON (LONDON) BOROUGH COUNCIL, January 18th.—Supply of cables; electricity meters; terminal, service, network and fuse boxes; oil circuit breaker switches; elec-

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trical sundries; wires; lamps; transformers, etc., for one year. Specification from the Town Clerk.

WEST RIDING EDUCATION COMMITTEE, January 19th.—Electric light installations in Norton New School and in Glass Houghton Ashton Road Council School and caretaker's house. Specification, until January 14th, from Education Department, County Hall, Wakefield.

ESSEX COUNTY AND COLCHESTER HOSPITALS COMMITTEE, January 21st.—Internal electric wiring of Brentwood Mental Hospital, with fuseboards, motors, etc. Specifications, etc., from Mr. H. H. Gepp, 66, Duke Street, Chelmsford; deposit £5 5s. Only registered contractors are invited to tender.

NEWBURY CORPORATION, January 21st.—Direct-coupled electric motor and centrifugal pump, etc. Specification, etc., from Messrs. H. Humphries and Sons, 28, Victoria Street, Westminster, S.W.1; deposit £1 1s.

LIVERPOOL CORPORATION, January 31st.—Twelve months' supply of various materials, including (E.S.1) cables, compounds and tapes; (E.S.2) insulated cables; (E.S.3) electricity meters; (E.S.4) cartage; (E.S.5) incandescent lamps; (E.S.6) brass and copper castings; (E.S.7) a.c. motors and starting gear; (E.S.8) stoneware troughing, etc.; (E.S.9) oils. Tender forms from City Electrical Engineer, 24, Hatton Garden, Liverpool. State number of form desired.

RIPON CORPORATION, February 1st.—Overhead 11 000 V transmission line and small quantity of e.h.t. underground cable (contract No. 2). Persons desiring to tender must communicate their intention to Mr. W. C. C. Hawtayne, 9, Queen Street Place, London, E.C.4, before January 11th. Specifications, etc., will be issued on or about January 18th to persons who, after receiving notice from Mr. Hawtayne, send to the Town Clerk a deposit of £2.

CENTRAL ELECTRICITY BOARD, February 18th.—Supply and erection of 132 000 V overhead transmission lines, in connection with the North-West England and North Wales Electricity Scheme. Specification (No. N.W.E.-P.L. 1) and form of tender from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

CENTRAL ELECTRICITY BOARD, February 18th.—Supply and erection of 132 000 V overhead transmission lines, in connection with the Central England Electricity Scheme. Specification (No. C.E.-P.L. 1) and form of tender from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

Overseas.

UNLESS otherwise stated, particulars of overseas contracts are to be had from the Department of Overseas Trade (Room 52), 35, Old Queen Street, Westminster, London, S.W.1. *Note.—An asterisk denotes that local representation is, in practice, essential.*

DUBLIN BOROUGH COMMISSIONERS, January 5th.—Supply of (1) capping, casing and wire, and (2) electric time switches. Specifications (5s. for each) from the City Electrical Engineer, Fleet Street, Dublin.

TURKISH DIRECTOR-GENERAL OF POSTS, TELEPHONES AND TELEGRAPHS, January 5th.—Supply of 60 000 porcelain insulators and 15 000 swan neck fittings. (Reference B.X. 4 904.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, January 8th.—Supply of switching equipment and relays, for use in automatic telephone exchanges (schedule C. 381). (Reference B.X. 4 880.)

INDIAN STORES DEPARTMENT, January 8th.—Three oil engine driven 12½ kW generator sets (order No. N/9248). (Reference B.X. 4 956.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, January 8th.—Supply of protective apparatus for telephone equipment, including fuses, heater coils and arresters (schedule C. 380). (Reference B.X. 4 881.)

ROUMANIAN MINISTRY OF COMMUNICATIONS, January 10th.—Supply of 17 000 insulators; iron, steel, copper and bronze wire; and 11 000 copper coupling rings. (Reference A.X. 7 289.)

SOUTH AFRICAN RAILWAYS AND HARBOURS (extension of date), January 10th.—Supply of five electrically-driven traversers and one 5-ton hand-operated crane (tender No. 1 344.) (Reference A. 7 023.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, January 10th.—Supply of telegraph material, including cross arms, insulators, copper wire, copper binders and tapes, g.i. stay wire, steel spindles and stay rods, and c.i. pole-bases (tender No. 1389.) (Reference A.X. 7 301.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, January 15th.—Supply of loading coil pots. (Ref. B.X. 4 879.)

BULAWAYO MUNICIPALITY, January 18th.—Supply of street lighting material, transformers, h.t. and l.t. cable, h.t. kiosks and pillars, and busbar material. (Reference B.X. 4 965.)

NEW SOUTH WALES PUBLIC WORKS DEPARTMENT, January 21st.—Supply of static power transformers, for Young-Wyangala section of Burrinjuck hydro-electric development transmission lines (contract No. 235/28). (Reference B.X. 4 995.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, January 22nd.—Supply of two concrete mixers, with electric motors (contract No. D.W. 67/107). (Reference A.X. 7 315.)

BOMBAY, BARODA AND CENTRAL INDIA RAILWAY CO., January 23rd.—Supply of 400 kW heavy oil engine-driven generating set. Specification, etc. (20s.), from Mr. S. G. S. Young, secretary, White Mansion, Petty France, Westminster, S.W.1.

CAPETOWN MUNICIPALITY, January 23rd.—Supply of electric cable (specification 446/1928). (Reference B.X. 4 978.)

JOHANNESBURG MUNICIPALITY, January 24th.—Supply of weatherproof copper wire, with fireproof coatings and outer braiding, for use on overhead electric lines. (Reference B.X. 4 976.)

JOHANNESBURG MUNICIPALITY, January 24th.—Supply of electric cable (contract No. 109). (Reference B.X. 4 977.)

JOHANNESBURG MUNICIPALITY, January 24th.—Supply of oil switches (contract No. 114). (Reference B.X. 4 994).

EGYPTIAN MINISTRY OF THE INTERIOR, January 27th.—Supply of transformer kiosks, electric cables and accessories required for the extension of the electric supply of Mit-Ghamr power station. (Reference B.X. 4 893.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, January 29th.—Accumulator batteries and counter E.M.F. cells (schedule C. 390). (Reference B.X. 4 906.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, January 29th.—Single core, paper insulated lead covered cable. (Reference B.X. 4 954.)

WAIRARAPA (N.Z.) ELECTRIC POWER BOARD, January 29th.—Supply of 15 sets of earth leakage protection equipment (contract No. 78). (Reference B.X. 4 950.)

EGYPTIAN MINISTRY OF THE INTERIOR (SECTION DES MUNICIPALITES ET COMMISSIONS LOCALES), January 31st.—Diesel engine driven generator set, d.c. rotary balancer, and accessories, for Kafrel Zayat electric station. (Reference B.X. 4 931.)

MANAWATU-OROUA (N.Z.) ELECTRIC POWER BOARD, January 31st.—Supply of automatic re-closing 11 000 V switchgear for pole platform mounting (contract No. 57.) (Reference B.X. 4 988.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, January 31st.—Supply of electrically driven locomotive turntable (tender No. 1 386). (Reference A.X. 7 253.)

VICTORIAN ELECTRICITY COMMISSION, February 4th.—Supply of 11 000 V switchgear, in connection with the Yallourn power station extensions. (Specification No. 29/5). (Reference B.X. 4 897.)

VICTORIAN ELECTRICITY COMMISSION, February 4th.—Supply of 22 000 V switchgear and accessories, for Richmond Terminal Station. (Reference B.X. 4 901.)

VICTORIAN ELECTRICITY COMMISSION, February 4th.—Supply of 11 000 V switchgear, for installation in the Richmond Terminal Station (specification No. 29/3). (Reference B.X. 4 898.)

VICTORIAN ELECTRICITY COMMISSION, February 4th.—Supply of pillar insulators, with metal parts, for use on 132 000 V outdoor circuits. (Reference B.X. 4 921.)

INDIAN STORES DEPARTMENT, NEW DELHI, February 5th.—Supply of turbo-alternator, boiler, economiser, switchgear and cables. (Reference B.X. 4 944.)

EGYPTIAN STATE RAILWAYS, February 9th.—Electrification and equipment of Heluan line, including equipment of power station, overhead transmission lines, track bonding motor and trailer coaches, etc. Tenders to General Manager, Cairo Station.

NEW SOUTH WALES PUBLIC WORKS DEPARTMENT, February 11th.—Supply, erection and maintenance of hydro-electric generating plant, in connection with Hume reservoir hydro-electric development. (Reference B.X. 4 989.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, February 12th.—Supply of 110 kV switchgear, and controlling equip-

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ment, for Waitaki power scheme, section 3. (Reference B.X. 4 848.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, February 12th.—Supply of dry cells, for telephone work. (P. and T. 151/1 205.) (Reference B.X. 4 991.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, February 28th.—Supply of six-conductor telephone cordage (No. P. and T. 151/1 234). (Reference B.X. 4 990.)

Tenders Accepted.

MORECAMBE CORPORATION.—Ferranti, Ltd., supply of 400 kVA transformer, £197 10s.

ROTHERHAM CORPORATION.—British Thomson-Houston Co., Ltd., supply of new nozzles for 30 000 kW set, £84.

ROTTERDAM MUNICIPALITY.—Metropolitan Vickers Electrical Co., Ltd., supply of two 42 000 kW turbo-generators.

GREAT INDIAN PENINSULA RAILWAY.—Metropolitan-Vickers Electrical Co., Ltd., supply of 21 electric passenger locomotives.

PRESTON CORPORATION.—English Electric Co., Ltd., transformer plant for Blackpool additional supply scheme, £35 100.

BELFAST CORPORATION.—Robert Craig and Sons, Ltd., erection of four sets of electrically driven pumps, for Gregg's Quay pumping station.

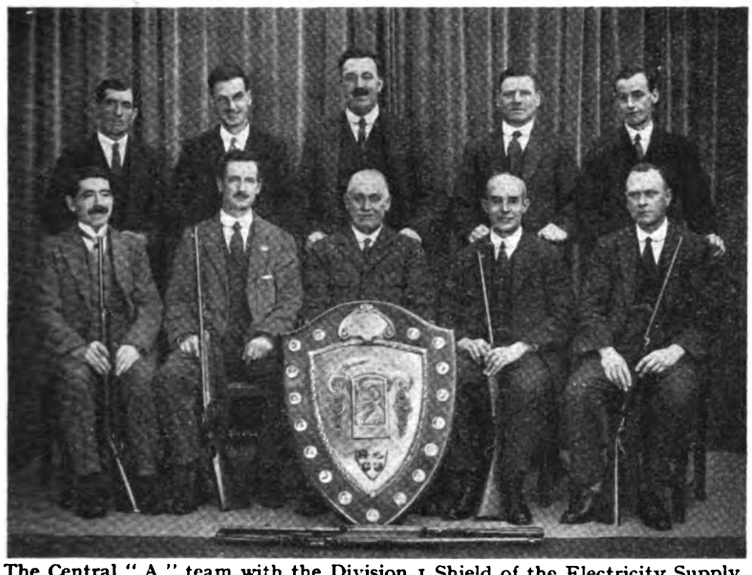
HACKNEY (LONDON) BOROUGH COUNCIL.—C. A. Parsons and Co., Ltd., supply of 30 000 kW turbo-alternator and condensing plant, £101 052.

EGYPTIAN GOVERNMENT.—Pirelli-General Cable Works, Ltd., manufacture and installation of a telephone trunk line between Alexandria and Cairo, £193 000.

ST. PANCRAS (LONDON) BOROUGH COUNCIL.—H. J. Toms and Sons, wiring and fitting twenty-four flats at Wicklow Street, £56. (Recommended.) Other tenderers: Taylor and Goodwin, £56; Sims and Sims, £57; City Electrical Co., £59; Bucknalls, Ltd., £62; White, Boys and Davey, £63; F. E. Pickering, £65; E. S. Russell and Co., £95; J. A. Wigg and Co., £100.

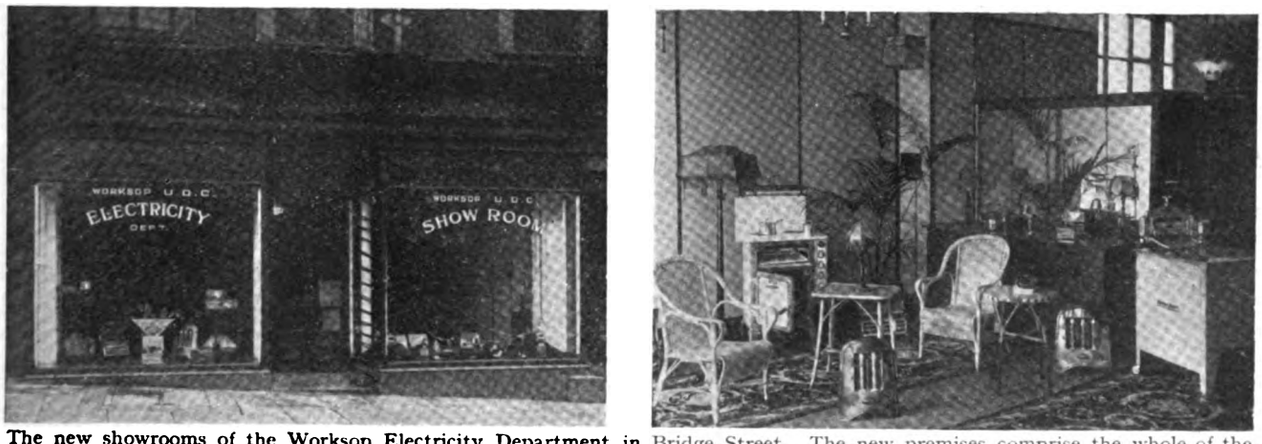
HESTON AND ISLEWORTH URBAN DISTRICT COUNCIL.—Supply of cables: Enfield Cable Works, Ltd., 5 000 yds. 0·01 twin-armoured, £510, 2 250 yds. 0·15 by 0·08 by 0·15 three-core armoured, £1 118. (Both recommended.) Also tendered: British Insulated Cables, Ltd., £522 and £1 145; Callender's Cable and Construction Co., Ltd., £518 and £1 135; Enfield Cable Works, Ltd., £510 and £1 118 (recommended); W. T. Glover and Co., Ltd., £520 and £1 136; Macintosh Cable Co., Ltd., £530 and £1 161; Pirelli General Cable Works, Ltd., £523 and £1 145; Siemens Bros. and Co., Ltd., £526 and £1 154; Union Cable Co., Ltd., £532 and £1 157.

ELECTRICAL NEWS OF THE WEEK IN PICTURES.



The Central "A" team with the Division 1 Shield of the Electricity Supply Rifle League, which was won after a tie with the City Co.'s "A" team. Reading left to right, the top row shows Messrs. W. Pearce, F. Smith, W. Owen, W. G. Wright and A. J. Beale. In the bottom row are Messrs. J. Lyons, E. E. Lee, W. C. Young, H. P. Gaze and A. E. Northop.

Mr. W. J. Jones, whose appointment as manager of the E.L.M.A. Lighting Service Bureaux in succession to Mr. W. E. Bush is announced on page 14. Mr. Jones has already played a prominent part in the Factory Lighting campaign.



The new showrooms of the Worksop Electricity Department in Bridge Street. The new premises comprise the whole of the double-fronted shop, while in the rear are the offices of the chief engineer and manager, Mr. M. S. Mason. A special feature of the new showrooms is a lounge (right) wherein is shown an extensive range of electrical fittings of domestic interest. Hitherto customers had some difficulty in keeping in touch with new developments, but with the present facilities a considerable extension of business is anticipated.

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COMPANY NEWS.

Marconi Marine Shares Relapse—Siemens-Schuckertwerke Improved Dividend—Westinghouse Brake and Saxby Signal Co. Increased Profit and Dividend—Directors' Reports and Dividends—New Companies Registered.

MARCONI Marine shares, which immediately after Christmas were as high as 77s. 6d., have this week relapsed to 71s. 3d.; Marconi's Wireless shares, which after the holidays rose to 78s. 9d., have maintained that higher level. Henley's Telegraph Works ordinary have also maintained their higher quotations of 115s. Eastern Telegraph stock has shed half of last week's 10-point rise. British Insulated Cables have this week improved 2s. 6d. to 82s. 6d.; British Electric Transformer preference are 3s. lower than before Christmas. Metropolitan Supply ordinary shares last week rose 2s. 6d. to 47s. 6d.

Last Annl. Divd.	Description.	This Week.	Last Week.	1912 to 1927. Highest.	Lowest.
%	**Electricity Supply.**				
(*d*)	Brompton & Kensington Ord. ..	27/-	27/-	45/-	23/9
4	Central Elec. Sup. 4% Deb. ..	93	93	100	67
(*a*)	Charing Cross Elec. Ord. (£1) ..	26/6	26/6	60/-	10/-
4½	,, ,, ,, 4½% C.P. (£1)	17/6	17/6	19/6	10/-
(*e*)	Chelsea Elec. Sup. Ord.	27/-	27/-	39/6	10/-
10	City of Lond. Elec. L'ting Ord. ..	30/7½	30/7½	52/10½	20/3
6	,, ,, ,, ,, ,, 6% C.P. ..	23/-	23/-	40/-	15/6
7½	County Lon. Elec. Sup. Ord. ..	44/6	44/6	68/6	14/6
6	,, ,, ,, ,, 6% C.P. ..	23/-	23/-	24/9	15/3
(*g*)	Kensington & K'bridge Ord. (£1) ..	26/6	26/6	104/6	3/-
(*b*)	Lon. Elec. Sup. Ord. (£1)	26/-	26/-	38/3	5/-
9	Metro. Elec. Sup. Ord.	46/3	47/6	43/-	8/-
4½	,, ,, ,, 4½% C.P. ..	17/6	17/6	18/6	9/6
7½	N'castle & Dis. Elec. Ltg. Ord. ..	30/-	30/-	22/6	7/9
6	N'castle-upon-Tyne Elec. Sup. Ord.	26/3	26/3	26/-	11/6
6	N. Metro. Elec. 6% C.P.	23/-	23/-	23/9	10/1½
6	Notting Hill 6% C.P. (£10) ..	10½	10½	10½	6/13/9
(*e*)	St. James & P.M. Ord. (£1) ..	27/6	27/6	62/-	22/-
1/4½	Shrops.Worcs.& Staffs.Power B.Or.	34/4½	34/4½	23/-	20/9
(*f*)	W'minster Elec. Sup. Ord. (£1) ..	27/-	27/-	52/-	18/-
4½	,, ,, ,, 4½% C.P. (£1)	17/6	17/6	21/6	13/-
8	Yorks. Elec. Power Ord.	35/-	35/-	32/9	12/6
6	,, ,, ,, 6% C.P. ..	24/-	24/-	25/-	14/3
	Railways and Tramways.				
8	Brit. Elec. Trac. Pfd. Ord. Stk. ..	124	124	152½	24
6	,, ,, ,, 6% Pf. Stk. ..	127½	127½	129½	53
4	Cent. Lon. Ry. Ord. Stk. (asstd.) ..	72½	73	89½	40½
4	,, ,, ,, 4% Deb.	82	82	103	56½
4	City & S. Lon. 4% Perp. Deb. ..	79½	79½	102½	50
4	Lon. Elec. Rly. Cons. Ord. Stk. ..	75½	75½	73½	10
4	,, ,, ,, ,, 4% Pf. Stk.	73½	73½	84/2/6	43
4	,, ,, ,, ,, 4% Deb. ..	80	80	98½	52
5	Lon. & Sub. Trac. A. Deb. ..	97½	97½	89	65
4	Lon. Un. Trams, 1st Deb.	61	61	82	30
4½	Met. Elec. Trams, 4½% Deb. ..	70	70	101½	49
5	,, ,, ,, 5% Deb...	67½	67½	102/17/6	53
3	Met. Rly. Cons. Ord. Stk.	65	65	84½	19
3½	,, ,, ,, 3½% Pf. Stk. ..	65	65	88½	40½
3½	,, ,, ,, 3½% Deb. ..	73	73	92½	51
4	Met. Dis. Rly. Ord. Stk.	80½	80½	66½	12½
4½	,, ,, ,, 4½% 1st Pref. ..	81½	81½	91	45
6	,, ,, ,, 6% Perp. Deb. ..	115½	115½	146/12/6	80
4	S. Met. Elec. Trams, 4% Deb. ..	77	77	73½	48½
5	Underground Electric Rlys. Ord.	27/-	26/6	5/3	2/1½
—	Yorks. (W.R.) Trams, Ord. ..	5/-	5/-	27/-	1/-
4½	,, ,, ,, 1st Deb. ..	59	59	87	52
	Electrical Manufacturing.				
7	Brit. Elec. Transformer 7% C.P. ..	15/-	15/-	22/1½	11/6
15	Brit. Insulated Cables Ord. ..	82/6	80/-	86/3	26/6
6	,, ,, ,, 6% C.P. ..	22/6	22/6	25/6	14/6
7	British Thomson-Houston Pref. ..	23/-	23/-	24/6	19/7
7	,, ,, ,, 7% Deb.	101½	104½	109½	92/-
10	Brush Electrical Ord.	28/9	28/9	29/9	10/-
15	Callender's Cable Ord.	81/3	80/-	86/-	22/-
6½	,, ,, ,, 6½% C.P. ..	23/9	23/9	26/7	3/-
7½	,, ,, ,, 7½% B. Pref. ..	27/6	27/6	27/6	16/6
8	Crompton-Parkinson 8% Cum. Pf.	25/-	25/-	25/-	9/10
6	,, ,, 6% Cum. 2nd Pf.	18/3	18/3	18/-	8/-
10	Edison Swan Elec. Ord. (4/-) ..	12/6	12/6	28/9½	1/11
7½	,, ,, ,, 1st Pref. ..	25/7½	25/7½	26/-	5/-
7½	Elec. Construction Ord.	26/10½	26/10½	25/9	6/7
7	,, ,, 7% C.P. ..	22/6	22/6	25/3½	16/-
—	English Elec. Ord.	7/6	7/6	29/3	7/3
6	,, ,, 6% C.P. ..	10/-	10/-	22/1½	10/6
7	Ericsson Telephones 7% Pref. ..	19/-	19/-	22/9½	12/7
35	Ever Ready (Gt. Britain) Ord. ..	28/3	27/9	93/9	18/6
6	Ferranti 6% Pref.	19/-	19/-	19/4½	16/9
7	,, 7% 2nd Pref.	19/-	19/-	19/3	13/9
10	General Elec. Ord.	43/9	43/9	59/-	13/6
‡25	W. T. Henley's Ord.	115/-	115/-	108/9	23/3
12½	Johnson & Phillips Ord.	36/3	36/3	67/11	14/6
7½	Lon. Elec. Wire & Smith's Pref. ..	23/9	23/9	27/6	17/6
6	Metropolitan-Vickers Ord... ..	30/-	30/-	37/-	13/1
8	,, ,, 8% C.P. (£2)	55/-	55/-	67/10	5/-
7½	Siemens Bros. & Co. Ord.	26/3	26/3	36/6	12/3
10	Telegraph Const. Ord. (£12) ..	25	25	56/2/6	19
	Telegraph.				
3½	Anglo-Am. Tele. Ord. Stk... ..	62½	62½	68½	40
10	Eastern Ord. Stk.	267½	272½	213½	113/2/6
3½	,, 3½% Pref. Stk.	67½	67½	84/17/6	49
4	,, 4% Deb.	79½	79½	103½	60
10	Eastern Extension Ord. (£10) ..	26½	27½	21½	10/12/6
22	Gt. Northern Telegraph (£10) ..	34½	31	42/12/6	19
10	Indo-European (£25)	47½	47½	56½	25
20	Marconi's Wireless T. Ord. ..	78/9	78/9	9/16/3	20/9
12½	,, Int. Mar.	71/3	77/6	5/11/3	14/11
10	Western Tel. Ord. (£1)	26½	26½	23	11/3/6

(*a*) 1s. 7 ⅞d. per share. (*b*) £8 8s. 6·66d. per cent. (*c*) 1s. 6·949d. per share.
(*d*) 1s. 8·706d. per share. (*e*) 1s. 9·3d. (*f*) 1s. 0.912d. (*g*) 1s. 7·223d.
‡ Including 1s. bonus.

STOTHERT AND PITT, LTD.—Half year's div. on pref. shs. at rate of 5% p.a. less tax, payable Jan. 1.

WELWYN GARDEN CITY ELECTRICITY SUPPLY CO., LTD.—Fin. div. at rate of 7% p.a. payable Dec. 31.

SIEMENS AND HALSKE A.G.—Net pft. for past year, £922 000. Div. 14%, agst. 12%. To spec. res. £125 000, agst. £250 000.

HYDRO-ELECTRIC SECURITIES CORPORATION.—Semi-annual div. at rate of 5% p.a. on 5% class B. participatg. pfd. shs. of $10 each payable Feb. 1.

SIEMENS-SCHUCKERTWERKE A.G.—Net pft. for past year, £828 000, increase £90 000. To spec. res. £150 000 (same as last year). Div. 10%, agst. 9%.

CROMPTON, PARKINSON, LTD.—On June 30, 1929, the whole of the outstandg. 1st mtge. debs. will be redeemed at £105 p. £100 deb. or £52 10s. p. £50 deb., with interest.

EDISON SWAN ELECTRIC CO., LTD.—It is intended to make annual accts to Dec. 31, instead of June 30. Accts. of 1927-8 will be for 18 months ended Dec. 31, 1928. Directors propose div. of 10%, less tax, on ord. shs. for 12 months ended June 30, 1928.

MARCONI INTERNATIONAL MARINE COMMUNICATION CO., LTD.—The directors announce that resolutn. for alteratn. of co.'s articles of associatn. to ensure that British control of co. be maintained was confirmed at extraordinary gen. mtg. of shhldrs. on Monday.

DIRECT WEST INDIA CABLE CO., LTD.—Credit blce. from workg. during year ended June 30, 1928, £18 389, or £16 184 after deductg. income tax, agst. £17 311. Blce. from last year, £12 652, makg. £31 041. Income tax £4 947; intm. div. 2½%, tax free; blce. £23 889, placed to gen. res.

WESTINGHOUSE BRAKE AND SAXBY SIGNAL CO., LTD.—Pft. for year to Sept. 30, 1928, after deducting int., £152 464, includg. £7 582 brt. in, agst. £117 372, includg. £10 254. Div. of 10%, less tax at 3s. 9½d., recommended, agst. 8% less tax. Fwd. £13 227. To res. £27 000, agst. £20 000.

WHITEHALL ELECTRIC INVESTMENTS, LTD.—It is reported that the American and Foreign Power Co. has agreed to sell to Mr. J. H. Macdonald, representg. Whitehall Electric Investments, Ltd., for $19 600 000, 100 000 shs. of the American and Foreign Co. $6 pfd. and £10 000 000 of 6% collateral notes of the South American Power Co.

MANN, EGERTON AND CO., LTD.—Pft. for year ended Sept. 30, 1928, £30 674, agst. £34 510. Pref. div. 8%; ord. div. 9d. p. sh. It is also proposed to pay 5% on and to allocate £8 000 to redemptn. of fundg. certs. Fwd. £12 312, subject to tax on fundg. certs. redeemed, compared with £9 826 brt. in. Subsidiary co. named Mann Egerton Finance, Ltd., has been registered to finance hire purchase operations.

HALIFAX AND BERMUDAS CABLE CO., LTD.—Credit blce. from workg. during year ended June 30, 1928, £34 378, or £31 244 after deducting income tax, compared with £26 949 for previous year. Brt. fwd. £82 083, makg. £116 461. Deductg. £3 134 income tax payable in England and intm. div. 10%, tax free, leaves £108 327, which is placed to gen. res. From gen. res. directors propose to pay bonus of £12 p. sh., absorbg. £120 000.

BENGAL TELEPHONE CORPORATION, LTD.—After paymt. of int. on mtge. bonds. Rs. 291 395, placing Rs. 145 530 to sinkg. fund for their redemptn., and provisn. of Rs. 722 206 for depreciatin., net pft. was Rs. 684 762, plus Rs. 17 420 brt. in. Div. on pref. shs. for half-year to Dec. 31, 1927, required Rs. 105 000, leavg. Rs. 597 182. Div. on pref. shs. for half-year to June 30, 1928, has been authorised. Div. on ord. shs. 7½%. Fwd. Rs. 32 897.

INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION.—This corporation, wh. recently made an offer for the United River Plate Telephone Co.'s ord. shs., has authorised the issue of 10-year convertible 4½% gold bonds, redeemable, at the option of the corporation, in amts. of not less than $10 000 000 at 102½% on and after Jan. 1, 1930. Hldrs. will have the option of convertg. the bonds at par into common stk. at $200 p. sh. from July 1, 1929, to July 1, 1932, at $210 p. sh. up to July 1, 1935, and afterwards at $220 p. sh.

COMPANIES TO BE STRUCK OFF THE REGISTER.—The following companies will be struck off the Register of Joint Stock Companies unless cause to the contrary is shown before

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February 28: Bastian Electric Co., East Lancashire Electrical Co. (Accrington). The following will be struck off unless cause to the contrary is shown before March 4: B. Barnett (Electrical Engineers, Leyton), Chase Electrical Manufacturing Co., Codd Arc Lamp Co., Electrical Distributing Co., International Radio Manufacturers, Morgan and Taylors Radio Electric, Northern Wireless Schools, Premier Electrical Supplies, Yera Electrical. The following will be struck off unless cause to the contrary is shown before March 14: Alphian Wireless, Ebonite Manufacturing Co., Essex Radio (Ilford), Hygienic Telephone Attachment Co., London and South Wales Electrical Engineers, Luen Electrical Supplies, Radiodyne, Radio Experimental Co., Spa Radio Co. The following will be struck off unless cause to the contrary is shown before March 18: Electrical Co., Electro Steel Foundries.

New Companies.

LISBELLAW ELECTRIC LIGHTING CO., LTD.—Cap., £1 000. To carry on business of electricity company. Reg. office: Lisbellaw.

ELECTROCORD, LTD.—Cap., £2 000. Manufacturers of and dealers in apparatus incidental to synchronising of mechanical music to cinematograph pictures, etc. Reg. office: 1, Cookridge Street, Leeds.

VERNON WISE (SHEPHERDS BUSH), LTD.—Cap., £100. To carry on business of authorised "Exide" battery service station agents, electrical, wireless and television engineers, etc. Reg. office: 298, Sandycombe Road, Kew.

SHROSBERY, BAKEWELL AND CO., LTD.—Cap., £1 000. To acquire business now carried on at Attleborough, Norfolk, as "A. J. Shrosbery," and to carry on the business of electrical engineers and contractors, etc. Reg. office: 69, Crouch Street, Colchester, Essex.

EINSTEIN'S ELECTRO CHEMICAL PROCESS, LTD.—Cap., £500 000. To acquire from Vladimir I. Einstein process invented by him for metalising materials by electro-chemical action, to carry on business of electricians, etc. Reg. offices: 16, St. Helens Place, London, E.C.3. (Public co.)

AVELING AND BARFORD AND PERKINS (SALES), LTD.—Cap., £10 000. Engineers, manufacturers of electric and other engines, dynamos, refrigerating and heating apparatus, etc. Solicitors: Durrant, Cooper and Hambling, 70–71, Gracechurch Street, London, E.C.3. (Public co.)

L. AND E. BRISTOW, LTD.—Cap., £2 000. To acquire the business of electrical engineers and contractors formerly carried on by L. Bristow and E. Bristow, at 40, Sloane Street, 5, Maddox Street, Buckingham Gate, and 21, Astwood Mews, London, and to carry on the same, etc. Reg. office: 40, Sloane Street, London, S.W.1.

UTILITIES CORPORATION (POLAND), LTD.—Cap., £400 000. To acquire, hold and deal in investments and securities of all kinds, to promote, finance, etc., electrical, mining and other businesses, and carry on business of engineers and contractors, etc. Reg. office: 33, Gracechurch Street, Lombard Court, London, E.C.3. (Public co.)

PEARL ELECTRICAL CO., LTD.—Cap., £100. To adopt an agreement with Lunar Electrical Co., Ltd., and to carry on the business of agents, factors, and importers of electrical goods and equipment, electrical and mechanical engineers, etc. Solicitors: Herbert Oppenheimer, Nathan and Vandyk, 1, Finsbury Square, London, E.C.2.

METAL AND CHEMICAL PRICES.

TUESDAY, January 1st.

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£75 15 0	£3 0 0	—
Electro Wirebars	„	£77 10 0	£2 5 0	—
H.C. Wires, basis	per lb.	10 13/16d.	1/4d.	—
Sheet	„	10 3/4d.	1/4d.	—
Phosphor Bronze—				
Wire (Telephone) basis ..	per lb.	1s. 1 1/16d.	1/4d.	—
Brass 60/40—				
Rod, basis	per lb.	8 1/4d.	—	—
Sheet „	„	10 1/2d.	—	—
Wire „	„	10 3/4d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£3 8 6	—	—
Galvanised Steel Wire, basis 8 S.W.G.	„	£14 15 0	—	—
Lead Pig—				
English	per ton	£23 5 0	15 0	—
Foreign or Colonial	„	£22 0 0	15 0	—
Tin—				
Ingot	per ton	£226 0 0	£1 5 0	—
Wire, basis	per lb.	2 11 1/2	1/4d.	—
Aluminium Ingots	per ton	£95 0 0	—	—
Spelter	„	£26 17 6	—	—
Mercury	per bottle	£22 8 6	—	—

Sulphur—Flowers, Ton £12 0 0 *Copper Sulphate*—Ton £26 15 0
„ Roll, „ £10 10 0 *Boric Acid* (Crystals) „ £30
Sulphuric Acid (Pyrites, 168°) Ton £6 5 0 *Sodium Chlorate*—Per lb. 2½d.
Sodium Bichromate—Per lb. 3½d.
Rubber—Para fine, 10½d.; plantation, 1st latex, 9d.
∴ The metal prices are supplied by British Insulated Cables, Ltd., and the rubber prices by W. T. Henley's Telegraph Works Co., Ltd.

COMMERCIAL INFORMATION.

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

ELECTRIC INSTALLATION CO., 25, St. Mary's Row, Birmingham, electrical engineers. £13 1s. 11d. November 14th.

GROSS, Thos., Westfield Electric Co., 81, Burley Street, Leeds, electrician. £52 8s. 10d. November 22nd.

HOLLAND, Mr. W. H., 10, Pitville Street, Cheltenham, wireless dealer. £62 13s. 11d. November 14th.

LOWMANS, 113, Broadwall, Blackfriars, S.E., electricians £15 14s. 9d. November 23rd.

Bills of Sale.

BELLONI, Massino, 1, Harewood Place, Marylebone, N.W., electrical engineer. Dated December 19th, filed December 19th. £150.

REIDPATH, Archibald Stewart, 36, Elmfield Mansions, Upper Tooting, electrical engineer. Dated December 18th, filed December 20th. £200.

London Gazette, etc.

Bankruptcy Information.

ANDERSON, Robert, Talbot Street, Grangemouth, electrical engineer. H. C. M'Millan, accountant, 13, Dundas Street, Glasgow, has been elected trustee, and P. E. Smith, electrical supplier, 19, Castle Street, Edinburgh, and W. J. Magowan, electrical supplier, 60, West Regent Street, Glasgow, have been elected commissioners. The examination of the bankrupt will take place at the Sheriff Court House, Falkirk, on Monday, January 21st, at 11 a.m. The creditors will meet in the chambers of M'Millan and Henderson, accountants, on Thursday, January 31st, at 3.30 p.m.

BROWNHILL, Harold James, back of 48, Whitehouse Street, Walsall, electrical engineer. First meeting, January 11th, 11.30 a.m., Official Receiver's Office, 30, Lichfield Street, Wolverhampton. Public examination, February 20th, 10.15 a.m., Court House, Lichfield Street, Walsall.

Company Winding-up Voluntarily.

HICKMAN, LIMITED. By special resolutions, November 30th, confirmed December 17th. A. C. Nash, York House, 5 and 7, St. Mary Axe, London, incorporated accountant, appointed a liquidator.

Application for Discharge.

WALLIS, Cyril Kenneth, 51, Mons Avenue, formerly Bedford Street, and Longford Road, Bognor, Sussex, electrical engineer. Hearing, February 14th, 12 noon, Court House, Church Street Brighton.

Orders Made on Applications for Discharge.

BROWN, William Lewis, carrying on business in co-partnership with another as SEWELL AND BROWN, at 6A, The Exchange, Muswell Hill, Middlesex, electrical and radio engineers. Discharge suspended for six months until May 27th.

HODGE, Wilfred Percy, 92, Cannon Street, London, E.C., wireless salesman. Discharge suspended for two years, November 30th.

Partnerships Dissolved.

S. W. BLIGH (Sydney William BLIGH and James FULLAGAR) 1 and 2, North Lane, Canterbury, radio and electrical engineers, by mutual consent, December 18th, 1928. Debts received and paid by S. W. Bligh, who will continue the business.

MORLEY AND BOOTH (Frederick Hampson MORLEY and Herbert Coulson BOOTH), electrical engineers and agents, Star Buildings, Newcastle-upon-Tyne, as from December 31st, 1928. F. H. Morley will carry on business at Star Buildings, and H. C. Booth will carry on business at 20, Saville Row, Newcastle-upon-Tyne.

ROYAL RADIO CO. (Donald William MORPHY and Robert George McCALL) manufacturers of wireless apparatus, 4 and 5, Dorset Mews North, Upper Gloucester Place, London, by mutual consent as from December 10th, 1928. Debts received and paid by D. W. Morphy, who continues the business.

Bankruptcy Proceedings.

TURTON, John William, Market Place, Banbury, Oxon, electrical engineer. This debtor's statement of affairs shows unsecured liabilities of £715, due to 68 creditors, and assets (including book debts £114) estimated to produce £258, or a deficiency of £457. The debtor has been sued for some months by creditors, several of whom had obtained judgment against him at the date of the receiving order, which was made on his own petition, two executions having been levied. Debtor's books had not been balanced since 1925.

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PATENT RECORD.

The following information is prepared from the Illustrated Official Journal (Patents) by permission of the Controller of H.M. Stationery Office. Printed copies of full Patent Specifications, when accepted, may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at 1s. each.

Specifications Accepted.

301 983 A. Graham and Co., Ltd., and A. C. Brockies. Manually operated selecting switches for telephone and like systems. (24/9/27.)
301 989 Sterling Telephone and Electric Co., Ltd., N. Blades, and J. R. Beard. Loud-speaking telephones. (27/9/27.)
301 991 British Thomson-Houston Co., Ltd., and C. H. Hastings. Systems of electric motor control. (28/9/27.)
279 086 Allmanna Svenska Elektriska Aktiebolaget. Arrangement in commutator machines connected in cascade to induction machines. (15/10/26.)
302 009 H. P. Bramah and Metropolitan-Vickers Electrical Co., Ltd. Electric locomotives. (22/10/27.)
302 012 T. Harden and H. A. Mepham. Electrical plugs. (27/10/27.)
282 020 F. S. Smith. High-voltage system and apparatus for use particularly with X-ray tubes. (27/10/27.)
302 024 Electrical Improvements, Ltd., and L. C. Grant. Electric circuit-breakers. (7/11/27.)
302 025 British Thomson-Houston Co., Ltd., and E. G. Parrott. Electric contact-breakers. (8/11/27.)
302 039 V. Hope. Electric fuses and isolators. (24/11/27.)
302 048 A. B. Field, A. N. Hanworth and Metropolitan-Vickers Electrical Co., Ltd. Electric circuit-breakers. (10/12/27.)
302 057 G. Pate and J. R. Laird. Flickering devices for imitation fires. (17/12/27.)
282 449 A. Pouchain. Negative electrode for electric accumulators. (20/12/26.)
282 693 Siemens-Schuckertwerke Akt.-Ges. Arrangement for protecting stationary dry surface contact rectifiers from overload. (22/12/26.)
302 063 T. Yamanouchi. Clamps or connectors for electric cables. (29/12/27.)
282 827 International General Electric Co., Inc. Temperature responsive devices. (30/12/26.)
302 064 Imperial Chemical Industries, Ltd., and J. H. Paterson. Electrodes for use in arc welding. (30/12/27.)
302 066 Electrical Improvements, Ltd., and H. B. Poynder. Thermo-electrically operated devices for the protection of rotary dynamo-electric machines. (3/1/28.)
302 068 J. Brighouse. Couplings for electric conduits. (12/1/28.)
302 071 Allmanna Svenska Elektriska Aktiebolaget. Air-drying apparatus for oil-immersed electrical transformers. (4/1/28.)
285 870 S. Schild. Automatic protection and control of electrical installations. (21/2/27.)
302 107 F. Whipp, Whipp and Bourne, Ltd., and Mather and Platt, Ltd. Automatic electric cut-in and cut-out switches for battery-charging systems. (19/1/28.)
289 418 H. J. Kuchenmeister. Valve-amplifying device combined with a reproducing apparatus for sound films. (2/11/26.)
302 109 J. E. Long. Electric sign. (27/1/28.)
290 975 W. Rebikoff. Planet gear-drive for electromechanical phonographs. (10/9/27.)
291 441 Electroacustic Ges. Leads for sounding purposes. (2/6/27.)
292 071 Bergmann Elektricitatswerke Akt.-Ges. Alternating-current motors with short-circuited armatures. (11/6/27.)
292 010 C. Tourne. Incandescent electric lamps and the like. (23/6/27.)
302 128 B. Quast and F. Lomberg. Electrically driven roller wavs. (25/1/28.)
302 130 G. Pate and J. R. Laird. Resistance elements for electric fires and the like. (6/7/28.)
299 035 Siemens-Schuckertwerke Akt.-Ges. Submersible electric machines. (20/10/27.)
297 434 Marconi's Wireless Telegraph Co., Ltd. Coupling arrangements for use in high-frequency circuits. (21/9/27.)
301 964 F. Berg. Electric control switch constructions. (6/8/27.)

Applications for Patents.

November 29th.

35 217 J. B. Hansell and Metropolitan-Vickers Electrical Co., Ltd. Devices for measuring temperature in oil-immersed electrical apparatus.
35 182 B. Hesketh. Electric switches.
35 200 International General Electric Co., Inc. Electric protective arrangements. (29/11/27, Germany.)
35 215 Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric and Manufacturing Co.). Electric elevator control systems, etc.
35 186 M. P. A. Wireless, Ltd., and J. F. Shaw. Control of electric sound reproducing apparatus.
35 228 E. F. Northrup. Electric induction furnaces. (8/6/27.)
35 171 H. H. Perry. Electric heating apparatus.
35 125 W. Rogers. Electric lamp holders.
35 041 Standard Telephones and Cables, Ltd. Automatic telephone exchange systems, etc.
35 143 S. J. Tamen. Electrically-operated fastening.

November 30th.

35 331 Allmanna Svenska Elektriska Aktiebolaget. Current transformers. (17/2/28, Sweden.)
35 318 R. L. Aspden. Combined gramophone and wireless instruments.
36 363 British Electrical Reproduction Co., Ltd., and C. Berrage-Moulton. Loud speakers.
35 308 D. S. Burleigh. Electric drives for gramophones.
35 321 S. G. S. Dicker (N. V. Philips' Gloeilampenfabrieken). Alternating current rectifiers.
35 337 Electrical Research Products, Inc. Television systems, etc. (6/4/27, U.S.)
35 272 H. J. Fisher. Electric cables.
35 360 A. F. Harrison and O. L. and S. M. Peard. Electric heaters.
35 345 E. B. Higgins and United Water Softeners, Ltd. Electrolytic production of sterilising agents, etc.
35 312 J. Keefe. Electric heating and cooking apparatus.
35 330 W. E. Lawton and S. Livingston. Apparatus for controlling electric advertising signs.
35 339 C. Lorenz Akt.-Ges. Piezo-electric control of valve oscillation generators. (2/12/27, Germany.)
35 323 G. Marr. Electric switches.
35 303 Metropolitan-Vickers Electrical Co., Ltd. Control systems for elevators, etc. (30/11/27, U.S.)
35 371 Siemens and Halske A.G. Telephone systems. (9/12/27, Germany.)
35 380 F. Warburton. Telegraph printers.
35 298 Western Electric Co., Ltd. (Bell Telephone Laboratories, Inc.). Acoustic devices.

December 1st.

35 491 F. G. Baum. Dynamo-electric machines.
35 413 J. H. O. Harries. Television systems, etc.
35 427 Landis and Gyr Soc. Anon. Electric measuring instruments. (24/1/28, Switzerland.)
35 490 C. Lorenz Akt. Ges. Vacuum tube oscillators. (2/12/27, Germany.)
35 411 R. Nicol. Electrical signalling apparatus for controlling vehicles.
35 426 A. Reynolds and Wandsworth Electrical Manufacturing Co., Ltd. Manufacture of operating dollies of electric switches.
35 466 Siemens and Halske A.G. Discharge vessels having electrically-heated cathodes. (2/12/27, Germany.)
35 483 E. Scott-Snell. Domestic electrical fixtures.
35 445 Walker, Hunter and Co., Ltd., and J. Walker. Electrically-heated ovens.

December 3rd.

35 534 C. D. Barklie. Thermionic valves, etc.
35 652 Benjamin Electric, Ltd., and G. Campbell. Shock absorbing mounts for thermionic valves, etc.
35 640 E. Bornand and H. A. Schlaepfer. Electric furnace. (8/12/27, Germany.)
35 612 British Thomson-Houston Co., Ltd. Electric contactors. (1/12/27, U.S.)
35 613 British Thomson-Houston Co., Ltd. Electric discharge devices. (2/12/27, U.S.)
35 636 Burovax, Ltd., and S. C. Winfield-Smith. Transformers for loud-speakers.
35 585 N. R. Campbell, and General Electric Co., Ltd. Electric discharge tubes.
35 505 L. I. Dennett. Electric gas lighters.
35 528 H. Hastings. Telephone transmitters.
35 501 E. V. Mackintosh. Moving-coil loud speakers.
35 565 H. Plein. Electric cut-outs.
35 627 R. Pollak-Rudin. Recording electric currents.
35 660 A. W. Saulter. Drums for carrying cables, etc.
35 661 A. W. Saulter. Containers for wound wire, etc.
35 655 Soc. Francaise Radio-Electrique. Alarm devices. (2/12/27, France.)
35 560 G. E. Taylor. Pedestals for electric conductors.
35 535 F. Wood. Thermionic valves.

December 4th.

35 703 British Thomson-Houston Co., Ltd., and J. C. Read. Transformers.
35 704 British Thomson-Houston Co., Ltd., L. R. Nixon and A. A. Pollock. Constant current distribution systems.
35 705 British Thomson-Houston Co., Ltd. Electric lamps. (6/12/27, U.S.)
35 729, 35 730, 35 731 P. Freedman. Thermionic valves.
35 770 Metropolitan-Vickers Electrical Co., Ltd. Electricity meters. (9/12/27, U.S.)
35 776 Nederlands Telegraaf Maatschappij Radio-Holland. Coupling devices for wireless telegraphy, etc. (6/12/27, Holland.)
35 698 J. W. Patrick. Electric fuse holders.
35 762 H. J. Round. Means for recording and producing sound.
35 785 Siemens and Halske A.G. Telephone installations. (23/6/28, Germany.)
35 686 F. L. Smith. Moving-coil loud speakers.
35 700 J. Swinburne. Selenium cells.
35 724 Westinghouse Brake and Saxby Signal Co., Ltd. Traffic controlling apparatus. (8/12/27, U.S.)

December 5th.

35 903 J. L. Baird and Television, Ltd. Television, etc., apparatus.
35 835 J. W. Bannister. Electromagnetic devices for actuating valves of organs, etc.
35 900 H. H. Berry. Signs.
35 886 British Thomson-Houston Co., Ltd., and A. A. Pollock. Dynamo-electric machines.
35 882 M. Dieterlen, H. Richter, and Siemens Schuckertwerke A.G. Crossfield d.c. machine.
35 836 G. Fieldhouse. Inductance coils.
35 807 G. E. Goodyear. Telephone apparatus.
35 925 P. St. J. Heaton and Radiovisor Parent, Ltd. Electric switches.
35 852 B. B. Johnson and Relay Automatic Telephone Co., Ltd. Electrical selectors.
35 911 L. Levy and A. Rio. Electromagnetic delay devices. (30/12/27, France.)
35 899 London Electric Wire Co. and Smiths, Ltd., and E. L. Wildy. High-tension cables.
35 919 A. I. Milledge. Electrical toys, etc.
35 907 H. J. Round. Microphones.
35 853 J. B. Snowden, and Young, Osmond and Young, Ltd. Resistance units.

December 6th.

36 043, 36 044 Associated Telephone and Telegraph Co. Telephone systems. (13/8/27, Belgium.)
36 057 Ateliers Vaucanson, and P. Marchal. Electric starting apparatus for motor vehicles, etc. (8/12/27, France.)
36 000 F. Baker, and Siemens Bros. and Co., Ltd. Electric contacts, etc.
36 010 F. G. Baum. Dynamo-electric machines. (6/12/27, U.S.)
35 988 G. A. Betulander. Electric relays.
36 028 British Thomson-Houston Co., Ltd. Apparatus for interconversion of sound and electrical impulses. (6/12/27, U.S.)
36 003 W. A. Cuthbert. Low frequency amplification.
35 990 Electric Fires, Ltd., and F. L. Newhouse. Thermostats.
36 014 H. Fairbrother (Vigilant Automatic Fire Alarm Co.). Fire alarms.

Coming Events.

Friday, January 4th.

Institution of Electrical Engineers (Meter and Instrument Section.)—Institution, Savoy Place, Victoria Embankment, London. Discussion on "Precautions in the Use of Standard Instruments." To be opened with a short paper by Mr. W. H. Lawes. *7 p.m.*

Monday, January 7th.

Institution of Electrical Engineers (Mersey and North Wales—Liverpool—Centre.)—The University. Paper by Mr. W. B. Woodhouse on "Overhead Electric Lines." (To be presented by a deputy.) *7 p.m.*

Tuesday, January 8th–Thursday, January 10th.

Physical and Optical Society's Exhibition.—Imperial College of Science and Technology, Imperial Institute Road, South Kensington.

Tuesday, January 8th.

Institution of Electrical Engineers (North-Western Centre.)—17, Albert Square, Manchester. Paper by Mr. J. L. Carr on "Recent Developments in Electricity Meters, with particular reference to those for special purposes." *7 p.m.*

Electrical Power Engineers' Association.—Junior Institution of Engineers, 39, Victoria Street, Westminster. Lecture on "Domestic Electrical Appliances: Design, Construction and Efficiency." *7.15 p.m.*

Institution of Electrical Engineers (Scottish Centre.)—Royal Technical College, Glasgow. Paper by Mr. L. G. H. Sarsfield on "The Electrical Equipment of X-Ray Apparatus." *7.30 p.m.*

Wednesday, January 9th.

Institute of Wireless Technology.—Engineers' Club, Coventry Street, London. Paper by Mr. J. Priechenfried on "Picture Transmission." *7 p.m.*

Thursday, January 10th.

Institution of Electrical Engineers.—Savoy Place, Victoria Embankment, London. General discussion on "A Study of the Future Development of Demand and the Economic Selection, Provision and Layout of Plant, as illustrated by Telephone Systems on the one hand and Power Systems on the other." Introductory papers by Captain J. M. Donaldson and Captain J. G. Hines. *6 p.m.*

Institution of Electrical Engineers (Dundee Sub-Centre.)—University College, Dundee. Paper by Mr. W. M. Mackay on "Static Rectifiers." *7.30 p.m.*

Friday, January 11th.

Institution of Electrical Engineers (London Students' Section.)—Institution, Savoy Place, Victoria Embankment, London. Paper by Mr. J. A. H. Lloyd on "Telephone Repeaters." *7 p.m.*

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THE ELECTRICIAN

Established 1861. The Oldest Weekly Illustrated Journal of

Electrical Engineering, Industry, Science and Finance.

Bouverie House, Fleet Street, London, E.C.4. Telegrams: "Benbrotric, Fleet, London." Telephone: City 0244 (Ten lines).

No. 2641. [No. 2. Vol. CII.] Friday, January 11, 1929. Annual Subscription, 25s. Overseas, 30s.

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Current Topics.

Gas Lighting on Railways.

IF there were any necessity to emphasise the danger of gas lighting of railway rolling stock the recent Charfield disaster—in which the death roll was materially increased by deaths from burns following the explosion of gas cylinders used for train lighting—provided undeniable proof. Nevertheless, there is no indication that the railway companies have taken any new steps to expedite the equipment of their older coaches with electric lighting sets. In Col. MOUNT'S report on a recent Welsh railway collision reference was made to an escape of gas from the passenger train involved, and though no explosion or fire occurred, the risk was present. It is understood that the subject of gas lighting generally on railway trains is being dealt with in the report on the Charfield accident, and we shall look forward with interest to the Ministry of Transport's recommendations. Meanwhile, the railways will be well advised to expedite their conversion plans. The railways have already lost a lot of custom to more attractive transport media, and indefinite continuation of the risk of cremation may be expected to encourage still more passengers to seek less hazardous means of locomotion. Although we shall continue to stress this safety aspect of railway lighting, we must also deplore the dismal appearance of many of the gas-lighted railway stations. Station after station at which one may stop on a main-line journey is enshrouded in gloom the profundity of which seems only to be emphasised by the dim glimmer of the antiquated gas lamps overhead. Apart from the depressing effect which such archaic lighting must exert on travellers, the railway companies might well consider how much these antiquities cost in reduced efficiency on the part of their employees. It is all very well to explain away these things by saying that even now the railways are not paying propositions. So long as a goodly proportion of their rolling stock and stations continue as throw-backs to the Victorian age, so long will the railways find difficulty in deriving financial reward. Safe lighting for all coaches and brighter and more efficient lighting for stations are among the necessary preliminaries to greater prosperity.

Wiring "Economy."

THE view that some form of compulsory registration for electrical installation contractors is really necessary continues to gain adherents, and though, as we have frequently pointed out, we cannot envisage a compulsory registration scheme until all the properly qualified contractors are included in the voluntary scheme of the National Register, two instances which have come to our notice within the present week certainly emphasise the need. In one case a well-known contractor sent one of his men to repair an ironing circuit in a house. He found that this had been added to the original installation put in some years ago. It was a metal sheathed job, and the ironing plug had been wired with a single 18's metal sheathed wire, and the sheathing used as a return. The sheathing was not properly bonded to the main installation, and had in consequence burned out. Comment on this case is equally as obvious as that of the other example brought to notice by a well-known firm of cable manufacturers. Receiving a request from an "electrical engineer and contractor" for a price list of wires and cables, they complied with his request, but were not unnaturally astonished to receive, a few days later, a request from that same "electrical engineer" for a diagram of connections for two-way switching!

Bare Wire Signalling Circuits.

CONSIDERABLE interest attaches to the report—recently referred to in our pages—on an investigation of the safety, in the presence of firedamp, of certified bare wire mine signalling bells when connected in parallel, which has been carried out at the Mines Department Testing Station at Sheffield. Since 1917 facilities have been afforded for the testing of mine bells and relays, and those that have passed the tests have been certified as safe for bare wire signalling underground with any source of current and at any pressure up to a maximum of 25 V. But, as pointed out in Mines Department Circular No. 24 of 1927, the certificate did not cover the use of such instruments in parallel, and the investigation, the results of which are now published, was undertaken to determine under what conditions they can be so used with safety. The inquiry has shown that the safety of the circuit is secured by limiting the current to a certain value below that which the resistance of the instruments themselves would allow to pass. The simplest and most reliable method of ensuring this current limitation is shown to be the use of a type of cell with a relatively high internal resistance, such as a 3-pint wet Leclanché cell, made in accordance with the specification in the Report. A list of the certified bells and relays which the use of this type of cell makes it safe to operate in parallel on bare wire circuits, which is also given, comprises most, but not all, of the certified types. Alternatives to the use of this type of cell, which are envisaged, include:—(i) A new type of

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battery; (ii) the use of insulated cables; and (iii) combinations of bare wires and insulated cables.

A "Reciprocal Understanding."

THE understanding which has been arrived at between the Radio Wholesalers' Federation and the Wireless Retailers' Association, details of which will be found on another page in this issue, implies that a strong need for co-operation exists on that side of the radio industry not covered by the R.M.A. The membership of the R.W.F. appears to include most of the large radio factors in the country, and it seems likely, therefore, that membership of the W.R.A. will be accepted as adequately establishing an applicants' right to trade terms. If our appreciation of the position is correct, it is expected that this aspect of affairs will become steadily of more importance as the modes of obtaining illicit discounts become increasingly restricted, a condition which we are given to understand both associations intend to bring about. The more closely the clauses of the "understanding" are examined the clearer will it be that they are intended to constitute a check on the price cutting practices so prevalent in the trade, and there seems little doubt that, given the support of the generality of wholesalers and dealers, changes for the better could be affected. The success or otherwise of this effort to stabilise the retail side of the radio industry depends very largely upon the willingness of dealers to join the W.R.A., for even though the R.W.F. agree to supply only the W.R.A., members of the former must still supply non-W.R.A. dealers if the membership of the latter is not sufficiently large to absorb their stocks. The theory of the "understanding" appears to be satisfactory enough, but in practice the man that pays the piper, in this case the dealer, usually calls the tune.

The "Listener."

FOLLOWING upon the recommendation of the Sir HENRY HADOW'S Committee which, it will be remembered, concluded, early in November, its inquiry into the possibilities of broadcasting in relation to adult education, the B.B.C. has decided to publish a paper to be called the "Listener." This new weekly publication will make its appearance on January 16th, and will confine itself mainly to personal subjects and matters associated with programmes. It is believed that the new paper will not enter into competition with other weekly journals of wireless interest, but will, we are given to understand, make broadcast talks more effective by publishing such addresses after they have been put "on the air." Whether this publishing of all the talks that are given is likely to be popular is a matter which does not concern us, but the fact that the B.B.C. has stated that it does not intend to compete with the popular technical journals dependent upon the radio industry and listening public is reassuring. The microphone publicity at the command of the B.B.C. is of such value, that were the Corporation to advertise a technical paper of its own publishing in the same way that it puffs its two well-known programme journals, we believe that the unfair competition would quickly tell on the company-owned wireless papers at present enjoying good circulations. The B.B.C. has at its unlimited disposal a form of publicity which cannot be bought in this country, and though such monopoly has not to our knowledge ever been abused, we trust that the "Listener" will not prove an exception to the rule. Some three years ago the B.B.C. used to broadcast a review of the popular wireless papers each week, with the result that the editors of such journals used to compete for the most "honourable" mention. The feature was, however, discontinued after some little while, leaving in its wake the weekly "puffs" on behalf of the "Radio Times" and "World Radio." Presumably we shall soon have the somewhat doubtful pleasure of listening also to reviews of the contents of the "Listener."

A Portable Lamp Warning.

AT an inquest at Poplar (London) last week, a jury returned a verdict of "accidental death through neglect of the firm in using defective gear." The facts of the case were that the man whose death was the subject of the inquiry was using a portable electric lamp attached to about 25 ft. of flexible conductor. Investigation at the inquiry showed that the porcelain of the lamp top was broken, and the current, at a pressure of 250 V, passed through the brass guard to the man's hand. The Coroner, Dr. W. B. PURCHASE, not only very properly condemned the use of this type of lamp in such circumstances, but also pointed out that safer lamps were obtainable. As most lamp manufacturers and contractors are already aware, portable lamps which have their tops and holders completely cased in insulating material have been on the market for some time, and if electricians of works permit the use of metal hand guards which can possibly become alive, they not only do an injury to the electrical industry, and probably in the long run, to their own interests, but also endanger life. Both users of portable lamps and electricians who are not well informed on the subject would do well to visit the Home Office Industrial Safety Exhibition, in Horseferry Road, Westminster, and inspect the portable lamps on view there. The exhibits include several genuine safety lamps, as well as a number of examples which have been responsible for fatalities.

Electrical Refrigeration.

ELECTRICAL refrigeration has made rapid strides in Brazil during the last few years, mainly through the sales and propaganda work of three American firms. So considerable has been the progress made that in the larger cities, such as Sao Paulo and Rio de Janeiro, electric refrigeration is enjoyed by the average household. According to a "Commerce Report" of American origin, this general adoption of electrical refrigerators is the outcome of advertising and installing the machines in newly built houses and flats, with the result that electric refrigerators are being introduced with reasonable success after comparatively easy selling. In this country, where at the moment there is also a considerable number of houses and flats in course of erection, though we find gas boilers and geysers installed, we have never heard of an electric refrigerator being fitted and included in the purchase price of the house. The idea, however, appears to be worthy of development, and in the case of those houses where the purchase price is over four figures, the addition representing the cost of the refrigerator would appear small by comparison with the rest of the expenditure.

The Physical and Optical Societies' Exhibition.

THE nineteenth annual exhibition of the Physical and Optical Societies, which was held from Tuesday until Thursday, at the Imperial College of Science and Technology, South Kensington, was, if possible, a more comprehensive show than that of former years. The exhibits included a number of new and fascinating measuring instruments, including a wave-meter incorporating a four-electrode valve. This instrument has been developed by Dr. N. W. MCLACHLAN and is so designed as to produce a radio frequency oscillation modulated at audio frequency. The instrument will be described in greater detail in our next issue. Many of the research laboratories in the country, including the National Physical Laboratory, exhibited working models, while in many cases, exhibitors showed on their stands apparatus in section and in component form in order to convey to the visitor a better understanding of the merits claimed. It has not been possible to give a complete review of the exhibition in a single issue, and, though the descriptions of a number of the exhibits are unavoidably held over, the pages devoted to the exhibition this week indicate the trend of development in instrument design during the past year. The good attendance at the Imperial College during the three days of the show undoubtedly indicates the interest which measuring and other instruments hold for those of a mathematical turn of mind, interest which must be gratifying to both manufacturers and organisers alike.

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LAMINATED SYNTHETIC RESIN PRODUCTS.

Notes on the Work of Early Experimenters—The Use of Paper or Fabric Bases—Importance of Control of Chemical Change—Varnish-paper and Varnish-fabric Boards and Tubes—Necessity of Guarantees to B.E.S.A. Specifications.

By A. R. DUNTON, A.M.I.E.E., and A. W. MUIR, D.S.O., M.C., B.Sc.

ALTHOUGH synthetic resin products have only recently come into general use in electrical engineering, and are still so incompletely understood by some engineers that they are viewed with a certain amount of suspicion where guaranteed reliability is demanded, it is interesting to note that some of the earliest experiments with such materials were made more than fifty years ago. Notable work in the production of resinous condensation products of aldehydes and phenols was carried out and described by Adolf Baeyer about 1872, and later by Kleeberg about 1891, by which time formaldehyde was a commercial product, and by Dr. L. H. Baekeland, who succeeded in producing a synthetic resin which could be controlled to a certain extent as it passed from the liquid stage into the final solid insoluble mass.

This development led to the production of materials in which a paper or fabric base was first impregnated with the resin and finally converted into a hard mass, and these materials found commercial application as a substitute for natural resin and shellac products, which are limited in their use by poor heat resisting properties, and especially by their low melting points.

The formation of synthetic resins generally involves the use of phenol and formaldehyde, the condensation product being obtained by heating definite proportions of these materials, either alone or, more usually, with a catalyst which may be either acid, alkali or neutral in character. In the process of manufacture the condensation process is arrested in order to produce a material which will readily soften at some definite temperature best suited to its use, as, for instance, its application to paper or fabric or mixture with fillers for moulded materials. The treated material is finally subjected to a further heating, which completes the condensation process and gives the hard characteristic material in its finished form.

The behaviour of the synthetic resin in the final change depends to a large extent upon the control of the chemical change in the first process, and owing to the difficulty of effecting this control considerable variations often occur in each fresh quantity of synthetic resin produced.

Manufacture of Boards and Tubes.

One of the most important applications of synthetic resin is in the manufacture of varnish-paper or varnish-fabric boards and tubes such as are now very extensively used in the electrical industry. For the manufacture of varnish-paper products, which are typical, long lengths of paper are passed through drying chambers where they are coated with synthetic resin varnish, which is usually applied in liquid form by the paper passing over rollers immersed in a suitable bath, and dried by the circulation of hot air in the chamber. The drying process calls for careful control in order to obtain the varnish-coated paper in exactly the right condition of dryness, or, as it is termed, "greenness." A varnish paper in too "green" a condition will give off an undue quantity of vapour during the later process of conversion, and a poor electrical product will result. If, on the other hand, it is dried too much, the varnish passes prematurely into the final stage of conversion and the adhesion between the laminæ of the final product will be weak.

The treated paper at this stage should not have a moisture content exceeding 3% by weight, and if not required immediately it should be carefully stored in a dry place, but not for too long a time, as a slow chemical change continues to take place.

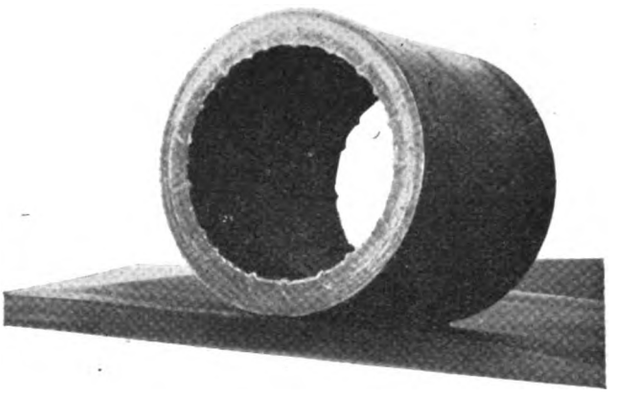


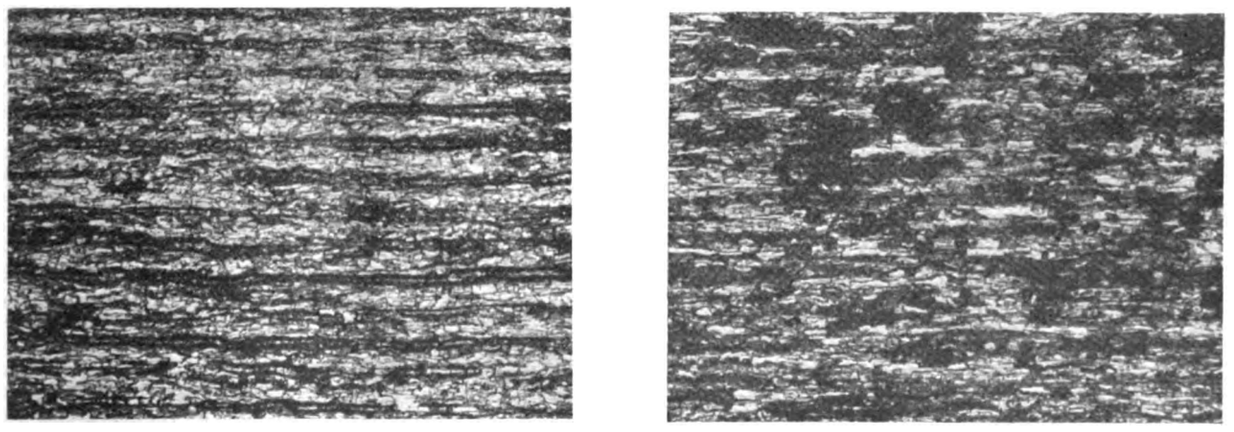
Fig. 1.—Synthetic resin paper tube showing effect of moisture absorption.

For the manufacture of boards the varnished paper is cut into suitable lengths and piled into stacks, which are subjected to a heat treatment under hydraulic pressure between highly polished metal plates. The pressure applied is approximately 1 000 lb./sq. in. and the temperature is maintained at about 150 to 170° C. The process is continued until complete conversion of the resin has been effected, the time required in some cases being at least four hours.

For making tubes and cylinders the process is in some respects more simple, since the treated paper can be run direct on to the mandrels of special winding machines. There is, however, quite an art in the control of temperature, and of the rate at which the paper is passed on to the machine.

In both the manufacture of boards and tubes there is often the temptation to hurry the process, as it is impossible to detect by casual observation the difference between good and bad products. For this reason the standard B.E.S.A. Specifications which are shortly to be issued detailing the desirable qualities of these materials will be of great value to all users. Guarantees to these standards should be insisted upon, and, wherever possible, the properties should be checked by suitable tests.

The class of board or tube depends not only upon the kind of carrying medium used but on the particular variety of that medium, and careful selection of medium is necessary according to the purpose in view.



Figs. 2 and 3.—A micro-photograph of laminated synthetic resin board (left) showing incomplete diffusion and (right) a similar photograph showing less distinct lamination due to more complete diffusion.

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A study of the characteristics of available board or tube made from different varieties of paper or fabric medium shows that a variety of grades exist, differing in their properties and

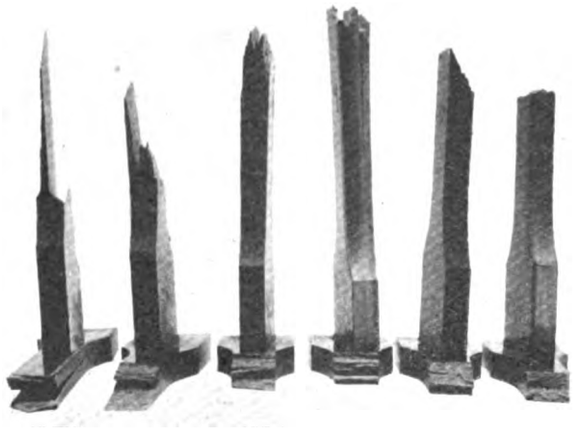

Fig. 4.—Fractures of synthetic resin paper tubes by tensile test.

therefore in the applications for which they are suitable. It is not sufficient, therefore, to specify simply " bakelite " board or tube, but the service must be considered and the suitable grade indicated.

It was at one time time thought that all synthetic resin boards and tubes were unaffected by moisture, but even some of the highest quality materials of their grade are seriously affected electrically by humid conditions. The drastic effect of moisture upon some grades is illustrated by Fig. 1, which shows the distortion of the inner layers and swelling at the ends of a tube which has been left immersed in water for some time. The degree of this effect depends on the thoroughness of diffusion of the resin through the carrying medium. Figs. 2 and 3 are reproductions of micro-photographs of cross sections of boards showing a marked difference in this respect. The board shown in Fig. 2 has a definite layered structure in which, if the material is not impregnated, the paper will act as a moisture conducting wick. The diffusion in the board shown in Fig. 3 is much more complete, giving a much better resistance to moisture penetration.

The nature of the structure of boards and tubes is also shown by the kind of fracture obtained in tensile tests, as illustrated in Figs. 4 and 5, which show the result of tests on specimens obtained from British, Continental and American manufacturers of repute. The specimens are arranged, from left to right, in the order of their tensile strength, the breaking points ranging from 23 000 lb./sq. in. in the case of the strongest material, having the layered structure and rugged fracture shown on the left of Fig. 4, to 9 000 lb./sq. in. in the case of the weakest material, having an almost homogeneous structure and the short fracture shown on the right of the same group. In boards and tubes giving a rugged fracture

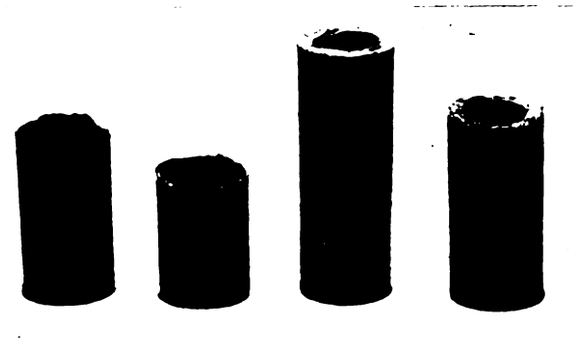

Fig. 5.—Specimens of synthetic resin paper tubes.

the resin content is approximately 30 to 40% and the mechanical features predominate, while the short fracture shows a material which has a resin content of about 60% or more, and which may be regarded as mechanically weak, but electrically far superior under humid conditions. For service under hot oil both kinds of material will be found to be equally satisfactory on electrical grounds.

Some idea of the average values for electric strength of synthetic resin paper-boards is given by Fig. 6, which is reproduced from " Electrical Insulating Materials,"* by Allan Monkhouse. The curves are given as based on information from various sources, including tests made on 29 different grades of materials supplied by 19 firms. The values for synthetic resin tubes and cylinders are considerably higher.

Some comparatively cheap variations of synthetic resin paper products are produced which have a low resin content, due to the use of a paper of low absorptive capacity, and even these materials may be satisfactorily used for electrical purposes in a limited field of application and under suitable conditions; for example, under dry transformer oil, but even under ideal conditions such materials should be given a suitable protecting film of at least three coats of a high grade moisture resisting baking varnish.

Acknowledgments are made to the Metropolitan-Vickers Co. for the use of photographs and information, and especially to the company's research department, where the investigational work and tests mentioned were carried out.

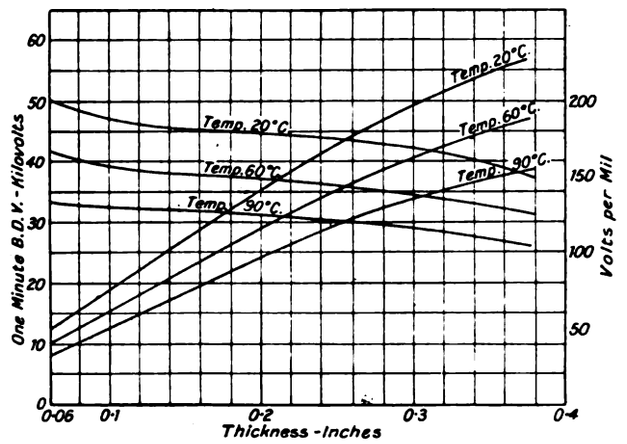

Fig. 6.—Curves showing average values for electric strength of synthetic resin paper-boards.

[* Published by Sir Isaac Pitman and Sons, Ltd.]

MICA PRODUCTION IN CANADA.

United States of America as the Biggest Buyer of Canadian Mica.

SHIPMENTS of Canadian mica during 1927 totalled 2 738 tons, valued at $174 377, according to finally revised statistics just issued by the Mining, Metallurgical and Chemical Branch of the Dominion Bureau of Statistics at Ottawa. The production in 1926 was 2 545 tons, worth $229 204. Increases were recorded in 1927 in shipments of rough-cobbed, thumb-trimmed and scrap mica; a considerable decrease was reported in shipments of mica splittings. Rough-cobbed and thumb-trimmed mica exported amounted to 165 tons; splittings, 159 tons; and scrap and waste, 4 536 tons. The total value of Canadian mica exported during 1927 was $326 846, which included shipments worth $304 781 to the United States and $21 035 to the United Kingdom.

In addition to the firms engaged in the primary production of mica there were four firms engaged in the secondary occupation of trimming and splitting mica. Nine of these mica trimming shops were in operation during 1927. Production from this source was valued at $285 555; employees numbered 479; salaries and wages reached $119 002; and raw materials cost $130 764.

ELECTRICITY IN QUARRIES.

In addition to orders which BLACKSTONE AND CO., LTD., of Stamford, report that they are receiving from all parts of the world for oil engines, the Jersey Granite and Concrete Co., Ltd., of St. John's, Jersey, which is modernising its power plant, has placed orders for the installation of the company's spring injection heavy-fuel oil engines to the extent of 450 H.P. This, we are informed, will result in reducing the cost of quarry output and ensuring favourable competition at English ports.

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ELECTRICAL DRIVING OF CEMENT MANUFACTURING MACHINERY.

Advantages of Electric Drive—Details of Plant Required—Economic Considerations—Working a Rotary Kiln—Electrical Excavating Equipment—Some Interesting Installations Described.

IN order that this country should maintain its pre-eminent position as the home of the best Portland cement, it has been necessary for unceasing attention to be paid to the scientific aspect of manufacture and to the development of highly specialised machinery. In this connection, it is interesting to note that, whether the wet or the dry process of manufacture is adopted, electrical driving is extensively used, the individual driving of machines and perfect control of every operation which this method ensures being of particular value to the industry.

The raw materials include limestone, marl, chalk, marine shells, clay, shale, slate, and blast furnace slag, the chief operations for the manufacture of Portland cement being embraced under the headings: preparation of the raw materials, burning, and grinding. For this work the necessary machinery may be classified as the excavators, crushers, screens, grinders, mixers, wash mills, tube mills, pulverised fuel plant, rotary kilns, rotary coolers, pumps, elevators and conveyors, packers and weighers.

Description of Process.

The wet process is almost universally adopted in this country for the manufacture of Portland cement, but as the difference between the two processes lies only in the preparation of the raw materials, it is sufficient in this article to refer in outline to the sequence of operations for the wet process. Thus, if hard chalk and clay are the raw materials, the initial operations are crushing and screening of the chalk, mixing with water and grinding fine in a wet grinding mill. The resulting slurry is fed to a mixer, this being a large tank with some form of mechanically-driven paddles, which keeps the slurry of uniform consistency. This slurry is passed, as required, to the wash-mill, where it meets the clay; which has previously been broken up into small pieces in crushers of the roller type. The resulting slurry is further treated in a slurry mixer, this being similar to the chalk mixer previously mentioned, but it may be added that, instead of paddles, a method of air agitation may be employed. The next process is one for very fine grinding, either in what is known as a combination mill or in a ball mill followed by a tube mill, then, after being dried in a rotary drier, heated either by waste heat or separate firing, the burning operation takes place with crushed, dried and pulverized coal in a rotary kiln. The resulting product is cooled, and, in the form of clinker, is the desired cement, ready for grinding down in clinker grinding mills to the requisite fineness, feeding to the storage hoppers and weighing and packing into bags.

It will be seen that a considerable amount of conveying plant in the form of pumps and pipe lines, bucket elevators or band conveyors may be necessary, and a few facts about some of the items of machinery with relation to the electric driving requirements may be interesting. Various reasons have led to the widespread adoption of electric driving, and it may be mentioned that notable economies have resulted from installations utilising electric power, increased output for a given power consumption being obtained in consequence. Under normal conditions, cement mills are kept in continuous production, operating 24 hours a day for seven days a week, although the preparation machinery may be in operation for a shorter time, and it is important that the shutting-down of any one machine shall not affect the remainder of the plant. This condition is fulfilled by the sub-divided drive possible with electric power, and at the same time a continuous record can be obtained of the amount of power used in each of the different sections of a mill. Thus an accurate check can be kept on the cost of manufacture and condition of the machinery. Most of the machines start under heavy overload, even up to 200 or 300 per cent., and some are liable to overloads when in operation. Electric motors run at very high efficiency during normal operation, and yet can be obtained with a large margin of overload capacity which is drawn upon automatically at any time either at starting or when in operation.

With the exception of rotary kilns, the majority of the larger machines used in the manufacture of cement are of the constant speed type, so that, as the electricity supply available is usually three-phase a.c., induction motors form ideal driving units in most instances, but for some of the larger powers synchronous motors are often used. The preliminary crushing of hard materials is generally effected with gyratory or jaw crushers driven through belting, and sometimes provided with a break-pin in the driving pulley as a protection against damage. Individual driving or group driving of three or four crushers with their attendant elevators and conveyors is usually adopted. The starting torque required is generally somewhat more than the full load torque of the motor. Ball mills take more than normal torque at starting, this being due to the high frictional effect and the weight of the steel balls, which will all be at the bottom of the cylinder when this is at rest. When, in operation, the screens may become temporarily clogged, so that as the material continues to feed into the mill, it may gradually fill up and require more power to drive it. This overload, however, is not likely to exceed 25%, and lasts only for a short time. These mills revolve at about 20 r.p.m., and are supplied with a countershaft geared to the drum. Belt drive from the electric motor to the countershaft is generally adopted, though the motor may be coupled to the countershaft through enclosed gearing or, in some instances, direct through a flexible coupling.

Tube mills are used to finish the product of the ball mills. The essential components are a steel cylinder lined with some special hard wear-resisting material, and about half-filled with flint pebbles or cast iron pellets. The cylinder is supported on trunnion bearings and is rotated at a comparatively slow speed. The material enters through a hollow trunnion, moves through the whole length of the mill body, while it rotates, and is discharged at the opposite end of the mill in a very finely pulverised condition. Sometimes considerable variation in the power required and output of a given size of mill may be noted, due to the quantity of pebbles in the mill, and, as the pebbles wear down, the power required by the mill decreases. In determining the size and type of motor, careful consideration must be given to the starting torque required, which may be about twice the full load torque of the motor.

Rate of Feed.

In order to obtain the best results with the rotary kiln, the firing process necessitates careful control of the rate of feed of raw material, rate of feed of fuel and speed of kiln. The raw material feed and the coal feed should have a wide speed range with a very large number of intermediate speeds, and if a d.c. supply is available, a d.c. variable speed motor may be used for this duty, while on a.c., a variable speed a.c. commutator motor is suitable. A speed range of 3 to 1 is normal with motors of this type, brush-shifting control giving an infinite number of intermediate speeds. Thus the motors meet the requirements for feeding the pulverised coal and slurry to the kilns, and as the brush-shifting arrangement is easily adapted to remote control, a sensitive control of slurry and coal feeds can be obtained from the firing platform. In addition to variation in the rate of feed of material, it has been general practice to demand also speed variation of the kiln from maximum down to 75 or in some cases, 50% of maximum. The speed control is obtained either by retention of the older line shafting with speed changing gears giving two or three speeds, or with cone pulleys giving a range of two or three to one, the driving motor being of a constant speed type, or by using a variable speed motor for each kiln. The drive may be taken from the motor through the medium, either of belt or gearing, but as the questions of ventilation and room temperature are important, belt drive is usually adopted, an incidental advantage being that the motor is thereby removed further away from the hot kiln.

If variable speed a.c. motors are used, these may be either of the induction type with wound rotors or of the commutator type, but for speed variation of between 25 and 50%, which is ample in most cases, induction motors have proved quite satisfactory. The speed variation is obtained by means of adjustable resistance connected across the slip-rings, and, although the method does not give the highest electrical efficiency, no serious objection can be taken, as the kiln drives account for only a few per cent. of the total

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power requirements in a cement works. It should be mentioned that by adding resistance to the secondary circuit the speed change for a given change in load is increased, and the greater the resistance the greater is the speed change, so that, when operating at low speeds, changes in torque have a noticeable effect on the speed of the kiln. These changes may be gradual, as when due to such causes as the partial blocking of the kiln by the formation of a clinker ring, or they may occur every revolution, due, for example, to the kiln being unbalanced.

In addition to synchronous motors, squirrel cage and slip-ring induction motors, as mentioned above, synchronous induction motors, "no-lag" power factor correction motors and a.c. variable speed commutator motors manufactured by the British Thomson-Houston Co., Ltd., Rugby, are extensively used in the cement manufacturing industry, and it is of interest to note some of the applications of the last types mentioned. "No-lag" motors are started and stopped in exactly the same manner as ordinary slip-ring induction motors, but run at or above unity power factor, so as to improve the power factor of the a.c. system to which they are connected. The effect of this is that more useful power can be generated with the same generating plant at the power station than if only ordinary induction motors are connected to the supply system: as a result the user obtains more advantageous terms for power, not only for that taken by the "no-lag" motors, but for all power taken from the system. Motors of this type have similar speed torque characteristics to those of ordinary slip-ring induction motors, and, therefore, can be used for any duty where slip-ring motors are suitable, whereas synchronous motors have a more limited field of application. In some cases a higher speed than the synchronous speed of the equivalent slip-ring induction motor may be required, and this can be obtained if a "no-lag" motor is used, as when being designed this special speed can be arranged for. As an example, reference may be made to motors of this type driving bag filling machines at the works of the Associated Portland Cement Manufacturers, Ltd. B.T.H. variable speed a.c. commutator motors are applied to various other kinds of drives than those previously mentioned, including the driving of coal screws for feeding pulverised coal to kilns, silo emptiers, slurry elevators, etc.

Some Examples.

Fig. 6 on the opposite page gives a view in the cement works of Greaves, Bull and Lakin, Ltd., Harbury, near Leamington. The electric motor on the left is driving a rotary cooler, and the motor on the right a rotary kiln. The first mentioned is rated at 15 H.P., and the second at 50 H.P. Both are of the slip-ring type manufactured by the British Thomson-Houston Co., Ltd., Rugby, the supply being at 433 V, three-phase, 50 cycles. In Fig. 5 is seen another example of electrical driving in the same works; the squirrel-cage induction motor illustrated is of 22 H.P., and drives a crusher and elevator. An instructive illustration of the ease of converting from steam engine to electric motor drive is given by Fig. 7. Here is seen part of the original engine-room of John Ellis and Sons, Ltd., at Barrow, near Loughborough, with a protected type slip-ring induction motor of 175 H.P. installed to drive some of the original line shafting of the mills through "Fabroil" pinion gearing. The motor-control gear is also shown, the motor speed being adjustable by the use of resistance in the rotor circuit through the medium of a controller of the tramway type. Connected to the shafting are two three-roll grinding mills, brick presses, elevators and conveyors. The illustration shows a stage in the conversion, the policy pursued by Messrs. Ellis having been to adopt electric motors for all extensions, retaining the steam engine (which was built in 1883) in service until fairly recently.

Another interesting electrical installation to which reference may be made is that at the works of the Rugby Portland Cement Co., Ltd. Here also the plant is now electrically driven, the motors being fed at 433 V, three-phase, 50 cycles. The motors range from 2½ H.P. to 250 H.P., three of the larger size being of the "no-lag" type. In Fig. 1 are seen a 250 H.P. "no-lag" motor driving a tube mill and a 100 H.P. protected type slip-ring induction motor driving conveying plant. One of the other 250 H.P. "no-lag" motors drives two "clinker and ball" mills, and another drives a crusher, tube mill and elevator. An example of a synchronous induction motor in a cement works is seen in Fig. 2, which shows a 600 H.P., 710 kVA 0.7 leading power factor, 250 r.p.m., 440 V, three-phase, 50-cycle machine driving a tube mill in the works of the Holborough Cement Co., Ltd., Snodland, Kent. This motor is shown in greater detail in Fig. 4.

In conclusion a word should be said about excavating equipment; electrically operated navvies are becoming increasingly popular for surface mining operations. In a plant which works continuously, the ability of the electric excavator to work 24 hours a day is of great value, and since there is no necessity to provide for transporting coal to the navvy, the wagon service can be organised for maximum efficiency. In addition to the elimination of coal handling, the cost and difficulties of supplying feed water are non-existent, and no delays are experienced through freezing in winter. A fairly large machine with complete electrical equipment is shown in Fig. 3, digging chalk at the Bevans Branch (Northfleet), of Associated Portland Cement Manufacturers, Ltd.

PLANT FOR THE HANDLING OF SACKS.

Lifting and Handling by means of Electrical Equipment—Its Adoption at Buenos Aires.

THE adoption of electric drives for lifting and handling plant has made it possible to build equipments which satisfy every requirement as regards simplicity in design and reliability in service. Experience has, in fact, shown that it is advantageous to adopt such mechanical means for the handling of goods, even when the latter are light in weight. An interesting equipment of this description is that installed by the Oerlikon Company at the sack factory of Messrs. Bunge and Born, at Buenos Aires; the plant in question, which is fully described in Bulletin No. 91, just issued by Oerlikon, Ltd., of 28-31, Essex Street, Strand, W.C.2, is intended for serving the various storerooms and workrooms of this factory. The storerooms for the rolls of material and for the completed sacks, consist of three parallel bays, each equipped with a travelling crane. The service between storerooms and workrooms is ensured by an overhead conveyor, on which circulate a number of electric motor hoists, the runway being provided with the necessary points for the different tracks. The travelling cranes of the storerooms are of standard design and fitted with a runway girder to link up with the runway of overhead conveyor. The motor hoists can thus run on to the travelling cranes and the whole storerooms can be served. The runway of conveyor is so arranged that separate access is provided to each individual crane. The points of the runway are set by hand from the driver's cab on the motor hoist. It is possible to run the motor hoists forwards or backwards, as required. The whole installation is operated with three-phase current at 200 V, 50 cycles.

CARDIFF CONTRACTORS.

Annual Dinner of the Cardiff Branch of the E.C.A.

AT the annual dinner of the Cardiff Branch of the Electrical Contractors' Association, which took place on January 3rd, with Mr. R. L. Booth, chairman of the Branch, in the chair, Mr. J. W. Beauchamp said he was extremely interested in the welfare of the electrical contractors. In these days, when the purchasing power of the people was greatly reduced and a great number of them had not much money to spend, there was more reason why they should try to develop some hobby interest in electricity. They wanted to bring their electrical gear into the interesting hobby category. With regard to the schemes of the Central Electricity Board they could not fail to reduce the cost, but people must not expect too much. He thought it necessary that they should have some accurate information as to what the scheme would really mean.

Mr. T. E. Algar, proposing the toast of "The Visitors," coupled with the names of Mr. Morley New and Mr. H. Coope, said Mr. New had always been a good friend to electrical contractors.

Mr. C. G. Morley New mentioned the interesting fact that during the last twelve months he had been able to place £25 000 worth of work in the hands of local contractors. A large proportion of that had gone to the members of the E.C.A. The £25 000 covered no less than 3 000 separate orders, and those were given during a period of great depression. The department had opened showrooms, and in this connection they had recognised the E.C.A. and discussed sales arrangements with them.

Mr. L. C. Penwill said the advent of women had proved a great advantage to the industry. The Electrical Association for Women had already become a great power.

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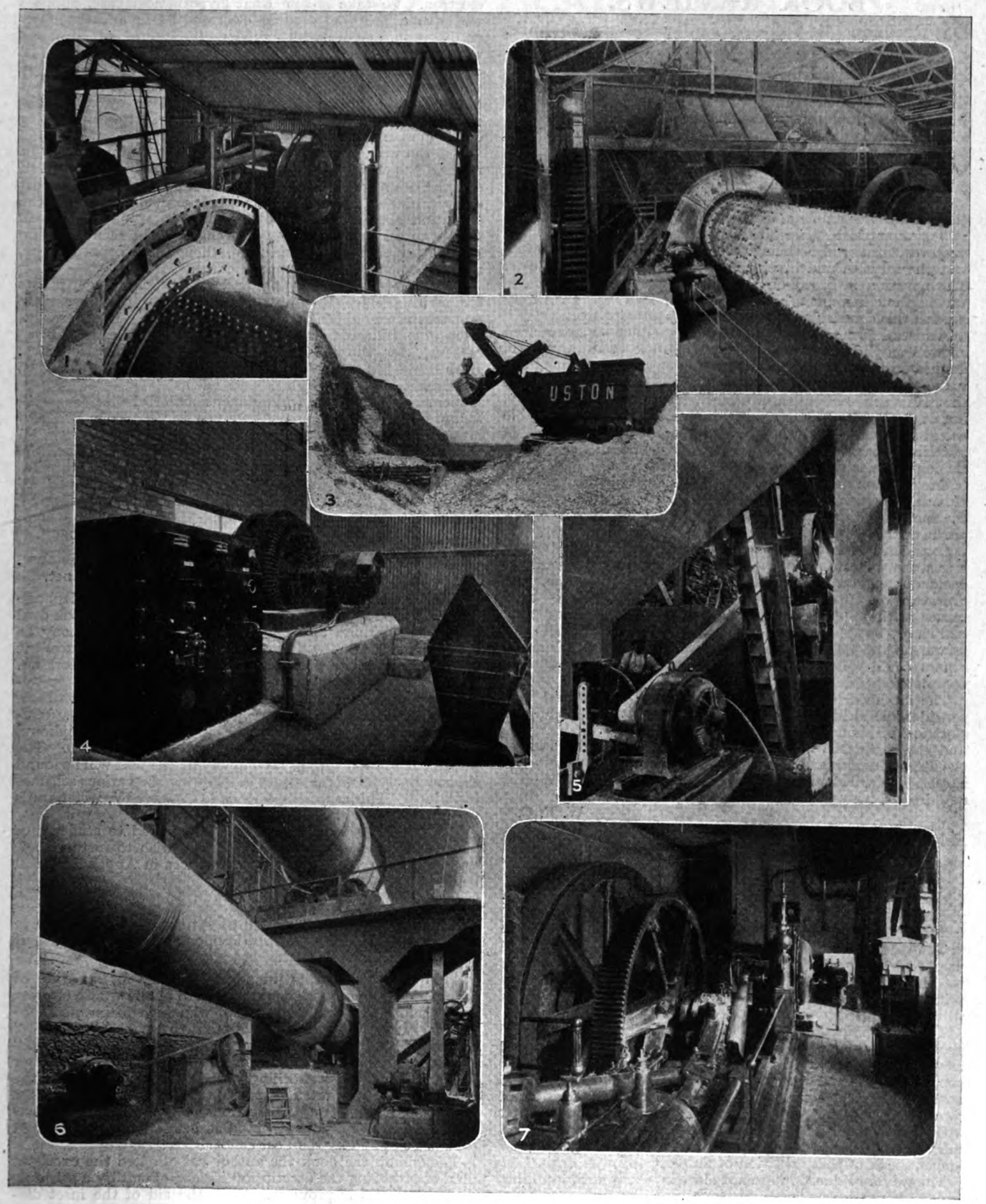

ELECTRIC DRIVE IN CEMENT WORKS.

A "NO-LAG" motor of 250 H.P. *driving a tube mill, and, in the background to the left, an induction motor of* 100 H.P. *driving a conveying plant;* (2) *a synchronous induction motor of* 600 H.P. *driving a tube mill;* (3) *an electrically-driven navvy in a chalk quarry;* (4) *a more detailed view of the* 600 H.P. *synchronous motor shown in* (2), *the starting equipment is also shown;* (5) *a* 22 H.P. *induction motor driving a crusher and elevator;* (6) *induction motors of* 15 *and* 50 H.P. *driving respectively a rotary cooler and a rotary kiln;* (7) *a view in the engine room at a cement works showing a* 175 H.P. *induction motor taking the place of an original steam engine driving the mill through the original line shafting during the complete change over from steam to electric drive.*

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BOOK REVIEWS.

Das Rechnen Mit Vektoren in der Elektro-Technik. By R. LUNDHOLM. (Stockholm : Centraltryckenet). Pp. 99.

This monograph consists of three chapters of about 20 to 30 pages each. The first chapter gives a complete analysis of three-phase circuits under conditions of unbalanced loading. With the rapid development of technical theory it is difficult to know how much must be taken as generally accepted and how much novel, and it is best perhaps to summarise the methods introduced in this chapter.

The system is based primarily on the well-known resolution of an asymmetric three-phase system of vectors into two symmetrical three-phase systems and one uniphase vector, special symbols being used to denote the asymmetrical and the forward and inverse sequence symmetrical systems. The notation is based on the polar system of co-ordinates which, though frequently found in American works is rarely used in this country in spite of its many advantages.

A special form of product—effective product—is introduced as well as the usual symbolic or complex product, and is defined as the product of the first vector and the momentary value of the second. This reminds one of the two products of the Heaviside-Gibbs three-dimensional vector geometry, but of course the definitions are different. Very considerable use is also made of the properties of conjugate functions, in particular the property that the sum of a complex function and its conjugate is equal to the real part of either.

The solution of differential equations is treated in terms of Heaviside's Operational Calculus, particular use being made of the method of expressing the impressed force as a function of the operator-p.

Considering the ground covered in approximately twenty pages the exposition is exceedingly lucid, but the work is decidedly of an advanced character. For example, the literature on Heaviside's operators is now very large—as a glance at the bibliography at the end of Carson's recent work will show, but it is a highly specialised subject appealing to telephone and telegraph engineers, and it is doubtful if many others could follow this part without reference to a more complete exposition.

The methods set out in the first chapter are applied with considerable skill in the second and third to the study of electrical machinery, and the problems of magnetic saturation and stable parallel operation are considered. This deserves the attention of machine designers and transmission engineers. Experience will show whether so complete an analysis is often required.

W. F. C.

Selected Papers on Wave Mechanics. By L. DE BROGLIE and L. BRILLOUIN. (London : Blackie and Son.) Pp. 151. 15s. net.

Collected Papers on Wave Mechanics. By DR. E. SCHRODINGER. (London : Blackie and Son.) Pp. xiii+146. 25s. net.

The electrical laws which the engineer knows so well and uses so successfully fail completely when they are applied to the interior of the atom. These books are reprints of original papers suggesting modifications of electro-mechanics which render it applicable to the interiors of isolated atoms.

These modifications are similar to those which convert geometrical optics into the undulatory theory of light. Just as we can no longer speak of the path of a ray when diffraction occurs, we can no longer assign a precise meaning to the position of an electron, when the scale considered is small compared with the " spread " of the wave-group associated with the electron. The group " spreads " at least once round the " orbit of the electron in the atom," so that we can no longer speak of the " position of an electron in its orbit."

The waves in question are not electric waves nor (according to Schrodinger) are they even waves in space, but are propagated in " configuration-space " (space of three times as many dimensions as there are atoms under discussion). Their connection with electromagnetic waves arises from the fact that the square of the modulus of the field-scalar (the " thing the waves are waves of ") is identified with density of electric charge. The wave mechanics provides a " natural " as opposed to an " artificial " explanation of the discontinuous nature of energy exchanges.

The principal application of wave mechanics is to the prediction of wavelengths and relative intensity of spectral lines, but the method also predicts new vagaries for the electron. To take a somewhat hypothetical case, suppose we have a beam of moving electrons as in a cathode-ray oscillograph, and we wish to reduce the lateral spread of the beam consequent on their mutual repulsion. Then, on classical electrodynamics, we might make the lateral spread zero by passing the beam through two pinholes each so small that two electrons could not scrape through side by side. The emergent beam would consist of single electrons following one behind another.

But the wave mechanics asserts if such a pinhole could be realised the electrons would be diffracted in going through it, and the beam would become a series of concentric cones (just as, in a pinhole camera, if the pinhole is made too small, the definition actually gets worse). Thus, he would be a rash man who said that the wave mechanics had identically no bearing on electrical engineering, though the connection is, at the moment, very remote.

The subject is still growing, and, as Dr. Schrodinger points out in his preface, it is not yet possible to give a complete and satisfactory exposition of wave mechanics. He, therefore, issues his collected papers in book form as a temporary measure, for the convenience of specialists in this work. Both books tax one's mathematical ability to the full, Thus, de Broglie discusses Kaluza and Kleins' " Universe of Five Dimensions." (" In the five-dimensional Universe the world line of every material particle is a geodisic.") Leon Brillouin introduces us to an ingenious physical assumption which, on statistical treatment, yields Einstein's formula for the fluctuations of black radiation. To this treatment he applies the curious name " the new statistics " ; one is tempted to murmur with Lord Goschen, " You can prove anything by statistics."

C. R, BURCH.

Automatic Telephony Simplified. By G. W. BROWN. (London : Sir Isaac Pitman.) Pp. 68+viii. 6s. net.

Originally appearing in the " Telegraph and Telephone Journal " as a series of articles, the contents of this book deal with the principles and practice of automatic telephony as adopted by the British Post Office. The book is an excellent introduction to the Strowger system of automatic working. Commencing with an introductory chapter, in which step-by-step switching, remote control, impulsing and the subscriber's dial are described, the reader is led in a very able and systematic manner to the more difficult phases of automatic telephony, viz., multi-exchange working and large exchange areas. The illustrations and diagrams accompanying the text will be found extremely useful to the reader in following the various schemes explained. This especially applies to Chapter IV, which deals with " Diagrams and Circuits."

The book can be confidently recommended to students of automatic telephony, and to those who wish to further their knowledge of circuit detail the references in Appendix I will be found useful.

A. S. C.

The Call Indicator System of Automatic Telephony. By A. G. FREESTONE. (London : Sir Isaac Pitman.) Pp. 112+xii. 6s. net.

Although this book is intended primarily for students of automatic telephony, it should appeal to others whose interest is of a more practical nature, and who wish to become conversant with the methods adopted to enable " manual " exchanges to be worked in conjunction with " automatic " exchanges during the period of conversion from the former to the latter type of working. Owing to the fact that the author has been granted permission by the Engineer-in-Chief to use the drawings and illustrations prepared by the Department, the book may be accepted as indicative of the present methods adopted by the Post Office.

Thoughout the book the author has adopted the excellent plan of preceding the description of each circuit by a schedule of the facilities it provides. With the aid of the inset diagrams provided, the reader should have little or no difficulty in understanding the operation of these circuits. It is a pity, however, that the inset diagrams have been placed in the book with so little regard to the need for continuous reference between them and the text.

The book appears to be free from material errors, and can be thoroughly recommended to those who wish to obtain further knowledge of machine switching principles, as applied to modern circuit problems.

W. S.

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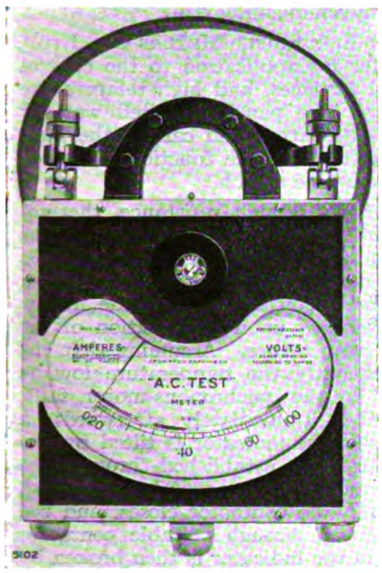
PHYSICAL AND OPTICAL EXHIBITION.

Many Electrical Exhibits Shown for First Time—A New Larsen-Potentiometer—Electroscope Development—An Improved Portable A.C. Multi-Range Instrument.

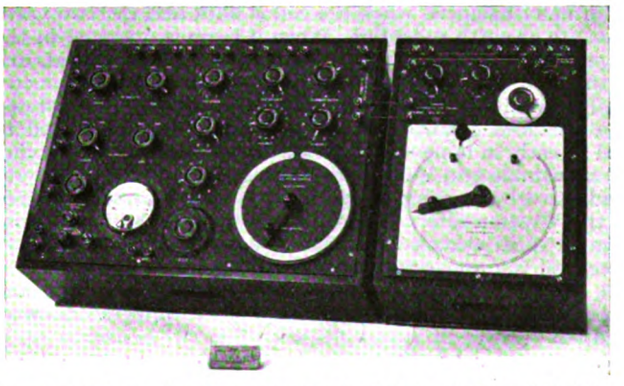
THE nineteenth annual exhibition of the Physical and Optical Societies was held on Tuesday, Wednesday and Thursday, at the Imperial College of Science and Technology, South Kensington, S.W.7.

The exhibits of the COX CAVENDISH ELECTRICAL CO., LTD., comprised induction coils, actino-therapy apparatus and sundry electro-medical and surgical instruments. The stand of CROMPTON PARKINSON, LTD., showed a wide range of instruments, including what is known as the "A.C. Test" portable a.c. multi-range ammeter and multi-range volt meter with single movement, an example of which was exhibited for the first time at the 1928 exhibition, but was shown this year with various new attachments. The instrument consists essentially of a ring of iron stampings forming a magnet and having a cylindrical gap in which the movement, somewhat on the lines of the ordinary moving iron movement, but with specially shaped moving irons, is fitted. When a conductor carrying current is passed through the ring of iron stampings these become magnetised, and the flux in the gap causes the moving irons to turn and tend to bridge the gap. The instrument has no windings, and as an ammeter is not connected electrically to the circuit to be measured. For current measurements the "A.C. Test" has an infinite number of ranges in a downward direction from the maximum for which it is scaled, depending only on the number of turns of the current-carrying conductor passed through the iron arch. Standard multi-turn attachments are made for instruments scaled 0/100, enabling them to be used for low current measurements down to a few milliamperes, and also as voltmeters up to 600 V. Other exhibits were portable d.c. multi-range testing sets, demonstration sets for laboratories, complete potentiometer equipment, Crompton-Robertson bridge potentiometers, etc. The DUBILIER CONDENSER CO. (1925), LTD., exhibited a wide range of radio condensers, both fixed and variable for laboratory use, as well as wave-meters and measuring instruments of more general type. The EDISON SWAN ELECTRIC CO., LTD., showed representative examples of transmitting and receiving valves, battery eliminating devices, resistances, tubular condensers, and loud speakers. Accumulators and batteries were also shown. Electrically-driven vacuum pumps were shown by W. EDWARDS AND CO. in operation, and, where possible, sections, components, and drawings were displayed to illustrate the construction of the apparatus.



The "A.C. Test" instrument, by Crompton Parkinson, Ltd.

Among the exhibitors were BAKELITE, LTD., who showed a variety of bakelite mouldings, varnishes, cements, laminated sheets, etc., in addition to a new flaked fabric moulding material which is claimed to be particularly resistant to shock. The CAMBRIDGE INSTRUMENT CO., LTD., exhibited for the first time a number of instruments, including a frequency recorder, which consists of a recording potentiometer, together with an electromagnetically operated vibrating member which is tuned approximately to the frequency to be recorded. This member carries two contacts, and at each oscillation one of these contacts completes a circuit through a precision mica condenser and a standard cell. The circuit is then broken, and the second contact made, which connects the condenser through a resistance to the potentiometer, thus enabling the condenser discharge to be measured and recorded. The provision of a standard cell ensures a constant charging voltage, so that the value of the condenser discharge depends on the frequency with which it is charged and discharged per second, that is, on the frequency of the circuit connected to the electromagnet actuating the vibrating member. The resultant temperature coefficient of the condenser and standard cell is so small as to render the arrangement almost independent of temperature variations. The record is traced on a continuous chart 7 in. wide, the range of frequency covered being 8 cycles per second, which gives a very open scale. The instrument shown had a range of from 46 to 54 cycles per second. If desired, the recorder can be replaced by an indicator. Another new instrument was a Campbell a.c. potentiometer (Larsen type), patented, by means of which it is possible to measure an unknown alternating current voltage in terms of its in-phase and quadrature components with reference to a fixed standard current i. In the ordinary Larsen type of potentiometer with adjustable resistance r and mutual inductance m, the unknown voltage v is obtained in the form $(r+j\omega m)\ i$, where the pulsatance $\omega = 2\pi \times$ frequency; so, to obtain the quadrature component, it is necessary to multiply the m reading by ω. In the present instrument this is avoided. By means of a loop-shunt system, the current in the primary of the mutual inductance can be set to any desired multiple of the standard current i. It is only necessary to observe the frequency and set its value directly on the shunt dials, when it will be found that the reading M of the inductometer gives the quadrature component directly without multiplication by ω, and $v = (r+jM)\ i$. Thus the two components are read directly in millivolts to an accuracy of 0·0 mV. The standard alternating reference current i is set and held constant by a thermal null method, in which it is balanced against a constant direct current (set by a standard cell and resistance), the balance being continually indicated by an auxiliary galvanometer. The mutual inductance part of the instrument consists of the recently developed inductometer, in which the impurity is reduced to a minimum; this can be used as a separate instrument with a maximum of 10 mH, and reading to 0·02 microhenry on its lowest stage. Other new exhibits of electrical interest were a portable electro-cardigraph, a high range thermionic voltmeter, an improved Paschen galvanometer with lamp, a circular pattern Lindeman electrometer with earthing switch, an l.t. Schering bridge, a self-contained decade Wheatstone bridge, and l.t. inductance decade resistance boxes.



A new a.c. potentiometer of Larsen type, by the Cambridge Instrument Co., Ltd.

THE CAMBRIDGE INSTRUMENT CO., LTD., showed a valve method of controlling h.t. supply. When the thermionic valve system is operated entirely from one source of electrical energy, the anode currents of the valves will be very sensitive to fluctuations in the supply voltage unless some form of control is employed. The apparatus shown was operated from several windings on one transformer. The d.c. high-tension supply was obtained by full-wave rectification, and was applied, through an ohmic resistance, to the anode of the control valve, the filament of which was heated from a winding on the same transformer. The actual voltage at the anode of the control

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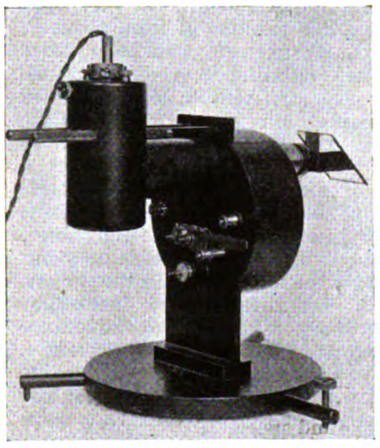
valve will depend on the ratio of the fixed ohmic resistance to the resistance or impedance of the valve. An increase in the supply voltage will be reflected both in the rectified a.c. and in the filament winding, and in the latter instance it will have the effect of decreasing the impedance of the valve. The value of the ohmic resistance can therefore be adjusted so that the voltage at the junction of this with the anode is independent of variations in the main supply. This control can be adjusted to compensate for changes induced in any auxiliary apparatus, and is also applicable where both high and low tensions are obtained from separate windings on a rotary generator.

The Research Laboratories of the GENERAL ELECTRIC CO., LTD., also exhibited, and among the instruments shown was one which is a development of the electroscope which was exhibited in conjunction with a machine for rating lamps at the last exhibition of the Physical Society. It employs the same form of tungsten filament for an indicator—an inverted flexible pendulum held rigidly at the base. The filament is attracted to one or other of two adjustable electrodes, between which there is a constant difference of potential usually of the order of 100 V (i.e. +50 V and −50 V respectively, the body of the instrument and the filament at zero reading being 0 V), and its image is projected on to a screen by means of a 6 V lamp, condenser and microscope objective. By adjusting the position of the electrodes, or varying the potential difference, the whole range of the scale may be varied from about 4 V to 400 V or more. Zero adjustment is obtained by levelling the whole instrument, which can be used for accurate work only when mounted on a solid bench, owing to its extreme sensitiveness to changes of level; on the other hand, the filament is robust, and the whole instrument may be carried from place to place without risk of damage or derangement of parts. The volts-deflection curve is very closely a straight line. Other exhibits were two photometric integrators arranged so that the light from the test lamp integrator passed into the smaller integrator containing the photoelectric cell, through an aperture over which is an adjustable Wratten filter. In this arrangement the cell is connected to a valve bridge, which is normally balanced when the cell is dark and the two valve grids are at earth potential. When a lamp is operated in the large integrator the voltage produced on one valve grid, due to the cell, can be opposed by an adjustable potentiometer until the galvanometer indicates that the bridge is restored to a balanced condition. The potentiometer is arranged to read directly in lumens. The scale range is altered by varying the adjustable grid leak across the cell. The colour sensitivity is adjusted by varying the proportion of the aperture covered by the Wratten filter. In order to prevent errors which arise from external electrical disturbances it is necessary to earth screen all the apparatus connected with the valve amplifier, and, for convenience of construction, demonstration and inspection, cubical instead of spherical integrators were used.



The electroscope shown by the General Electric Co., Ltd.

A self-contained photoelectric set which works entirely from the a.c. mains was also demonstrated. The set is of robust construction, and is designed for industrial use. The method of using the photo-cell is to cause an intermittent current to pass through the cell when the illumination falls below a certain value. When the illumination rises above that value the current becomes continuous. The intermittent current is amplified and rectified, and then operates a relay, which can be made to operate any desired mechanism in accordance with a change of light falling on the photo-cell connected in the set. Various applications were demonstrated at the exhibition, these including burglar alarms, street lighting, failure of plant for purifying blast furnace gas, etc.

The BRITISH THOMSON-HOUSTON CO., LTD., exhibited an apparatus for tracing visual characteristics of loud speakers and amplifiers. The loud speaker to be tested is faced by a calibrated condenser microphone and supplied (through an appropriate valve) with constant grid voltage at varying audio frequency. The latter is obtained from a beat oscillator giving substantially constant voltage over a range from 0 to 10 kilocycles. The output from the microphone passes through a straight-line amplifier and operates a special type of hot wire galvanometer which traces the characteristic on a screen. The vertical deflection of the light spot is controlled by the sound energy output (as picked up by the microphone) and the horizontal deflection by the movement of a mirror attached to the condenser controlling the frequency. Further details of this exhibit will be given in a later issue.

A feature of the exhibit of ELECTROFLO METERS CO., LTD., was a new control pyrometer for application to the control of electric, gas and oil-fired furnaces, and high temperature industrial heating generally. The panel exhibited was for application to electric furnace control, and carried the indicating control pyrometer, a coil box, the function of which is described later, a relay, and a time switch.

The instrument is essentially a high resistance thermo-electric indicator, calibrated for the required range. The control mechanism consists of a depressor bar, which is periodically raised and lowered by means of a Warren synchronous motor, and causes contact to be made in one of two electric circuits, depending upon the position of the pointer, i.e., the operating temperature. Assuming that the furnace is cold, and consequently the temperature low, as the depressor arm, operated by the synchronous motor, falls, the bottom contact is made. Immediately afterwards, a mercury vacuum switch inside the indicator is tilted by the synchronous motor, and a circuit is established through the relay coil. This causes the mercury relay switch to establish circuit to the contactor coil; the contactor closes, and the furnace current is switched on through suitable contactor gear. The mercury switch in the indicator is then broken by the operation of the synchronous motor, which, an instant later, raises the depressor arm. The circuit through the relay coil is broken, but the current is maintained in the contractor circuit by means of a holding switch also operated by the relay coil. The furnace temperature continues to rise until the indicator pointer is above the control index, when, on the depressor arm falling, the alternative top contact is made. The mercury switch is then tilted as before, and a circuit is established which shorts the relay coil. The relay switch then falls back, breaking the contactor coil circuit, and the contactor is then open. When the furnace temperature drops, the indicator falls below the control index and the cycle of operation is repeated, the furnace being maintained at the determined temperature by the position of the control index. The object of the coil box, also mounted on the panel, is to cause the indicating pointer to deflect to the right of the control index in the event of the thermo-couple burning out or becoming disconnected. This is a patented system which ensures that the electricity supply to the furnace is cut off, so that no damage occurs to the charge or furnace, as might otherwise be the case.

ELLIOTT BROS. (LONDON), LTD., exhibited various interesting types of apparatus, including moving coil, moving iron and dynamo meter measuring instruments, portable and switchboard patterns, indicating and recording types, testing sets, etc., as well as miniature instruments, comprising switchboard and portable ammeters, milliammeters, voltmeters and testing sets, and instruments for radio frequency, with heater insulated from the couple. The type "O.L." instrument shown while intended primarily for a.c. measurements, fulfils all the requirements of an accurate ammeter or volt-meter for direct or alternating current. When used on alternating current circuits the guaranteed accuracy is "substandard" in accordance with British Standard Specification No. 89–1926. It is also quite suitable for use on d.c., and when thus employed, although errors may be slightly increased, these are claimed to be within the limits obtained with most other makes of ammeters and voltmeters used for such purposes. Another interesting instrument was an averaging recorder for bulk power supplies. This instrument with chart 6 in. wide, gives the total consumption and also the maximum demand averaged over a definite time interval. It can be calibrated as a kVA meter if desired.

(*To be continued.*)

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CORRESPONDENCE.

The Editor welcomes the free expression in these columns of genuine opinion on matters of public interest, although he disclaims responsibility alike for the opinions themselves and the manner of their expression.

Load-Factor Fallacies.

[To the Editor.]

Sir,—I have read with interest the article by Mr. Edward V. Clark in the January 4th issue of The Electrician, and quite agree with your remarks in "Current Topics" that this article will doubtless give rise to no small amount of criticism, and that Mr. Clark's contentions run counter to the expressed opinions of many electrical engineers. I also agree with you that in view of Mr. Clark's position, his views at least deserve consideration, and it is because of this that I think municipal engineers should register their opinions on this article.

A careful study of Mr. Clark's contentions, and they are only contentions, must reveal the fact that there are more fallacies in his violent straining after his object than there are in the load factor question which he considers has been overrated. Mr. Clark would appear to contradict himself, for in one part we read "that better load-factors will permit of lower average costs of electricity is unquestionable" and later he sets out to prove that a 40% load factor is better than 100% load factor—but in order to do so he changes the selling price from 0·375d. to 0·5d. only doing one fifth of the business at the higher price. By subtle changes like this in any contention one can make figures prove anything.

Mr. Clark's trouble would appear to be in his economics, not ethics, as he would have us assume from the first paragraph on page 6 where he refers to hot water in large quantities being a luxury. A commodity is something which satisfies a human want; we have no judgment to pass on whether people ought to want it, and yet some of our most urgent necessities are not commodities, for example—air. Mr. Clark says "this matter is only referred to because of the frequent assumption that reduced prices of commodities are necessarily beneficial to the community," but surely Mr. Clark is aware of the fact that reduced prices bring increased consumption, which means increased output, and every increase of output from any industry puts into operation a set of economic forces which inevitably provides other industries with an opportunity of increasing their output, so that it seems to me the community must benefit from the reduction in price of a commodity.

Well, let us leave the economic question and return to his fallacies of load-factor. By far the most objectionable feature in Mr. Clark's article is the opprobrium he pours on the municipal undertaking; for example, to the company, the profit and loss account and balance sheet are all-important. The municipal undertaking considers more statistical figures, etc., then again, from these considerations it naturally follows that, in general, companies are much less interested in load factor as such, than are municipal undertakings. The former must regard any new business upon its merits, the assumption being that municipal undertakings do not. Anyone who knows anything about munieipal undertakings knows that such a statement is manifestly incorrect and unfair, as evidenced by the many successful municipal undertakings selling electricity at prices below company prices in the same area.

There is a wealth of truth in Dr. S. Parker Smith's statement "to make cheap electricity a possibility. Probably improvement of load-factor by better utilisation has much more significance." In early 1926, when the Government's Electricity Bill was in the committee stage, we were asked to criticise the Bill, and the writer contributed an article on The Government Scheme versus Improved Load-factor. At that time much was written in the lay Press, and politicians talked glibly about "Bus Mains" and "Grids." Journalists also showed us the way "Through Power to Prosperity." The object of the writer at that time was to show that to provide—to use Mr. Baldwin's words—that over the whole country the source of light and power should be materially cheapened, the first step was to improve load-factors on existing stations, the second step being standardisation, and the third step linking up. Mr. R. A. Chattock, in his Presidential address to the I.E.E. in 1925, made the following statement: "In conclusion, two most urgent problems in the supply field are load factor and cost of distribution."

In the example which Mr. Clark works out for a station with an annual load factor of 25%, and then assumes this station to have a load factor of 100%, it seems to me that if the additional units only cost 0·35d. he forgets that by increasing the output to 300% the average cost per unit of the original output is reduced considerably, because standing charges, remaining the same, are divided by a number three times as large as before, thus reducing this factor in the cost per unit. Mr. Clark suggests ignoring load-factor and concentrating on diversity factor. But how can one ignore load factor for the diversity factor when the diversity factor is an element in the station load-factor? To equal the factors we have:

$$\text{Station Load-factor} = \frac{\text{Diversity Factor} \times \text{units sent out}}{\text{sum of separate maxima,}}$$

each expressed over a given period of time, so that so far as the station is concerned the diversity factor does not concern us much, as the station maximum load is proportional to the total of the separate loads divided by the diversity factor, and as the separate maxima demands do not remain constant and may not be ascertainable, the relation can only be of very little use. On distribution networks the diversity factor is of utmost importance as between various areas or feeders in a given area, but in each case it is still only an element of load factor as mentioned before, so that load factor cannot be ignored, any more than one could ignore capital or standing charge apart from running costs in considering the cost of a unit of electricity to an undertaking.

In Mr. Clark's concluding paragraph he assumes that supply engineers have not given diversity factor its due consideration. It is difficult for one engaged in the supply industry to understand why this assumption is made. One can agree that with a bulk supply, and the tariff for such supplies known in advance, the position will be cleared, but this does not help us to sell cheap electricity if the tariff is wrong or too high to start with. The difficulties Mr. Clark refers to in the self-contained station regarding the assessing of costs to standing charges and running costs has not prevented us from supplying electricity cheaper than one of the largest supply companies in Britain and making handsome profits, after providing for all charges to sinking funds, reserve and special reserve funds, and contributing, in times of stress, to the rates.—I am, etc.,

T. D. Martin,
South Shields Corporation Electricity Supply Dept.

Trade Credit.

[To the Editor.]

Sir,—Correspondence on the B.E.A.M.A. Report is raising a crop of interesting questions. We are in the midst of a host of difficulties arising from the necessity of rapidly adjusting our economic system to the needs of a changing world. Unfortunately, it is assumed that the brunt of this readjustment must be borne by industry, as the function of finance appears to be regarded either as too esoteric to be understood, or too sacrosanct to be exposed to examination or revision.

The function of industry is to produce goods, and so great has been the advance in technical skill and scientific knowledge, that any kind of goods, except food, can now be produced in lavish abundance. But the manufacturer, having surmounted the difficulties of production, is confronted with the difficulty of selling his goods, a difficulty created by the fact that persons who need his goods have often too little money or credit with which to buy them. In other words, the financial machine fails to liberate money or credit for purchase as rapidly or as plentifully as the industrial machine can liberate goods for use.

Lack of co-ordination appears to be the trouble. Do the goods producing agencies (manufacturers) and the credit producing agencies (bankers) realise the true nature of the relationship that should exist between them? It is tacitly assumed that industrial policy must bow to the needs of financial policy. But the industrialist has to conduct his business within the very rigid limitations imposed upon him by the nature of the materials and power he uses on the one hand, and the needs of his customers on the other, and seeing that in the whole field of economic activity money is the only factor that is entirely man-produced and entirely man-controlled, it would appear reasonable to expect that any necessary readjustment should first be made in the domain of finance, if only for the reason that it is easier and more simple.

In any case, the ordinary citizen is perfectly justified in expecting that the financial system should enable him to enjoy the products of artistic creation and technical skill which industry can place so lavishly at his disposal, and if some defect in the financial machine short circuits this desirable consummation, the industrialists, who are the first to feel the brunt of this deprivation, are perfectly justified in asking that the defect shall be discovered and if possible, removed.—I am, etc.,

Geo. S. Francis.

London, N.W.3.

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NEWS IN BRIEF.

Hull Corporation and Electric Houses—I.M.E.A. Annual Convention—Loan for Leeds Wiring Scheme—New Fire Alarms for London—Irish Free State's Imports of Electrical Goods—Brighton's Electrical Exhibition.

A NEW lighting system is to be installed at the Llanfabon Schools, Nelson.

Residents of Birtley are agitating for electric street lighting.

Coventry Electricity Committee has obtained sub-station sites in the Dovedale and Foleshill Hall estates.

The Incorporated Municipal Electrical Association will hold its annual convention at Torquay next June.

Leeds Corporation Electricity Committee is to seek sanction for a loan of £50 000 for the assisted wiring scheme.

Warrington Corporation has accepted a tender for the erection of a sub-station on the Bewsey housing estate.

Electric power is now used for ringing the 800-years' old curfew bell in Rouen, which has hitherto been tolled by hand.

The houses to be erected in Burton Stone Lane, Hull, by the Corporation's housing department will be of the all-electric type.

Prestatyn U.D.C. has adopted a recommendation of the Electricity Committee to sell electrical apparatus, with a limitation of appliances.

A tender, amounting to £905, for the erection of a sub-station in Lime Grove, Seaforth, is recommended for acceptance by Liverpool Corporation.

An apparatus for the transmission of photographs by wireless has been received from Germany and installed in the Central Telegraph Office at Leningrad.

The "Telegraph and Telephone Journal" states that there are about 32 500 000 telephones in use in all parts of the world, an increase of 1 500 000 over the number in use a year ago.

Douglas (Isle of Man) T.C. has placed contracts for foundations and steel work in connection with the new power station at Pulrose, amounting to £3 386 and £4 506 respectively.

Mr. C. H. Yeaman, city electrical engineer of Stoke-on-Trent, is to advise as to the installation of electricity plant at Stallington Hall, which the corporation is converting into a mental institution.

The British Columbia Power Corporation announces that another hydro-electric project is to be carried out at Ruskin at an expenditure of £1 450 000, and that the Bridge River plant is to be extended at a cost of £200 000.

Sidmouth U.D.C. has decided that its gas and electricity undertakings shall be separately managed as from March 31st, 1929, and will meet to consider the conditions under which the respective posts of gas manager and electricity manager are to be held.

Hull Electricity Committee has obtained a site in Hardy Street for the erection of a sub-station in connection with the electrical developments in the Cottingham Road area, and a site in Lowfield Road for a sub-station for supplying electricity to Anlaby village.

When the shops of Helston, Cornwall, were lighted electrically on December 19th, for the first time, one enterprising tradesman illuminated one of his windows with gas and the other with electricity, in order to demonstrate the improvement effected by the latter.

London County Council Fire Brigade Committee proposes to introduce a new experimental fire alarm system at a cost of £3 000. A closed circuit system has been prepared by the General Post Office, and it is proposed that the 26 fire alarms now connected with the headquarters fire station shall be replaced by the new system.

Two contracts, amounting to about £5 000 and £3 000, respectively, for the foundations of the towers for the crossing of the river Forth and the foundations of the sub-station at Yoker have been placed by the Central Electricity Board. The contracts for the foundations of the sub-stations at Motherwell and Port Dundas have also been given out, the amounts being about £5 000 and £5 500.

The Empire Industries News Service calls attention to the fact that in the four industries which were safeguarded as from July 1st, 1925, numbers of insured persons (between the ages of 16 and 64) actually in employment expanded from 276 600 in July, 1925, to 320 000 in July, 1928, an increase of 16%, while the increase in all other manufacturing industries, which include some safeguarded industries, was from 4 856 000 to 4 972 574, an increase of less than 2½%.

Tenders have been accepted for 38 additional police telephone boxes for Manchester.

Electric lighting will probably be adopted in the Mercer Hall, Great Harwood.

A contract for the electric lighting of the town of Nazareth has been given to the Rutenberg Electric Corporation.

The United Methodist Church at Tywardreath, Cornwall, is the first building in the village to be lighted by electricity.

Axminster Board of Guardians has accepted a tender of £112 for the electric light wiring at the Poor Law institution.

Birmingham Watch Committee has authorised experiments in automatic traffic control in certain thoroughfares in the city.

An election for membership to the Institution of Heating and Ventilating Engineers is due to take place at an early date.

Stoke-on-Trent Electricity Committee has purchased a site in Greenbank Road, Burslem, for the erection of a sub-station.

A new 500 kW rotary converter at Whittlefield electricity sub-station, Burnley, was put into operation for the first time on December 21st.

The telephone cable facilities between Sweden and Finland are expected to contribute to livelier commercial relations between the two countries.

Southend T.C. has decided to instal electric water heating apparatus in ten houses recently erected in Pavilion Drive, if the tenants are agreeable.

Imports of electrical machinery and apparatus into the Irish Free State during November, 1928, amounted to £73 244, as compared with £39 763 for the same month last year.

The Executive of the Association of British Chambers of Commerce has passed a resolution expressing the opinion that the amalgamation of the cable companies will be of benefit to British trade.

Worcester electrical contractors have issued to members of the City Council a statement that they do not consider it desirable that the Corporation should carry out its municipal electricity showroom scheme.

Large firms rent from the Post Office private telephone lines to their branches throughout the country at reduced rates, and the Treasury has now decided that a similar concession shall be made in regard to lines to subsidiary companies.

The next luncheon meeting of the Engineering Section of the I.S.B.A. will be held at the First Avenue Hotel, London, on January 18th, when Mr. H. W. Kefford, will introduce the subject of "Getting the Raw Material for Engineering Advertising."

A special matinee of "Many Waters" will be held at the Ambassadors Theatre, London, to-morrow (Saturday), all proceeds going to the Lord Mayor's Fund. Tickets may be had at the theatre or from Mrs. Malone, 6, Phene Street, Chelsea, S.W.3.

Brighton Corporation has approved the recommendation of the Lighting Committee for the organisation of an Electrical Exhibition from October 3rd to 12th, 1929, at the Dome and Corn Exchange, and has agreed to contribute £1,000 towards the cost.

In the New Zealand Parliament, Sir Joseph Ward recently submitted the first instalment of the Government's financial policy in the form of a Bill extending the existing appropriations by £825 000 to provide for additional railway and road construction, hydro-electric development, etc.

The meeting of the Institute of Fuel which was to have been held on Wednesday, has been postponed until January 16th. The paper which was to have been presented by Mr. H. A. S. Gothard, has been cancelled, and, in its place, Messrs. Berg and Vogt will read an address entitled "Continental Experience in Pulverised Fuel Practice."

Taunton T.C. has adopted the Electricity Committee's recommendation that installations for lighting only, exclusive of lamps, shades and special fittings, be put in consumers' premises by the Council, payment for the installations to be quarterly and extend over three years. Some members of the Council advocate a free wiring scheme, but the committee does not consider it at present a paying proposition.

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PERSONAL.

MR. W. Aitken desires us to point out that his address is now 14, King's Avenue, Muswell Hill, London, N.10.

Mr. F. J. Pryer, shift charge engineer, Dover electricity department, resigned his appointment as from December 31st, 1928.

Estate of the gross value of £11 031, with net personalty £4 276 was left by the late Mr. William Simms, electrical engineer, Felixstowe.

Mr. E. J. Strange, J.P., of Strange and Sons, Ltd., electrical engineers, Tunbridge Wells, has consented to be nominated to fill a casual vacancy on the Town Council.

Estate of the gross value of £100 919, with net personalty £91 886, was left by the late Sir Horace Darwin, a director of the Cambridge Scientific Instrument Co., Ltd.

At last week's meeting of the Blackpool branch of the National Association of Local Government Officers, Mr. C. Furness, borough electrical engineer, was elected president.

Mr. G. E. Naylor, electrical engineer and tramways manager at Nelson, is to take control of the engineering side, and a new manager of the tramways and bus undertaking will be appointed.

Estate of the gross value of £4 759 with net personalty £3 904, was left by the late Dr. Robert Knox, editor of the "British Journal of Radiology," who died on September 21st, aged 60 years.

The staff of the Corporation tramways have presented Ald. C. F. Wright, chairman of Colchester Tramways Committee, with an inscribed umbrella, upon his attaining 21 years as a committee member.

Mr. C. C. Hill, assistant erecting engineer to Metropolitan-Vickers Electrical Co., Ltd., Newcastle Branch, has been appointed to the position of assistant shift engineer at the North Road Works, Brighton.

Estate of the gross value of £2 558, with net personalty of £1 549, was left by the late Mr. Charles James Jewell, general manager of Norwich Electric Tramways, who died on November 2nd last, aged 56 years.

The staff and employees of the Derby tramways department, numbering about 500, were associated with a farewell presentation to Mr. F. Harding, who has just resigned the position of manager of the department.

Coun. W. J. Perrett has been appointed chairman of the newly constituted Light Railways and Transport Committee of Southend Corporation, it having been decided to separate the undertaking into two distinct departments.

Mr. J. Aldworth who has been general manager of Nottingham Corporation's tramways for 30 years, vacated that position on December 31st, and is succeeded by Mr. W. G. Marks, hitherto manager of the Chesterfield tramways.

Mr. J. Alex. Chew, of the staff of the Welwyn Garden City Electricity Co., Ltd., on his marriage to Miss Dora Coggins, for nine years supervisor at the Harpenden telephone exchange, has been presented by his colleagues with a collection of household electrical appliances.

The triennial award of the Coopers Hill War Memorial Prize and Medal, which fell in 1928 to the Institution of Electrical Engineers, has been made by the Council to Mr. W. Phœnix for his paper on "Electricity in Agriculture, with special reference to Electro-Culture."

According to information received in London, the Radiological Society of America has awarded the Gold Medal for Merit in X-ray Science to Dr. Bouwers, the British inventor of the Metalix X-ray tube. Dr. Bouwers is shortly visiting the United States to lecture to American radiologists.

Mr. George Parker, general secretary of the National Union of Enginemen, Firemen and Electrical Workers, has relinquished his position and has been succeeded by Ald. S. Hall, Mayor of Rotherham. Mr. Parker has served on the Joint Industrial Council for the Electricity Supply Industry since its inception.

Mr. Arthur Teasdale, for many years electrician to the Westhoughton Coal and Cannel Co., near Wigan, has retired, after 46 years' service, and has been presented with a gold watch. He was the firm's first electrician, and took charge of the first electrical plant installed at the Colliery, following a fire at the pit bottom caused through an oil lamp.

Major H. Derby, who has relinquished the position of general manager of the Aldershot and District Traction Co., which he has held for six years, has been presented by the employees with a grandmother clock and a gold wristlet watch, and by the drivers and conductors with an illuminated address. Mrs. Derby was given a pair of silver vases.

Mr. C. Remington, who for the past twenty years has been attached to the engineering section of the Automatic Telephone Co., Ltd., Liverpool, has resigned his position to take up the post of general manager and engineer to Messrs. Garnett, Whiteley and Co., Ltd., Liverpool. He was presented with a gold hunter watch, suitably inscribed, by his old friends and colleagues.

Following our notice of the impending retirement of Mr. T. L. Miller, consulting engineer, we are advised that he has transferred his practice and all office records to Mr. A. B. Mallinson, of Worsley Street, Salford, and St. James' House, Brazennose Street, Manchester. Mr. Miller's Liverpool office will be closed, and Mr. Mallinson will deal with any inquiries from Manchester, where he has been in practice as a consultant for seventeen years.

The Council of the Physical Society has awarded the Sixth (1928) Duddell Memorial Medal to Dr. Charles Edouard Guillaume, the Director of the Bureau International des Poids et Mesures, Sèvres. Dr. Guillaume is known to the world for the invention of three metallic alloys of great importance, invar, elinvar and platinite. Speaking industrially the last one of the three is the most important. It is a nickel-iron alloy having approximately the same temperature co-efficient of expansion as glass, so that it can be fused into glass and used as the wire for introducing the current into electric incandescent lamps. The wire is frequently covered with a thin coating of copper to which the glass adheres, and in this form the wire is known as "red platinum." The other two alloys are of scientific importance. Invar, a nickel-steel, discovered in 1896, has practically no temperature co-efficient of expansion, so that if a surveying tape is made of it the length is almost unaffected by temperature. The third material, elinvar, was invented by Dr. Guillaume for the manufacture of the balance springs of watches.

Obituary.

MR. JOHN EDWIN COLES, aged 82 years. He was formerly connected with Veritys, Ltd.

MR. MARTIN HAWKE, on December 20th. He was managing director of the Carborundum Co., Ltd.

MR. RICHARD EVANS, engineer in charge of electricity and other plant at Bodfari poor law institution, at Carnarvon.

MR. EDWARD SIMON AMES, on January 1st, aged 56 years. He was in the employ of the Bradford Corporation Electricity Department for about 26 years, and for over 20 years was the chief meter inspector.

MR. C. O. CLARK, on December 1st, aged 53 years. He was an electrical engineer at 4, Northampton Street, Dover, and Mill Road, Deal, with branches in London and Horsmonden. He established the East Kent Electricity Works, in Mill Road, Deal, seven years ago.

DR. DAWSON TURNER, on December 25th, aged 71 years, from illness caused by thirty years of X-ray work, as medical electrician to the Royal Infirmary, Edinburgh. Prior to 1925 he had lost three fingers and one eye as a result of his pioneer work in X-ray investigation.

MR. W. E. ROBERTS, on December 25th. He was outside representative for the London Electric Wire Co. and Smiths, Ltd. for several years and was well known in the electrical trade. He had been associated with the company for 29 years having joined them in January, 1900.

MR. STEPHEN PAGET LUKE, on January 1st, aged 83 years. He was appointed to the Indian Telegraph Department in 1868. In 1890 he was appointed Director of the Construction Branch of the Telegraph Service. In 1895 he was promoted to be Deputy Director-General of Telegraphs, represented India at the International Telegraph Conference at Budapest in 1896 and retired in 1897. Mr. Luke was a director of the Telegraph Construction and Maintenance Co., Ltd., and was for some years chairman of the Calcutta Electric Supply Association.

SIR HENRY TRUEMAN WOOD, secretary of the Royal Society of Arts, on January 7th. He was born on November 13th, 1845, and had been associated with the Society since 1872, when he became editor of its "Journal." He was appointed secretary in 1879. Amongst the useful work which he did for the Society was that of securing a number of prominent men to serve on the Council, and he also earned a reputation as an organiser in connection with the Health Exhibition in 1883, the Inventions Exhibition in 1885, and the Paris Exhibition in 1889.

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BRITISH INDUSTRIES FAIR.

Advance List of Exhibitors of Electrical Interest at Birmingham and London.

THE preliminary list of exhibitors of electrical interest at the Birmingham Section of the British Industries Fair, which opens at Castle Bromwich on February 18th, shows that an even greater number than last year will participate. The firms so far included in the list are :—

Aerostyle, Ltd., H. E. Ashdown (Birmingham), Ltd., Attwoods Spraying Equipment Co., Ltd., British Brass Fittings Co., Ltd., Bulpitt and Sons, Ltd., Carron Company, Davis and Timmins, Ltd., Gregson Manufacturing Co., Ltd., John Harper and Co., Ltd., Ingram and Kemp, May and Padmore, Ltd., Parker, Winder and Achurch, Ltd., the Rawlplug Co., Ltd., the Ruberoid Co., Ltd., E. Showells and Sons, Ltd., H. C. Slingsby, Spring Washers, Ltd., Sturge and Baker, Ltd., G. and J. Swingler, Herbert Terry and Sons, Ltd., Vac Tric, Ltd., Willis and Bates, Accles and Pollock, Ltd., Allen-Liversidge and Co., Ltd., W. and T. Avery, Birkby's, Ltd., Blackstone and Co., Ltd., the Bromford Tube Co., Ltd., Bull Motors, Ltd., W. Canning and Co., the Cape Asbestos Co., Ltd., Clear Hooters, Ltd., the Commutator Grinding Block Co., Crossley Bros., Ltd., the Crosthwaite Engineering and Furnace Co., Ltd., Davey Paxman and Co., Ltd., Davidson and Co., Ltd., Dexine, Ltd., the Diamond Fibre Co., Ltd., R. and J. Dick, Ltd., Die Castings, Ltd., W. H. Dorman and Co., Ltd., the Drayton Regulator and Instrument Co., Ltd., Earle, Bourne and Co., Ltd., Fielding and Platt, Ltd., Thomas Firth and Sons, Ltd., the Foster Instrument Co., Gillespies, Ltd., Frank B. S. T. Gilman, Ltd., Hadfields, Ltd., Thos. L. Hale (Tipton), Ltd., Alfred Herbert, Ltd., the Hewittic Electric Co., Ltd., Heyes and Co., Holden and Hunt, Hollings and Guest, Ltd., the Horstmann Gear Co., Ltd., R. Johnson, Clapham and Morris, Ltd., Lacy-Hulbert and Co. (1921), Ltd., R. A. Lister and Co., Ltd., Low Temperature Carbonization, Ltd., M. C. L. Repetition, Ltd., the Midland Fan Co., Ltd., T. H. Mold and Son, Negretti and Zambra, W. and C. Pantin, Petters, Ltd., Ransomes Sims and Jefferies, Ltd., the Rapid Magnetting Machine Co., Ltd., the Ray Engineering Co., Ltd., Reavell and Co., Ruston and Hornsby, Ltd., Silvertown Lubricants, Ltd., Stewarts and Lloyds, Ltd., Stuart Turner, Ltd., the Sturtevant Engineering Co., Ltd., Tangyes, Ltd., Taylor and Callen, Thomas Bertram, Thor Lamps and Supplies, Ltd., Tubes, Ltd., Turner Bros., Asbestos Co., Ltd., T.V.E., Ltd., the Uniflo Pump Co., Ltd., C. C. Wakefield and Co., Ltd., Henry Wiggin and Co., Ltd., Timmins Wynn and Co., Bakelite, Ltd., Berkeley and Young, Ltd., Berry's Electric, Ltd., the Birmingham City Electric Supply Department, Birmingham Electric Furnaces, Ltd., Geo. Bray and Co., Ltd., the British Sangamo Co., Ltd., the British Thomson-Houston Co., Ltd., Brook Motors, Ltd., S. G. Brown, Ltd., the C.M.A., Callender's Cable and Construction Co., Ltd., the Castle Fuse and Engineering Co., Ltd., Chesterton Jones and Co., the Chloride Electrical Storage Co., Ltd., Credenda Conduits, Ltd., Donovan and Co., Ltd., the Edison Swan Electric Co., Ltd., Electric Furnaces, Ltd., the Electrical Power Engineering Co. (Birmingham), Ltd., the E.P.E.A., Geo. Ellison, the Ever Ready Co. (Great Britain), Ltd., Fox and Offord, Ltd., the General Electric Co., Ltd., Gent and Co., Ltd., the Hackbridge Electric Construction Co., Ltd., W. C. Holmes and Co., Ltd., the Jackson Electric Stove Co., Ltd., Chas. Joyner and Co., Kelvin Bottomley and Baird, Ltd., Lighting Trades, Ltd., the Liverpool Electric Cable Co., Ltd., the London Electric Wire Co. and Smith's, Ltd., the Metropolitan-Vickers Electrical Co., Ltd., Micanite and Insulators, Co., Ltd., Moffatts, Ltd., Moorwoods, Ltd., Wm. McGeoch and Co., Ltd., Mudies Electrical Co., Ltd., the Omega Lampworks, Ltd., C. H. Parsons, Ltd., Peebles and Co., Ltd., Pritchett and Gold and Electrical Storage Co., Ltd., Record Electrical Co., Ltd., Restlight, Ltd., the Revo Electrical Co., Ltd., A. Reyrolle and Co., Ltd., Shropshire, Worcestershire and Staffordshire Electric Power Co.. Ltd., Siluminite Insulator Co., Ltd., Spauldings, Ltd., Sperryn and Co., Ltd., Streetly Manufacturing Co., Telegraph Construction and Maintainence Co., Ltd., Thermo Path Co., Ltd., J. H. Tucker and Co., Ltd., Welsbach Light Co., Ltd., Young, Osmond and Young, Ltd.

London Section.

The exhibitors of electrical interest in the London Section, which opens on the same date as Birmingham, include radio manufacturers and makers of medical equipment. The chief exhibitors comprise :—

The "Attracta" Electrical Co., Ltd., Berry's Electric, Ltd., Dexine, Ltd., George Nobbs, Ltd., Ernest Turner, Joseph Bourne and Son, Ltd., Doulton and Co., Ltd., James A. Jobling and Co., Ltd., Bakelite, Ltd., Birkby's, Ltd., Ellis Simpson and Saunders, Ltd., Goodworks, Ltd., Ferranti, Ltd., S. G. Brown, Ltd., the Brownie Wireless Co. of Great Britain, Ltd., H. Clarke and Co. (Manchester), Ltd., A. C. Cossor, Ltd., the Dubilier Condenser (1925), Co., Ltd., J. Dyson and Co., Ltd., J. J. Eastick and Sons, the Ever Ready Co. (Great Britain), Ltd., the Fuller Accumulator Co., Ltd., Garnett Whiteley and Co., Ltd., the Igranic Electric Co., Ltd., the Langham Radio, Ltd., the Loewe Radio Co., Ltd., the M.L. Magneto Syndicate, Ltd., M.P.A. Wireless, the Ormond Engineering Co., Ltd., Spauldings, Ltd., the Watmel Wireless Co., Ltd., Wright and Weaire, Ltd., Lissen, Ltd., the Mullard Wireless Service Co., Ltd., the Westinghouse Brake and Saxby Signal Co., Ltd., Creswick C. Atkinson, E. K. Cole, Graham Farish, Ltd., the Halcyon Wireless Supply Co., Ltd., Belling and Lee, Ltd., the Formo Co., Ltd., the Telegraph Condenser Co., Ltd.

Official Visits.

In connection with the Electrical Section at Birmingham, a representative Advisory Committee was set up some six months ago, the personnel of which is as follows :—Messrs. H. H. Berry (chairman), T. R. Martin (deputy chairman), A. Page, F. Anslow, Ll. B. Atkinson, E. G. Batt, R. A. Chattock, D. N. Dunlop, Sir J. M. Gatti, Lt.-Col. W. J. Kent, Mr. A. Nichols Moore, Col. R. K. Morcom, Messrs. A. H. Railing, T. Stretton, C. W. Sully, Lt.-Col. W. A. Vignoles, Messrs. W. H. Walton and E. J. Jennings.

The arrangements for official visits of Associations connected with every phase of electrical industry are now complete, and a conference arranged by the South Midland Area Committee of the British Electrical Development Association will be held in the Conference Hall on February 22nd, at 11.30 a.m. A luncheon on the same day in the Royal Dining Room, "C" Building, will be attended by representatives of the Incorporated Municipal Electrical Association, the Incorporated Association of Electric Power Companies, the Provincial Electric Supply Association, the British Electrical Development Association, the Municipal Tramway and Transport Association, Inc., and the Tramways and Light Railways Association. Representatives of the Electrical Power Engineers' Association will attend luncheon in the same room on February 23rd, while in the afternoon the South Midlands Students' Section of the I.E.E. will assemble for tea. After luncheon members of the E.P.E.A. will attend a conference in the Conference Hall. On March 1st a luncheon will be given in the Royal Dining Room, Building "C," to the Institution of Electrical Engineers, the Association of Consulting Engineers, the Association of Supervising Electrical Engineers, the Electrical Contractors' Association, the Electrical Contractors' Association of Scotland, the Electrical Wholesalers' Federation, Ltd., the Electrical Merchants and Manufacturers' Association, the Illuminating Engineering Society, and the Association of Mining Electrical Engineers. In the afternoon the Electrical Association for Women (Birmingham and Midlands Branch) will be entertained to tea.

"WIRELESS TRADER" YEAR BOOK.

Many Additions and Improvements to be Found in 1929 Edition.

THE 1929 edition of "'The Wireless Trader' Year Book and Diary," just published is likely to be more valuable than ever to all associated with the wireless and allied trades. An addition is the incorporation of gramophone information and trade lists. A new section has been devoted to this giving practical information for the use of traders catering for the wireless and gramophone public. All sections of the book are revised and up-to-date. Besides some 100 pages of trade, technical, and general information covering the wireless, gramophone and allied trades, there are comprehensive trade lists including trade and professional addresses of manufacturers and manufacturers' agents; trade and professional addresses of factors; a classified buyers' guide to goods supplied and services rendered; names of proprietary goods and their manufacturers. In addition a diary for 1929 is provided, giving one week at opening and interleaved with blotting paper.

The price of the book is 5s. 6d. post free.

Application for Extension of Patents.

Standard Telephones and Cables, Ltd., has applied for a five-years' extension of the terms of patents No. 5 653/1913, No. 3 358/1914, and No. 3 359/1914, for "Improvements in machine telephone switching systems"; No. 25 774/13 for "Improved method and apparatus for electric code impulse signalling systems"; No. 3 360/1914, for "Improvements in impulse control systems for automatic telephone exchanges"; No. 3 699/1914, for "Improvements in electromagnetic relays"; and No. 104 719 (dated March 11th, 1916), granted to the Western Electric Co., Ltd., and F. R. McBerty, for "Improvements in impulse control systems for automatic telephone exchanges." An originating summons, issued on behalf of Standard Telephones and Cables, Ltd., asking for the extension of the terms of the patents will come before Mr. Justice Tomlin, in the High Court of Justice on January 15th.

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INDUSTRIAL HEATING.

Some of the Exhibits at the Manchester Show which Opened on Monday.

IN connection with the Industrial Heating Exhibition which opened at Manchester on Monday, under the auspices of the E.D.A. and Manchester Corporation, the GENERAL ELECTRIC CO., LTD. displayed an 8 kW electric furnace having a chamber approximately 18 in. long by 12 in. wide by 10 in. high. This furnace has a maximum working temperature of 950° C. A 30 kW furnace was also shown, the chamber being 21 in. wide by 44 in. long by 17 in. high. It is designed for use in the annealing of metals and for similar processes carried out at temperatures up to 1 000° C. such as vitreous enamelling. Another exhibit was a small electric japanning oven specially suitable for garages and similar establishments. A specimen of the "Magnet" air heater also figured in the exhibition. This heater consists of a bank of elements enclosed in a box-like structure through which air is drawn by an extractor fan and distributed for heating buildings, etc. It has a maximum loading of 7 kW.

Among other items shown by the G.E.C. were a wax tank, having a capacity of approximately 4 gallons, a maximum loading of 2 kW, and three heat control; 1 kW oil pipe heater, incorporating a type of element adapted for clamping round pipes conveying oil or other viscous fluids to raise the temperature; a conforming steamer for hats; and a water still, arranged with a loading of 4 kW to deliver one gallon of distilled water per hour. One of the standard "Magnet" type of single-deck baking ovens with a 18 kW loading was also shown.

Other Exhibits.

Among the exhibits of the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., was an induction furnace equipment of 5-cwt. capacity. An interesting feature of the equipment is that the furnace operates on a supply of power at 500 cycles. This frequency is, we understand, lower than was previously considered efficient for this type of work. The equipment includes a motor generator set which takes power at 50 cycles frequency and gives a supply at 500 cycles for the furnace. Two banks of condensers are provided for power factor correction, one bank being permanently connected in parallel with the furnace coil, and the other bank being arranged in sections for switching in or out as required. The time required for melting a charge is approximately one hour and the overall power consumption is from 700 to 900 kWh per ton, depending on the casting temperature and other conditions.

For enamelling, drying, heat-treating, and other industrial baking processes involving the use of temperatures up to 600° F., a Metropolitan-Vickers type "K" oven was exhibited accompanied by specimens of typical products. These ovens are manufactured in a range of sizes, the exhibit being of medium size with a baking chamber 3 ft. 9 in. high, 3 ft. wide and 3 ft. deep, with a rating of 10 kW. A 2-deck electric peel type oven suitable for baking bread and confectionery was another exhibit by the Metropolitan-Vickers Electrical Co. The ovens are supplied with one, two or three decks, each deck forming a separate and portable unit, which can be used by itself or assembled with others as required. The oven exhibited was a 2-deck combination of ½ sack capacity. Each hearth is 4 ft. by 4 ft. in size and each deck is rated at 10 kW. The elements of each deck are disposed at the top and bottom of the chamber, each group being controlled by a separate three heat switch. It is claimed that an oven of the size exhibited will heat up to 450° F. in about an hour and thereafter maintain this temperature with a consumption of 5 to 6 kW.

Electric furnaces were also shown by WILD-BARFIELD ELECTRIC FURNACES, LTD.; the LEEDS ELECTRICAL CONSTRUCTION CO., LTD.; BIRMINGHAM ELECTRIC FURNACES, LTD.; the BRITISH RESISTOR CO., LTD.; and the ELECTRIC FURNACE CO., LTD. Other exhibitors were SULZER BROS. (electric thermal storage system); FERRANTI, LTD. (thermal storage, heating elements, thermostats, and control relays); BRITISH INSULATED CABLES, LTD. (electric rivet heaters and welding equipment); YOUNG, OSMONDE AND YOUNG (tubular heaters); MARRYAT AND PLACE (electric welding equipment and rivet heaters); the PREMIER ELECTRIC WELDING CO., LTD. (electric welding plant). The E.D.A., Manchester and Salford Corporations, and the LANCASHIRE ELECTRIC POWER CO., LTD., were also represented.

IN PARLIAMENT.

Electricity Supply Special Orders Approved by the House of Commons.

THE House of Commons has approved Electricity Supply Special Orders in respect of (1) Dronfield urban district; (2) Burnham-on-Sea urban district; (3) part of county of East Lothian; (4) part of Burnley rural district; (5) parts of East Ashford rural district; (6) Kirkham urban district and parts of Fylde and Garstang rural districts; (7) part of Woodbridge rural district, and amendment of Felixstowe and Walton Electric Lighting Order, 1900; (8) West Mersea and Wivenhoe urban districts, parts of Lexden and Winstree, Maldon and Tendring rural districts and part of Samford rural district; (9) part of Hambledon rural distict; (10) the burgh of Tain; (11) Dawlish urban district and parts of St. Thomas and Newton Abbot rural districts; (12) the borough of Louth; (13) Middlesbrough rural district; (14) Monks Kirby rural district and parts of Foleshill, Meriden, Nuneaton, Rugby and Warwick rural districts; (15) Lynton urban district, and part of Barnstaple rural district; (16) Hursley rural district; (17) part of West Lancashire rural district, and (18) constitution of joint board consisting of representatives of Alderley Edge and Wilmslow Urban District Councils and joint exercise of powers under the Electricity Acts.

Replies to Questions.

The following are points from answers to questions in the House of Commons:—

It is not proposed in the near future to reduce inland telegraph rates.

Seven wireless beacons around the coast of Great Britain are being erected. Six of these should be in operation by April next.

Means for telephone communication between a number of persons speaking from different places are already available in this country.

The new telephone cable for use between the Isle of Man and this country is being manufactured, and it is hoped that it will be laid next July.

The Minister of Transport has seen in the Press some reference to the proposal for utilising the tidal power of the Wash, but neither he nor the Electricity Commissioners have given it any countenance or approval.

The total number of wireless receiving licences in force on October 31st last in Wales was about 80 600, which is equivalent to a rate of 36·5 per thousand of population. The corresponding rate for England is 62·8, for Scotland 37·3 and for Northern Ireland 21·9.

The amount standing in the telephone department's books as subscribers' deposits at September 30th last was about £2 500 000. The amounts standing in the books as deposits are, as a rule, more than balanced by accrued liabilities of subscribers for which accounts have not yet been rendered.

There have been 75 inquiries during the past two years respecting the erection of overhead transmission lines. The average time which has elapsed between the application and the inquiry has been about 5½ weeks, and between the application and the announcement of the decision of the Minister of Transport about 17 weeks.

The question whether inventions and improvements relating to cables and wireless discovered by employees of the Communications Co. will be the property of that company, will depend on the terms of the agreement between the merger and Communications companies, which have not yet been formed.

The Central Electricity Board states that contracts have been let for approximately 246 miles of grid main line transmission in Scotland, and 550 miles in South-East England. The erection of the line has been commenced on two routes in Scotland—52 miles in length—and on one route in England—10 miles in length.

The British delegate at the Ninth Assembly of the League of Nations opposed the acceptance of the schemes submitted for setting up a wireless station as part of the peace machinery of the League, on the ground that it would be difficult to justify in present circumstances any expenditure of a considerable sum by the League with the object of assuring a means of communication of very doubtful efficiency to be used only in a hypothetical and, it is to be hoped, remote case. The matter will come up again for decision next September.

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BUSINESS ITEMS.

HARDING BROS., Ltd., of Commercial Street, Hereford, have opened new electrical showrooms.

BROOKHIRST SWITCHGEAR, LTD., announces that a service engineer has been attached to the London staff at Australia House, W.C.2.

A special window show of Thor electrical appliances is being given by Mr. F. C. I. MORGAN, electrician, 149, Brighton Street, Wallasey.

THORPE AND BOSCO, LTD., advise us that their day telephone numbers have been changed to Gerrard 8313/4 and the night number to Streatham 8530.

HIGGS MOTORS, Witton, Birmingham, announce that their London address has been changed to Dudley House, 36/38, Southampton Street, Strand, W.C.2.

OMEGA LAMPWORKS, LTD., Rodney Place, London, S.W.19, announce that they have completely reorganised, re-equipped, and restaffed their technical departments.

The address of the REVO ELECTRIC CO., LTD., has been changed to 30, Great Queen Street, London, W.C.2; trade entrance, 26, 28 and 30, Parker Street, W.C.2.

The TUNGSRAM ELECTRIC LAMP WORKS, LTD., announce that they have inaugurated a shop window campaign, having engaged expert window dressers for the purpose.

Electric Sirens.

A Swiss firm is desirous of getting into touch with supplier of electric sirens for factories. Further information from the Department of Overseas Trade, reference B.X. 4 894.

A confidential report on the electric light and power public service and industrial installations in Chile, has been received by the Department of Overseas Trade, reference B.X. 4 853.

The Swedish Educational Authorities, who are embarking on an extensive scheme for the provision of wireless receivers in schools, have decided to use the Marconiphone moving coil instruments.

Mr. James Fullager has retired from the firm of S. W. Bligh, electrical and radio engineers, 1 and 2, North Lane, Canterbury, and the business will be continued by Mr. Sydney William Bligh.

A fire occurred in a portion of the private offices of the HACKBRIDGE CABLE CO., LTD., at Hackbridge, on Monday. It destroyed nothing of importance, and the works were not involved in any way.

The Department of Overseas Trade announces that a Swiss firm desires to be placed in touch with suppliers of electric sirens for factories. Further particulars from the Department upon quoting reference B.X. 4891.

THE METROPOLITAN-VICKERS ELECTRICAL CO., LTD., and the ELECTRIC FURNACE CO., LTD. (who are sole licensees for the British Ajax-Northrup patents) have entered into an agreement whereby each company has the right to manufacture and supply coreless induction furnaces incorporating the Ajax-Northrup and Metropolitan-Vickers patents.

Messrs. TAMPLIN AND MAKOVSKI, electrical engineers, have carried out considerable extensions to their premises in Brighton Road, Redhill. There are new offices, and the showroom now fills the whole of the space previously occupied by the old showroom.

The S.A. DES FOYERS AUTOMATIQUES, of Paris, has obtained an order from the Etablissements Gillet, of Lyon, to instal at their works at Villeurbanne, Lopulco pulverised fuel equipment for two boilers, each of 3 750 sq. ft., complete with two 4-ton Raymond roller mills, raw coal-handling equipment, combustion chambers lined with Murray fin tubes, water screens and air heaters.

The ALTON BATTERY CO., LTD., Alton, Hants, has recently received orders for nine batteries for Sydney, Melbourne and Tasmania. These orders bring the number of Alton batteries ordered for Australia since 1926, to nearly thirty, which represents an interesting development in the export business of the Alton company. Further recent contracts cover batteries for Mansoura, Egypt and Lisbon.

SIR W. G. ARMSTRONG, WHITWORTH AND CO., LTD., of Kinnaird House, Pall Mall East, S.W.1, advise us that Felten and Guilleame, cable manufacturers, of Koln Mulheim, have recently ordered monometer three-ton capacity cable furnaces, with all latest improvements, such as anti-oxidation system, automatic temperature control, and atmospheric syphon type burners. The A.E.G. Cable Works, Oberspree, have also placed an order for a three-ton monometer cable furnace.

The MARCONIPHONE CO., LTD., has just completed a wireless receiver for Mount Lavinia Hospital, near Singapore, capable of supplying ten loud speakers and a number of headphones. Owing to the climatic conditions, a special panel is used, mounted on a strong angle iron frame, which also carries a complete switching and charging system for high and low tension accumulators. Every possible precaution has been taken to render the equipment immune from leakage due to the humid atmosphere, and the whole installation is of British manufacture throughout.

The MEDICAL SUPPLY ASSOCIATION, LTD., 167/185, Gray's Inn Road, London, W.C.1, announces that instructions have been received from the Lord Mayor of Buenos Aires to supply a large quantity of ultra-violet ray apparatus, massage apparatus, high frequency current apparatus, static electrical apparatus, radiant heat apparatus, and electro-medical apparatus generally for the equipment of the Instituto de Radiologia, Buenos Aires. It is believed that this is the largest order for electro-medical apparatus ever placed in this country by a foreign power.

INTERNATIONAL COMBUSTION, LTD., Africa House, Kingsway, W.C.2, announce that the Combustion Engineering Corporation has received orders from the Mead Pulp and Paper Co., of Chillicothe, Ohio, for one Lopulco pulverised fuel storage system, complete with air heater, fin tube furnace and settings, and one boiler of 46 000 lb. evaporation; the Ford Motor Co., of Fordson, for four Raymond 15-ton 6-roller mills; the Dupont Rayon Co., of Waynesboro', Virginia, three Lopulco pulverised fuel storage systems, complete with fin tube furnaces, water screens and settings; and three boilers, each of 27 500 lb. evaporation; the Philip Carey Co., of Lockland, Ohio, two steam generators of 1 800 lb. pressure per sq. in. This point is of interest in that it is claimed to be the highest boiler pressure so far selected for the United States.

International Combustion, Ltd., also announces that the French company, Société Anonyme des Foyers Automatiques, of Paris, has secured orders for Lopulco pulverised fuel equipment from the Sociétié Houillère de Sarre and Moselle, of Merlebach, and the Compagnie Auxiliaire d'Électricité, of Brussels. The first plant, to be installed at Merlebach, is equipment for one S.A.C.M. boiler of 10 760 sq. ft. heating surface, 255 lb. pressure, 100 000 lb. normal evaporation, complete with suspended arch and Lopulco water-cooled walls. The second plant, to be installed at Antoing, is equipment for one B. and W. boiler of 8 070 sq. ft. heating surface, 710 lb. pressure, 56 000 lb. normal evaporation, complete with a six-ton Raymond mill, two of the new "R" type horizontal burners, suspended arch and water-cooled walls.

Welding Equipment.

We are informed that ALLOY WELDING PROCESSES, LTD., 14–16, Church Street, London, N.1, have secured a contract for the supply of a motor generator electric arc welding plant for two operators for the Assam Bengal Railway Co. This machine is to be fitted with their latest B.P. type dynamos, which are self-stabilising, drooping characteristic machines, giving the arc voltage at their terminals. The special features of the "A.W.P." generator are that no separate series resistance, reactors, or transformers are required, neither is separate excitation necessary. The company has supplied similar equipment to the East Indian Railway, the Nigerian Railways, the South African Railways, the Rangoon Dockyard, the Rhodesian Railways, the Eastern Bengal Railway, the Crown Agents for the Colonies, the Singapore floating dock, and Woolwich Arsenal.

The MARCONIPHONE CO., LTD., 210/212, Tottenham Court Road, E.C.4, has prepared a short lecture on the subject of screen grid valves, illustrated by eighteen slides. This deals with the subject quite comprehensively, and is timed to last between forty and fifty minutes. It is proposed to loan a copy of the lecture and a set of slides to secretaries of radio societies for reading by a member on occasions when an outside lecturer cannot be present. It will also be of use to members of the trade who wish to lecture before their local societies. It is intended shortly to arrange a second lecture on the subject of power from a.c. mains, wherein high and low tension and grid bias circuits will be fully explained with about twenty slides. The number of lectures is limited. The Marconiphone Co., Ltd. has also drawn our attention to the fact that the Sterling luminous bell system is being installed at the new "Oddenines" Hotel and Restaurant in Regent Street, London. In this system the bells are replaced by lamps so disposed that a waiter, valet or chambermaid may be called at will from any part of the building to any room in his or her particular section.

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A NEW SHOWROOM.

A Comprehensive Display of Domestic Lighting Fittings and Appliances.

A NEW electrical showroom for the benefit of the trade was opened on Monday, by the Welsbach Light Co., Ltd., Welsbach House, King's Cross, London, W.C.1, the layout and arrangements being to the designs of Mr. R. F. Tempany, manager of the electrical department. The showroom is divided into sections approached from a main aisle running the whole length of the room. On entering one views a full range of wood fittings arranged in an appropriate setting, while an attractive fireplace with an electric fire installed gives to this section an atmosphere of uncrowded comfort not often met with in showrooms of this kind. In addition to lighting fittings this same section houses electric fires, bowl fires, etc., including the "Kern" and 1 and 2 bar electric "Handy" heaters. Another section is decorated in colours specially chosen to give effect to dressing table pendants and bedroom fittings, while in still another section is displayed a range of crystal fittings, the wall decorations again being of such colours as to show the fittings to their best advantage. Other sections in various colour schemes are devoted to the display of amber fittings, domestic appliances, cookers, bowls, and fancy and indirect lighting fittings. Along the main aisle full ranges of dining room counter weight fittings, elaborate bowls, etc., are also displayed. Glass showcases are included as part of the showroom appointments, and in these are displayed silk shades of all kinds. Glassware shades of various colours and shapes are arranged in groups round the columns of the centre aisle, the whole showroom presenting an orderly arrangement conducive to comfort and easy selection. The two photographs which we reproduce on page 47 indicate to some extent the simple yet pleasing surroundings. It may be mentioned that among the exhibits is a range of "architectural" fittings for wall and ceiling decoration. These take the form of open and closed designs, and are shown to very good effect in the indirect lighting section. That portion of the showrooms devoted to electric cookers and similar equipment was not complete at the time of the opening, but we understand that a comprehensive range will be carried, while the space allotted to the section indicates that considerable attention will be paid to the display of this class of equipment.

The visit was terminated with a luncheon at the Midland Hotel, King's Cross, with Mr. A. T. Metcalf, general manager, in the chair.

TRADE PUBLICATIONS.

ELECTRIC light fittings are the subject of a new issue by OSLER AND FARADAY, LTD., Lanthorne House, Newman Street, W.1.

The current issue of the "B.E.N. Bulletin," published by B. E. N. PATENTS, LTD., of 92, Tottenham Court Road, W.1, has been received.

The BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, W.C.2, has published leaflet L.452 describing ceiling and wall attachments.

A catalogue of wireless receivers and components has been published by the SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, London, W.C.2.

The A. E. G. ELECTRIC CO., LTD., 131, Victoria Street, S.W.1, has published a green folder on time switches, automatic circuit breakers, special instruments and fractional H.P. motors.

"Rational Cleaning of Coal," by R. Lessing, has been reprinted from the "Journal of the Institute of Fuel," and is being distributed by the CLEAN COAL CO., LTD., 317, High Holborn, W.C.1.

Aluminium foundry practice is dealt with in a new publication of the BRITISH ALUMINIUM CO., LTD., Adelaide House, King William Street, London, E.C.4. The reference is No. 313, and the issue supplements publication No. 190.

Floodlights and floodlighting are dealt with in a new issue of the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2. The publication is illustrated throughout with striking examples of floodlighting and gives details of the projectors. The reference is F. 4 822.

The MULLARD WIRELESS SERVICE CO., LTD., Denmark Street, W.C.2, has published leaflet W.A. 18 relative to the "P.M." potential divider; V.R. 56, type P.M. 5B valves; V.R. 57; P.M. 1A type valves; V.R. 58, type P.M. 3A valves; V.U. 7, DU/10 valves; V.T. 7, VO/50 valves, and V.R. 65, relative to P.M. 12 and P.M. 14 valves.

WIRELESS NOTES.

"Reciprocal Understanding" Between the R.W.F. and the W.R.A.

A "RECIPROCAL understanding" has been arrived at between the Radio Wholesalers' Federation and the Wireless Retailers' Association of Great Britain, embodying points which the Councils of both organisations recommend their members to observe. These recommendations are to the effect that members of the W.R.A. should give preference in purchasing to firms and companies that are members of the R.W.F.; that members refrain from purchasing from firms and companies acting as wholesalers but who compete with them either openly or otherwise, by selling retail as well as wholesale; and that W.R.A. members communicate to the R.W.F. the name of any wholesaler or manufacturer offering radio goods at prices or on conditions other than manufacturers' listed prices and or terms. The "understanding" also points out that the R.W.F. agrees to circulate amongst its members, after verification, the names of applicants for trade terms who, in its view, do not comply with recognised trading requirements, and recommends its members to use their influence with their retail customers to induce them to become members of the W.R.A.

In connection with above paragraph it is interesting to note that the membership of the Radio Wholesalers' Federation comprises: Brown Brothers, Ltd., Mayall and Co., Ltd., Lawrie and Co., Southern Motor Factors, Ltd., F. Riddiough and Son, Superlamp, Ltd., Sloan Electrical Co., Ltd., Wholesale Fittings Co., Ltd., Murdoch Trading Co., Flinders (Wholesale), Ltd. James Bridger, Ltd., F. D. Newcombe and Co., T. Beadle and Co., Ltd., Carr and Childe, Ltd., Cook's Wireless Co., Ltd., Albion Electric Stores, Fred Dawson, Ellison and Hillman, Houghton-Butcher (Great Britain), Ltd., H. Wadsworth Sellers, Midland Motor Factors, Ltd., Downes and Davies, Sidney Hathaway and Co., Richardson's, Accessories (Edinburgh), Ltd., A. J. Dew and Co., Ecco Radio Co., Ltd., Enterprise Manufacturing Co., Ltd., Harris and Russell, Ltd., London Electric Stores, Ltd., Young and Wildsmith, Hirst, Ibbetson and Taylor, Ltd., R. O'Brien and Co., Arthur Jones and Co., Thomson and Brown Brothers, Ltd., Harris and Russell, Ltd., J. F. Irvine and Co., Ltd., Wood and Cairns, Ltd., Michael Black, William Harper and Co., North British Machine Co., Ltd., James Robertson.

Broadcasting in East Africa.

The Office of H.M. Trade Commissioner in East Africa reports that the programmes of the British East African Broadcasting Co., Ltd., comprise transmissions on 33·5 metres (1 kW), with a range of approximately 1 000 miles, and also on 400 metres (4 kW), with a range of approximately 60 miles. Broadcasting will take place each evening simultaneously. It is estimated that at least 2 000 sets will be sold within the next twelve months in the area served by the station. The most popular set will probably be the three-valve short-wave set with a loud speaker, designed to pick up British, American and Dutch broadcasting services in addition to the local station, and adapted also to receive the 400-metres station. A smaller set of two valves with headphones will probably be demanded as a cheaper alternative, and crystal sets for use with the 400-metre station may also be in demand. British firms interested may obtain the names of likely importers of wireless apparatus on application to the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1.

COLLEGES' REPORTS.

The report of the work of the Department of Technology of the City and Guilds of London Institute for the session 1927-28 has been issued by Mr. John Murray, Albemarle Street, London; price 1s. net. It contains lists of the members of the Council and the Executive Committee, the results of the examinations in England, Wales, Scotland and Ireland, lists of prize winners, etc.

The annual report of the Royal Technical College, Glasgow, on the 132nd session, is also to hand. The book contains the names of the governors, members of Committees, Board of Studies and Staff, statistics showing the numbers of students and enrolments, the names of students who have graduated at the University, other distinctions gained by students, diplomas and certificates granted, donations and bequests to the College, the publications of members of the College during the past year, the recent additions to the electrical engineering laboratory equipment, etc.

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BUSINESS OPENINGS.

Latest Particulars of Electrical Engineering and Wiring Installation Contracts for which Tenders are being Invited at Home and Abroad.

WE give below the latest particulars of contracts for which tenders are invited. The closing date is given, when available.

BRENTFORD GUARDIANS.—Installation of electric lift at West Middlesex Hospital, Isleworth. Particulars from the Clerk to the Guardians, Toolands House, Isleworth.

CARLISLE SOUTH-END CO-OPERATIVE SOCIETY.—Electric lighting installation in business premises at Longsowerby. Particulars from the architect, Mr. S. W. B. Jack, Lloyds Bank Chambers, Carlisle.

WEST RIDING EDUCATION COMMITTEE.—Electric light installation at Gildersome Street Lane Council School. Specifications from Mr. B. Sheard, Education Offices, 8, St. John's North, Wakefield.

SHEFFIELD CORPORATION, January 11th.—Supply of 1 000 tons of tramway rails, copper bonds, etc. Specifications, etc., from Mr. A. R. Fearnley, General Manager, Tramways and Motors Department, Division Street, Sheffield.

ASHFORD (KENT) URBAN DISTRICT COUNCIL, January 14th. —Heavy-oil engine, to drive 600 kW three phase 50 period alternator, with starting air bottles, piping, fuel service tank, etc.; also supercharger silencer, centrifugal pump and fuel oil tank. Further particulars from the Clerk.

BETHNAL GREEN (LONDON) BOROUGH COUNCIL, January 14th.—Electric lighting and power and telephone installations at Public Baths and Washhouses in course of erection in Old Ford Road. Specification, etc., from the Borough Engineer Town Hall, Bethnal Green, E.2; deposit, £3 3s.

CAMBERWELL (LONDON) BOROUGH COUNCIL, January 14th. —Maintenance of electric lighting, heating and power installations (section L) and supply of electric lamps (section S) for twelve months. Forms of tender from Borough Engineer and Surveyor, Town Hall, Camberwell, S.E.5.

CENTRAL ELECTRICITY BOARD, January 14th.—Supply and erection of 132 000 V transformers, in connection with Central England Electricity Scheme. Specification (C.E.-P.T.1) and form of tender from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

CENTRAL ELECTRICITY BOARD, January 14th.—Supply and erection of 132 kV outdoor switchgear for transforming stations in area covered by the Central England Electricity Scheme. Specification (C.E.-P.S.1) and form of tender from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

EDINBURGH CORPORATION, January 14th.—Boiler feed-water de-aerating plant for Portobello power station. Specification (No. 96) from Mr. Edwin Seddon, electrical engineer and manager, Electricity Department, Edinburgh; deposit, 10s. 6d.

HUDDERSFIELD CORPORATION, January 14th.—Electrical work for new baths. Particulars from the borough architect, Mr. L. Smith, 26, Ramsden Street, Huddersfield.

KETTERING URBAN DISTRICT COUNCIL, January 14th.— Supply of (*a*) high and low tension cables; (*b*) transformers. Specifications from Mr. W. A. Walker, Electricity Works, Kettering; deposit £1 1s. for each.

STOKE-ON-TRENT CORPORATION, January 16th.—Supply and erection of an electrically-driven air compressor at the central power house, Hanley. Specification, etc., from the City Electrical Engineer, St. George's Chambers, Kingsway, Stoke-on-Trent; deposit, £2.

STOKE-ON-TRENT CORPORATION, January 16th.—Wiring and fitting of eight electric houses in Avenue Road, Hanley. Specification, etc., from the City Electrical Engineer, St. George's Chambers, Kingsway, Stoke-on-Trent; deposit, £2.

STOKE-ON-TRENT CORPORATION, January 16th.—Supply of low tension d.c. switchboard, for electricity sub-works, Bagnall Street, Stoke-on-Trent (contract 2 836); and supply of e.h.t. ironclad type switchgear at Central power house, Hanley (contract 2 839). Specifications from the City Electrical Engineer, St. George's Chambers, Kingsway, Stoke-on-Trent; deposit, £2 for each.

KEIGHLEY CORPORATION, January 17th.—Supply and erection of water-tube boiler, to evaporate 30 000 lb. of water per hour, for the Electricity Department. Specifications from Mr. H. Webber, borough electrical engineer, Coney Lane, Keighley; deposit, £2 2s.

EDINBURGH DISTRICT BOARD OF CONTROL, January 18th. —Electric power and lighting installation at Gogarburn, Edinburgh. Specifications from Mr. Stewart Kaye, 14, Hill Street, Edinburgh.

ISLINGTON (LONDON) BOROUGH COUNCIL, January 18th.— Manufacture and supply of one 5 000 kVA Scott-connected transformer, for three-phase system, 6 600 V and 2 000/2 300 V per phase, with voltage regulator; and 375 kVA and/or 750 kVA Scott-connected transformers, for three-phase system, 6 600 V and 2 000/2 300 V per phase. Specification from the Borough Electrical Engineer, 60, Eden Grove, Holloway, N.7.

ISLINGTON (LONDON) BOROUGH COUNCIL, January 18th.— Supply of cables; electricity meters; terminal, service, network and fuse boxes; oil circuit breaker switches; electrical sundries; wires; lamps; transformers, etc., for one year. Specification from the Town Clerk.

WEST RIDING EDUCATION COMMITTEE, January 19th.— Electric light intallations in Norton New School and in Glass Houghton Ashton Road Council School and caretaker's house. Specification, until January 14th, from Education Department, County Hall, Wakefield.

ESSEX COUNTY AND COLCHESTER HOSPITALS COMMITTEE, January 21st.—Internal electric wiring af Brentwood Mental Hospital, with fuseboards, motors, etc, Specifications, etc., from Mr. H. H. Gepp, 66, Duke Street, Chelmsford; deposit, £5 5s. Only registered contractors are invited to tender.

NEWBURY CORPORATION, January 21st.—Direct-coupled electric motor and centrifugal pump, etc. Specification etc., from Messrs. H. Humphries and Sons, 28, Victoria Street, Westminster, S.W.1; deposit, £1 1s.

GLASGOW CORPORATION, January 28th.—Electrical installation and heating installation, in connection with conversion of Family Home, St. Andrew's Street, Glasgow, for use as additional police headquarters. Specifications, etc., from the Office of Works, 64, Cochrane Street, Glasgow; deposit £3 3s.

BELFAST CORPORATION, January 29th.—Installation of automatic telephones in the Infectious Diseases Hospital, Purdysburn. Specification, etc., from Mr. R. Meyer, town clerk; deposit £2 2s.

LIVERPOOL CORPORATION, January 31st.—Twelve months' supply of various materials, including (E.S.1) cables, compounds and tapes; (E.S.2) insulated cables; (E.S.3) electricity meters; (E.S.4) cartage; (E.S.5) incandescent lamps; (E.S.6) brass and copper castings; (E.S.7) a.c. motors and starting gear; (E.S.8) stoneware troughing etc.; (E.S.9) oils. Tender forms from City Electrical Engineer, 24, Hatton Garden, Liverpool. State number of form desired.

RIPON CORPORATION, February 1st.—Overhead 11 000 V transmission line and small quantity of e.h.t. underground cable (contract No. 2). Persons desiring to tender must communicate their intention to Mr. W. C. C. Hawtayne, 9, Queen Street Place, London, E.C.4, before January 11th. Specifications etc., will be issued on or about January 18th to persons who after receiving notice from Mr. Hawtayne, send to the Town Clerk a deposit of £2.

SHEFFIELD CORPORATION, February 14th.—Equipment for new generating station at Blackburn Meadows, Sheffield, including turbo-alternator, with condensing, evaporating and steam preheating plant (specification B.M. 67); water-tube boilers, with chimneys, superheaters, stokers (or pulverised fuel firing equipment), economisers, valves, etc. (B.M. 68); wagon tippers, conveyors and elevators (B.M. 70); cooling towers (B.M. 72); and overhead electrically and hand-operated cranes (B.M. 73). Specifications from Mr. S. E. Fedden, general manager and engineer, Electric Supply Department, Commercial Street, Sheffield; deposit £3 3s. for each.

CENTRAL ELECTRICITY BOARD, February 15th.—Supply and laying of 66 000 V cables in London area, in connection with South East England Electricity Scheme. Specification (S.E.E.-L.C.1) and form of tender from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

CENTRAL ELECTRICITY BOARD, February 18th.—Supply and erection of 132 000 V overhead transmission lines, in connection with the North-West England and North Wales

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Electricity Scheme. Specification (No. N.W.E.-P.L. 1) and form of tender from Sir J. R. Brooke. Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit, £2 2s.

CENTRAL ELECTRICITY BOARD, February 18th.—Supply and erection of 132 000 V overhead transmission lines, in connection with the Central England Electricity Scheme. Specification (No. C.E.-P.L. 1) and form of tender from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit, £2 2s.

Overseas.

UNLESS otherwise stated, particulars of overseas contracts are to be had from the Department of Overseas Trade (Room 52), 35, Old Queen Street, Westminster, London S.W.1. *Note.—An asterisk denotes that local representation is, in practice, essential.*

VICTORIAN ELECTRICITY COMMISSION, January 14th.—Supply of 11 000 V transformers and spares (specification No. 29/1). (Reference B.X. 4 900.)

NEW ZEALAND POSTS AND TELEGRAPHS, January 15th.—Supply of telephone cords (tender No. P. and T. 151/1 084). (Reference B.X. 4 847.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, January 15th.—Supply of vitreous enamel indicating plates. (Reference B.X. 4 927.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, January 15th.—Supply of timing clocks (schedule C. 382). Reference B.X. 4 905.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, January 15th.—Telephone transformers (schedule C. 383.) (Reference B.X. 4 878.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, January 15th.—Supply of loading coil pots, (Ref. B.X. 4 879.)

TURKISH DEPARTMENT OF POSTS, TELEGRAPHS AND TELEPHONES, January 16th.—Supply of underground telegraph cable, and accessories. (Reference B.X. 4 942.)

• VICTORIAN RAILWAY COMMISSION, January 16th.—Rotary converter or rectifier set, for Glen Waverley sub-station. (Reference B.X. 4 893.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, January 17th.—Air compressor, arc welding set, electrically-driven wheel lathe, motor-driven foundry sand and loam mill, motor-driven rattler and motor-driven stone crushing machine (tender No. 1 367.) (Reference A.X. 7 226.)

BULAWAYO MUNICIPALITY, January 18th.—Supply of street lighting material, transformers, h.t. and l.t. cable, h.t. kiosks and pillars, and busbar material. (Reference B.X. 4 965.)

NEW SOUTH WALES PUBLIC WORKS DEPARTMENT, January 21st.—Supply of static power transformers, for Young-Wyangala section of Burrinjuck hydro-electric development transmission lines (contract No. 235/28). (Reference B.X. 4 995.)

GRAHAMSTOWN (SOUTH AFRICA) MUNICIPALITY, January 22nd.—Supply and erection of centrifugal pumps, motors and cable (Contract B. of 1928). (Reference A.X. 7 187.)

GRAHAMSTOWN MUNICIPALITY, January 22nd.—Supply of cable, transmission lines and transformers (contract C. 1 928). (Reference B.X. 4 913.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, January 22nd.—Supply of two concrete mixers, with electric motors (contract No. D.W. 67/107). (Reference A.X. 7 315.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, January 22nd.—Supply of telephonists' telephones. (Reference B.X. 4 888.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, January 22nd.—Telephone transmitters and associated parts (schedule C. 386.) (Reference B.X. 4 889.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, January 22nd.—Telephone receivers and associated parts (schedule C. 387). (Reference B.X. 4 890.)

BOMBAY, BARODA AND CENTRAL INDIA RAILWAY CO., January 23rd.—Supply of 400 kW heavy oil engine-driven generating set. Specification, etc. (20s.) from Mr. S. G. S. Young, secretary, White Mansion, Petty France, Westminster, S.W.1.

CAPE TOWN MUNICIPALITY, January 23rd.—Supply of electric cable (specification 446/1928). (Reference B.X. 4 978.)

EGYPTIAN MINISTRY OF THE INTERIOR, January 24th.—Supply and installation of electric system for Beba. (Reference B.X. 4 916.)

JOHANNESBURG MUNICIPALITY, January 24th.—Supply of 4 500 porcelain insulators (Contract No. 106). (Reference B.X. 4972.)

JOHANNESBURG MUNICIPALITY, January 24th.—Supply of weatherproof copper wire, with fireproof coatings and outer braiding, for use on overhead electric lines. (Reference B.X. 4 976.)

JOHANNESBURG MUNICIPALITY, January 24th.—Supply of electric cable (contract No. 109.) (Reference B.X. 4 977.)

JOHANNESBURG MUNICIPALITY, January 24th.—Supply of oil switches (contract No. 114). (Reference B.X. 4 994.)

JOHANNESBURG MUNICIPALITY, January 24th.—Supply of steel lighting and tramway poles (Contract No. 107). (Reference A.X. 7302.)

SOUTH AFRICAN DEPARTMENT OF POSTS AND TELEGRAPHS, January 24th.—Supply of telephone switchboards (tender No. 143). (Reference B.X. 4 912.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, January 24th.—Supply of two small d.c. generating sets, running on crude oil, for Maquassi. (Reference B.X. 4 943.)

EGYPTIAN MINISTRY OF THE INTERIOR, January 27th.—Supply of transformer kiosks, electric cables and accessories required for the extension of the electric supply of Mit-Ghamr power station. (Reference B.X. 4 893.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, January 29th.—Accumulator batteries and counter E.M.F. cells (schedule C. 390). (Reference B.X. 4 906.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, January 29th—Single core, paper insulated lead covered cable. (Reference B.X. 4 954.)

THE stands of the Marconiphone Co., Ltd. (left), and Marconi's Wireless Telegraph Co., Ltd. (right), at the Physical and Optical Societies' Exhibition, which took place at South Kensington from Tuesday until yesterday, Thursday. Details of some of the exhibits are given on pages 33 *and* 34.

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WAIRARAPA (N.Z.) ELECTRIC POWER BOARD, January 29th.—Supply of 15 sets of earth leakage protection equipment (contract No. 78). (Reference B.X. 4 950.)

CHILEAN MINISTRY OF MARINE, January 30th.—Two electric travelling cranes. (Reference A.X. 7353.)

EGYPTIAN MINISTRY OF THE INTERIOR (SECTION DES MUNICIPALITES ET COMMISSIONS LOCALES), January 31st.—Diesel engine driven generator set, d.c. rotary balancer and, accessories, for Kafrel Zayat electric station. (Reference B.X. 4 931.)

MANAWATU-OROUA (N.Z) ELECTRIC POWER BOARD, January 31st.—Supply of automatic re-closing 11 000 V switchgear for pole platform mounting (contract No. 57). (Reference B.X. 4 988.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, January 31st.—Supply of electrically driven locomotive turntable (tender No. 1 386). (Reference A.X. 7 253.)

VICTORIAN ELECTRICITY COMMISSION, February 4th.—Supply of 11 000 V switchgear, in connection with the Yallourn power station extensions. (Specification No. 29/5.) (Reference B.X. 4 897.)

VICTORIAN ELECTRICITY COMMISSION, February 4th.—Supply of 22 000 V switchgear and accessories, for Richmond Terminal Station. (Reference B.X. 4 901.)

VICTORIAN ELECTRICITY COMMISSION, February 4th.—Supply of 11 000 V switchgear, for installation in the Richmond Terminal Station (specification No. 29/3). (Reference B.X. 4 898.)

VICTORIAN ELECTRICITY COMMISSION, February 4th—Supply of pillar insulators, with metal parts for use on 132 000 V outdoor circuits. (Reference B.X. 4 921.)

INDIAN STORES DEPARTMENT, NEW DELHI, February 5th.—Supply of turbo-alternator, boiler, economiser, switchgear and cables. (Reference B.X. 4 944.)

EGYPTIAN STATE RAILWAYS, February 9th.—Electrification and equipment of Heluan line, including equipment of power station, overhead transmission lines, track bonding motor and trailer coaches, etc. Tenders to General Manager, Cairo Station.

NEW SOUTH WALES PUBLIC WORKS DEPARTMENT, February 11th.—Supply, erection and maintenance of hydro-electric generating plant, in connection with Hume reservoir hydro-electric development. (Reference B.X. 4 989.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, February 12th.—Supply of 110 kV switchgear, and controlling equipment, for Waitaki power scheme, section 3. (Reference B.X. 4 848.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, February 12th.—Supply of dry cells, for telephone work. (P. and T. 151/1 205.) (Reference B.X. 4 991.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, February 12th.—Supply of v.i.r. wire (No. P. and T. 151/1184) (Reference B.X. 4 951.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, February 14th.—Supply of 15-ton electrically-driven portal titan crane (tender No. 1 366). (Reference A.X. 7 272.)

INDIA STORE DEPARTMENT, February 15th.—Supply of hydro-electric plant, comprising four 12 000 kW water-wheel driven alternator sets, auxiliaries and spares (schedule 4). Forms of tender (5s.) from the Director-General, Belvedere Road, London, S.E.1.

NEW SOUTH WALES DEPARTMENT OF PUBLIC WORKS. Extension of date.—February 18th.—Supply and erection of hydro-electric generating plant for Burrinjuck development. (Reference 4 938.)

NEW ZEALAND POSTS AND TELEGRAPHS, February 19th.—Supply of bronze wire and copper binding wire. (Reference A.X. 7 252.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, February 19th.—Supply of 120 000 galvanised steel spindles for insulators. (Reference B.X. 4 948.)

CAPE TOWN MUNICIPALITY, February 20th.—Pumping equipment for storm water, etc., for the electricity department (specification 445/28). (Reference A.X. 7345.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, February 28th.—Supply of six-conductor telephone cordage. (No. P. and T. 151/1 234.) (Reference B.X. 4 990.)

WHANGAREI (N.Z.) HARBOUR BOARD, February 28th.—Supply of one 15-ton electrically-operated level luffing gantry crane (contract No. 35). (Reference A.X. 7 263.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, March 5th.—Supply of seven single-phase 5 500 kVA transformers, for Waitaki power scheme, section 4. (Reference B.X. 4 873.)

VICTORIAN ELECTRICITY COMMISSION, March 18th.—Supply of 1 300 strings of suspension insulators, 600 strings of tensioning insulators, 1 300 conductor suspension clamps, 350 conductor tensioning clamps, 50 semi-anchor clamps for "V" strings of insulators, 200 semi-anchor clamps for single strings of insulators, 475 earth wire suspension clamps and 125 earth wire tensioning clamps. (Reference B.X. 4 997.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, March 19th.—Supply of 110 000 V transformer, for Mangahao electric power scheme (section 204). (Reference B.X. 4 952.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, March 19th.—Supply of 11 000 V switchgear, for Mangahao power development (section 203). (Reference B.X. 4 953.)

TANGANYIKA GOVERNMENT, June 1st.—Concession for utilisation of Pangani River Falls for the development of electric power. Copies of the draft concession may be obtained from the Crown Agents for the Colonies, 4, Millbank, London, S.W.1.

STATE ELECTRICITY WORKS, MONTEVIDEO, July 8th.—Construction and equipment of 50 000 kW power station.

Tenders Accepted.

WAR OFFICE.—Edison Swan Electric Co., Ltd., supply of bell brackets and bell bracket cases.

STOKE-ON-TRENT CORPORATION.—A. Bew, electric lighting installation at Copeland Street stores, £95.

BEDFORD CORPORATION.—Cambridge Instrument Co., Ltd., supply of recorder and indicator outfit, £50.

WARRINGTON CORPORATION.—Brush Electrical Engineering Co., Ltd., supply of extraction water pump.

INDIAN STORES DEPARTMENT.—General Electric Co., (India), Ltd., feeder panel for switchboard, Rs. 1 560.

NAVAN COUNTY COUNCIL.—Gilbert Bros., electric light and power re-wiring in County Hall, Navan, £84.

BERMONDSEY (LONDON) BOROUGH COUNCIL.—United Electrical Works, rewinding of motor armature, £13.

SOWERBY BRIDGE URBAN DISTRICT COUNCIL.—Harrison and Co., of Halifax, electrical work at 16 houses.

GREAT WESTERN RAILWAY CO.—Holt and Willets, 25-ton portable electric crane, for Millbay (Plymouth) pier.

EAST HAM CORPORATION.—Crompton Parkinson, Ltd., spare armature for charging plant at sewage works, £107 10s. (Recommended.)

ISLINGTON (LONDON) BOROUGH COUNCIL.—Hardy and Padmore, Ltd., supply of 12 steel tube lamp columns, £24 18s. each. (Recommended.)

HACKNEY (LONDON) BOROUGH COUNCIL.—A. Reyrolle and Co., Ltd., switchgear, for generating station extension, £56 045 3s. (Recommended.)

HERNE BAY URBAN DISTRICT COUNCIL.—S. Terry, (331 18s. 7d.) or E. C. Spray (£333). electric light installation at King's Hall. (Recommended.)

SHOREDITCH (LONDON) BOROUGH COUNCIL.—Elliston, Evans and Jackson, Ltd., electric light installations at 155 tenements in Bleyton Dwellings, £595.

STAFFORD CORPORATION.—English Electric Co., Ltd., insulators, transformers, etc., in connection with alterations to machinery at electricity works, £95 19s.

HIGH WYCOMBE EDUCATION COMMITTEE.—Wycombe (Borough) Electric Light and Power Co., Ltd., electric light installation at new schools at Terriers, £67 5s.

BEDFORD CORPORATION.—Barber and Colman, Ltd., installation of electric traffic signals at St. Peter's, £179 5s., and at St. Mary's, £141. (Both recommended.)

BRIDLINGTON.—Service Co., electricians and plumbers' work in connection with erection of semi-detached villas, Sands Cottage estate, Bridlington, for Mr. A. Russling, £156.

ILFORD CORPORATION.—Crompton Parkinson, Ltd., supply of 1 000 kW rotary converter equipment, £3 235 10s.; Foster Engineering Co., Ltd., supply of 200 kVA transformer, £144.

BIRMINGHAM EDUCATION COMMITTEE.—Ellis and Ward, Ltd., electrical installations at Ada Street and Yardley Wood schools; W. J. Sheath, electrical installation at Gower Street school.

SPENBOROUGH EDUCATION COMMITTEE.—F. W. Birkett and Sons, Ltd., electric light installation in connection with alterations and additions at South Parade School, Cleckheaton.

LONDON COUNTY COUNCIL.—E. Showell and Sons, Ltd., and Yorkshire Switchgear and Engineering Co., Ltd., supply of controller segments, fingers, tips, etc., to the tramways department during 1928-9.

FULHAM (LONDON) BOROUGH COUNCIL.—J. Lever and Sons, and H. A. Lamb and Sons, wiring of consumers' premises

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under rental wiring scheme, at schedule of prices set out in contract. (Recommended.)

LONDON COUNTY COUNCIL.—Dorman, Long and Co.; supply, during year 1929-30, of tramway track rails, etc., £55 381; bolts, and nuts, £1 075; and slot rails, £4 846, Frodingham Iron and Steel Co., Ltd., supply of conductor rails during year 1929-30, £10 464.

ST. PANCRAS (LONDON) BOROUGH COUNCIL.—Greenwich Cable Works, Ltd., supply of l.t. cable, £968. (Recommended.) Also tendered: Hackbridge Cable Co., Ltd., £1 029; Siemens Bros. and Co., Ltd., £1 044; Pirelli-General Cable Works, Ltd., £1 071; British Insulated Cables, Ltd., £1 084; Standard Telephones and Cables, Ltd., £1 085.

DUBLIN CITY COMMISSIONERS.—Supply of arc lamp carbons: British Thomson-Houston Co., Ltd., 9mm. by 15 in. flame carbons, £3 4s. per 1 000, and 9mm. and 8mm. by 15 in. flame carbons, £6 per 1 000 pairs; Roper Bros., Dia carbons, 25mm. by 270mm. and 16mm. by 240mm., £74 1s. 6d. per 1 000 pairs, and Dia carbons, 22mm. by 260mm. and 19mm. by 240mm., £7 10s. per 100 pairs.

DOVER CORPORATION.—Pirelli-General Cable Works, Ltd., supply and laying of about 2 500 yards of e.h.t. cable, suitable for 6 600 V, £2 232. Also tendered: W. T. Glover and Co., Ltd., £2 360; British Insulated Cables Ltd., £2 422; Macintosh Cable Co., Ltd., £2 406; Standard Telephones and Cables, Ltd., £2 424; Siemens Bros. and Co., Ltd., £2 406; Watsham's, Ltd., £2 295; E. E. Garrard, £2 183 (French cable); Johnson and Phillips, Ltd., £2 421; W. T. Henley's Telegraph Works Co., Ltd., £2 424; Callender's Cable and Construction Co., Ltd., £2 372; Enfield Cable Works, Ltd., £2 377; Power Lines Construction Co., Ltd., £2 295; Liverpool Electric Cable Co., Ltd., £2 409; Switchgear and Cowans, Ltd., supply and erection of 2 200 V switchgear, £530. Also tendered: Metropolitan-Vickers Electrical Co., Ltd., £868; Crompton Parkinson, Ltd., £925; New Switchgear Construction Co., Ltd., £1 150; Ferguson, Pailin, Ltd., £870; J. G. Statter and Co., £660, alternative £635; Erskine, Heap and Co., Ltd., £880; British Thomson-Houston Co., Ltd., £1 129, alternative £1 136; A. Reyrolle and Co., Ltd., £895; English Electric Co., Ltd., £786; Whipp and Bourne, Ltd., £1 587; Park Royal Engineering Co., Ltd., £1 105, alternative £1 200; General Electric Co., Ltd., £905.

TRADE CALENDARS, &c.

A LARGE wall-type calendar, illustrating some of the company's products, has been received from PETTERS, LTD., Yeovil.

A daily date-slip refill for the holder supplied some years ago has been received from the SUN ELECTRICAL CO., LTD., Charing Cross Road, W.C.

A "Kleer-figure" calendar has been received from the SIEMENS AND GENERAL ELECTRIC RAILWAY SIGNAL CO., LTD., Central House, Kingsway, W.C.2.

The ENGINEERING AND LIGHTING EQUIPMENT CO., LTD., Sphere Works, St. Albans, Herts, has issued a calendar quoting and illustrating famous sayings. The drawings are in each case by Will Owen.

We have received from VENNER TIME SWITCHES, LTD. of 45, Horseferry Road, London, S.W.1, a gift of a thermometer. The instrument was accompanied by a card containing New Year greetings in verse and epigram, a sample of which is given below:—

What tho' distance fahr-en-heit immense
Come between ourselves and you,
To show our feelings most intense
We've centigrade of wishes true.

The 1929 calendar of METRO-VICK SUPPLIES, LTD., Trafford Park, Manchester, is illustrated by a coloured picture by Bert Wilson, showing in the right foreground part of a small standard lamp with yellow shade, with a dark-haired, smiling girl in the background. The picture is mounted upon a dark brown board and makes a very pleasing whole. A distribution has already been made to the trade, but a few copies are still available for those who have not yet had one.

An attractive calendar has been sent to us by CROMPTON PARKINSON, LTD., Guiseley, comprising four large coloured sheets showing on each a quarter of the year and an illustration relative to certain of their manufactures. The first quarter is illustrated by a large liner in dry dock coupled with d.c. motors for marine use; the second quarter shows a mining view coupled with motors for use in damp, dust or fumes; the third quarter is illustrated with a picture of a power station and transformer; while the last quarter depicts another dock scene, coupled with crane and haulage motors.

REDUCTIONS IN CHARGES.

THE following reduced charges for electricity are announced. Figures in parentheses represent the former rates:—*Whitchurch and Pangbourne Electric Supply Co.*, lighting, 10d. (1s.). *Spenborough*, power 1½d. (3d.), lighting 5½d. (6d.), public lighting 2d. (3d.). *Prescot Urban District* (British Insulated Cables Ltd.), minimum charge of 10s. per quarter during summer months is abolished. *Dorchester*, sliding scale, first 2 500 kWh per annum, 9d. per kWh, all above, 8d. *Walton-on-Thames*, lighting, 7½d. (9d.), heating and cooking, 2d. (4½d. for first 100 kWh and 3½d. beyond), power, first 100 kWh, 6d. per kWh (7d.), next 3 000 3½d. (4d.), beyond 2½d. (3d.); minimum charges abolished; shop window lighting between 7 p.m. and 10 p.m. 50% of new tariff. *Chatham and Rochester* (Kent Electric Power Co.), lighting, 6½d., power, heating and cooking, 2d. *Weybridge* (Urban Electric Supply Co., Ltd.), power and heating: first 3 000 kWh per quarter, 3d. per kWh, all over 3 000, 2d., heating, 2½d.

Heating at Three-Farthings at Derby.

Derby, lighting, first 1 000 kWh p. qrtr, 4d. per kWh, next 1 000, 3¾d., beyond, 3½d.; heating and cooking, first 2 000 kWh per quarter, 1½d. per kWh, next 2 000, 1d., beyond, ¾d.; rateable value system, minimum account per quarter to be 7s. 6d., power, flat rate, 1½d.; water heating, by storage method, restricted service from 9 p.m. to 7 a.m., ½d., continuous service, ¾d. Combined scale for power continued at £5 per H.P., but charge for current reduced to 0.6d. kWh (0.7d.), 0.5d. per kWh for all in excess of 150 000 kWh per month; domestic lighting and heating combined, for Council houses, 1s. per week, to cover 30 kWh per quarter, 1d. per kWh beyond (in lieu of fixed payment of 1s. per week and 1d. per kWh all round). *Dewsbury*, lighting: first 500 kWh 4d. per kWh, next 500, 3¾d.; beyond, 3½d.; maximum demand, lighting, first hour per day, 6d. per kWh, beyond 2d., shop window lighting after closing hours, 2d., heating 1½d., cooking 1d., heating with cooking, 1d., street lighting, 2d.; power, maximum demand, first hour per day, 2¾d. per kWh, beyond, ½d., less 2½ per cent. for prompt payment; special charge for restricted hours: up to 5 000 kWh per quarter, 1d. per kWh, up to 12 500, 0.9d., up to 25 000, 0.8d., beyond, 0.7d. net; rateable value, lighting and heating, 15 per cent. of rateable value, plus ¾d. per kWh, minimum of 600 kWh per annum to be consumed, automatic meters, 5d.; ordinary meter rents reduced to 3s. per annum. *Dumfries*, shop window lighting after closing hours throughout year, 4d. per kWh, with minimum annual charge, 20s. *West Hartlepool*, domestic rate and business premises, from ¾d. (1d.) per kWh, plus a fixed charge; two-rate tariff, lower rate at present charged on power scale reduced to flat rate of 1d.; public lighting, 1½d. (1¾d.). *Taunton*, lighting, under 501 kWh per quarter, 4½d., under 1 001, 3½d., beyond, 2½d.; heating, winter quarters, 1d., summer quarters, ¾d.; power, under 4 001 kWh per quarter, 1½d., exceeding 4 000 per quarter, 1¼d., exceeding 32 000, per annum, 1d., pre-war charges. In the outside area consumers are charged 25 per cent. extra. *Bury* (*Lancs*), present scale for power retained for ordinary class of consumers, but for consumers who agree to take a supply for at least five years, and to guarantee a minimum annual payment of £200 the scale is 2d. per kWh for first 1 000 per quarter, 1½d. for next 1 500, 1d. for next 35 000, 0.8d. for next 125 000, and 0.6d. beyond, lighting for such consumers to be charged at the rate of 10 per cent. of power consumption at the consumer's average power rate, and remainder at 3d.; cookers, suitable for small families, and washing boilers hired at 2s. 6d. per quarter, free length of service increased from 12 to 20 yds. *Glossop* (Urban Electric Supply Co., Ltd.), lighting, 8d., subject to minimum charge; power, 4d. per kWh for first 3 000 per quarter, 2½d. for next 15 000 and 2d. beyond. *Hendon Electric Supply Co., Ltd.*, lighting, 3½d. (3¾d.); domestic purposes (other than lighting) and heating and power installations up to 2 kVA, first 120 kWh per quarter, 2½d. per kWh (2¾d.), all in excess ¾d. (⅞d.); industrial purposes (other than lighting) and exceeding 2 kVA but not exceeding 150 kVA installed or 75 kVA maximum demand, 1¼d. (1⅜d.), or, alternatively, fixed charge of 10s. per quarter per B.H.P. installed, plus ¾d. (⅞d.) per kWh; domestic tariff (dwelling houses only), quarterly fixed charge, plus ¾d. (⅞d.); business tariff, lighting, a quarterly charge of 1s. for each 15 W of maximum demand in quarters ending March 31 and December 31, and of 1s. for each 40 W of maximum demand in quarters ending June 30 and September 30, and, in addition, 1½d. (1¾d.) per kWh, rentals for demand indicators range from 1s. 6d. per quarter up to 15 A capacity, to 3s. up to 50 A.

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ELECTRICITY SUPPLY.

Arbroath and Dereham Supplies Commenced—Cables and Switchgear for West Ham—Loan for New Equipment at Birkenhead—Llandrindod Wells Plant Extension—Victoria Embankment Lighting Proposals.

BIRTLEY P.C. has decided to apply for a loan of £2 600 for public electric lighting.

Electricity supply at Forfar was inaugurated last week, current being taken from the Arbroath power station.

Dereham urban district has now a supply of electricity, obtained from Norwich Corporation. The U.D.C. has undertaken the distribution.

Greenock Dean of Guild Court has granted permission to the Central Electricity Board to erect four towers in the upper part of the town for carrying the 132 000 V lines.

Leeds Electricity Committee recommends that consumers taking 100 000 kWh or over per annum for lighting be offered an alternative tariff of £10 per kW of maximum demand, plus ½d. per kWh.

Sheffield Electricity Committee has agreed to take back its recommendation that the 10% charged on rateable value to domestic users of electricity be charged on the basis of the new assessments.

Bolton Electricity Committee has obtained sanction to supply electricity to premises at Walker Fold, in the area of supply of the Horwich U.D.C., and also consent to the erection of the requisite overhead line.

Kensington (London) B.C. has granted permission to the Brompton and Kensington Electricity Supply Co. to open up certain carriageways and footways for the purpose of laying electricity cables. The company proposes to lay a sufficient number of ducts to provide for the requirements of the district for many years to come.

A Ministry of Transport inquiry was held recently by Mr. A. D. Erskine, respecting the application of the Leicestershire and Warwickshire Electric Power Co., to erect 13 poles at Melbourne (Derbyshire). Derbyshire County Council opposed the application, on the ground that, for the safety of the public, it was undesirable to erect additional poles on the highways.

Mr. J. H. Bowden, borough electrical engineer, having reported to Poplar (London) Electricity Committee that the long and continued delay in connection with the erection of the new sub-station in the central district is severely taxing the converting plant at the main station, the Committee has decided to proceed with the purchase of the necessary land.

The Electricity Commissioners have appointed Col. T. C. Ekin to hold an inquiry at Guildford on January 15th into the applications for the following special orders:—Aldershot District Electricity (Extension) No. 1, No. 2, and No. 3, Petersfield Electricity (Extension), West Sussex Electricity, Steyning Electricity (Extension), and Alton Electricity (Extension).

West Ham Electricity Committee is to seek sanction from the Electricity Commissioners to the borrowing of £69 300 for the provision of h.t. feeder cables and switchgear to comply with the terms of the agreement with London County Council for the provision of a h.t. feeding cable to its pumping station, and to meet the steadily increasing demand in the northern part of the borough.

The Electricity Commissioners state that they are unwilling to confer upon Warrington Corporation competitive powers of supply in the area of another authorised undertaker (the Mersey Power Co.), and they see no reason to alter their decision to exclude from the area of supply under the Corporation's proposed extension Order the five parishes in the rural district of Runcorn.

Brampton R.D.C. has received from Carlisle Corporation a letter with regard to the proposed extension of the electricity supply to the area, and asking whether the Rural Council is desirous of taking a bulk supply and to act as distributor or whether it would be willing for the Corporation or a private company to carry out the distribution. A deputation is to discuss the matter with the City Electricity Committee.

The question of an electricity supply for the district was again considered by Milton Regis U.D.C. on December 4th, when the Clerk reported that at a joint meeting of representatives of Sittingbourne Urban and Milton Rural Councils, and of E. Lloyd, Ltd., who have offered a supply of electricity, has taken place. The Commissioners are to be asked whether they would be likely to grant a Special Order to the Councils.

Birkenhead Electricity Committee has obtained sanction to borrow £3 582 for mains and £11 200 for other equipment, including £666 for transformers and £2 730 for switchgear.—The Committee has obtained consent to the placing of overhead lines in the parishes of Prenton, Landican, Thingwall, Irby, Thurstaston and Heswall, for the transmission of energy at 11 000 V for the purposes of the area covered by the Wirral and Neston Electricity Special Order, 1925.

Aberdeen Electricity Committee has decided to recommend the Council to oppose the Grampian Electricity Supply Co.'s application for a Provisional Order, on the ground of safeguarding the interests of its own undertaking. The powers sought include the supply of parts of Aberdeenshire, Banffshire and Kincardineshire. The Aberdeen undertaking supplies an area extending as far west as Culter, eight miles from Aberdeen.

The new extension to the electricity works owned by Llandrindod Wells U.D.C. was formally opened on December 12th, by Mrs. C. C. Hughes, wife of Mr. C. C. Hughes, J.P., chairman of the Council. Mr. Hughes mentioned that since the Council took over the electricity works, just over five years ago, the price of current for lighting had been reduced from 1s. 2d. to 8d., power from 10d. to 5d., heating and cooking from 10d. to 2d., while their consumption had increased by 45%.

London County Council Highways Committee proposes to accept an offer by the Charing Cross Electricity Supply Co., Ltd., to install and supply current to electric lanterns suspended over the centre of the road on the Victoria Embankment, to supersede the present lamps on the kerb of the footway. The lanterns will be 140 ft. apart, and each will contain two 1 500 W gasfilled lamps. The initial cost of this work and of equipment for lighting lamps on three standards in the Northumberland Avenue approach and the Embankment refuge and parapet lamps is estimated at £14 184.

Southwark (London) Electricity Committee reports that in 1926 it decided to extend its generating plant at the power station to cope with the future demands. The Electricity Commissioners declined to sanction the extension, and decided that a partial bulk supply should be obtained from one of the electric light companies. The Committee is of opinion that a financial expert should be engaged to advise the Council upon the cost of taking a partial bulk supply and the possibility of meeting such cost by an increased demand. The Committee recommends the engagement of an expert at a fee of £400.

Stoke-on-Trent Electricity Committee is to extend mains at a cost of £1 500 to supply premises which are being erected by the Burslem and District Co-operative Society, the premises of the Silverdale Co-operative Society, etc., in Oxford Road, Basford, and 70 or 80 houses which are being erected by Messrs. Phillips and Co., at Sneyd Green.—The Electricity Department has received a letter from Messrs. Alfred Meakin (Tunstall), Ltd., stating that the company has in contemplation the erection of an electrical kiln for the purposes of firing enamel goods at its Newfield factory. Subject to the firm entering into the usual agreement, the three-phase e.h.t. main is to be extended to the pottery, and application will be made for sanction to borrow £2 400 to defray the cost.

Brighton Electricity Committee has received from Mr. W. H. Overton, a detailed estimate of the cost of the alterations to be carried out at the North Road electricity works, and it has been decided to apply to the Electricity Commissioners for sanction to borrow £35 577, made up as follows: building work, £19 989; constructional work, £5 055 10s.; heating, £3 000; electric light and power, £1 500; clerk of works' salary, £832; fire protection, hydrants, etc., £500; contingencies, £3 000, and architect's fees and expenses, £1 700.—The Electricity Committee has authorised mains extensions at a cost of £1 870.—The Central Electricity Board has inquired whether the Corporation would be willing that the terms already agreed for the supply of current to the Board to enable them to supply the Worthing Corporation should extend to a proposed supply to the Haywards Heath and District Electric Supply Co. The Electricity Committee is of opinion that the circumstances in the case of the proposed supply to Haywards Heath are not such as to justify

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ELECTRICAL NEWS OF THE WEEK IN PICTURES.

In order to overcome the necessity of climbing to the starting point of the toboggan run at Oberhof, Germany, an electric "lift" to convey both craft and passengers has been installed.

This photograph of an early type of electric vehicle has been sent to us by a reader, and shows a vehicle brought back from retirement for service during the war-time petrol shortage. We understand that it was used almost every day during the greater part of the war, in spite of its age without breakdown.

Two views of the new showrooms of the Welsbach Light Co., Ltd., referred to on page 41. The first shows the entrance hall, where are displayed wood fittings and pedestal and other heaters, while the second picture shows a general view looking towards the entrance, and includes on the left a portion of one of the sections devoted to classified fittings. As will be seen, the pillars down the aisle are arranged for the display of glassware, while dining-room pendants, bowls, etc., are also shown in the aisle.

the specially reduced rate of charge made to the Board in respect of the supply to Worthing, but further consideration will be given to the question upon receipt of the reasons why the Board suggest that the charge is appropriate.

The Dawlish Electric Light Co. has secured an Order authorising it to supply electricity in Kenton and Starcross, Dawlish West, Ashcombe and Mamhead. At the recent inquiry, the application by Devon County Council for the insertion of a clause providing that in the case of any road widening the company should be responsible for removing and re-erecting the electric poles or standards, was rejected.

Settle R.D.C. has approved a draft Special Order for a supply of current in the Council's district (except Ingleton and Thornton-in-Lonsdale), to be provided by Crompton Parkinson, Ltd. The maximum charges are to be for the quarters ending March 31st and December 31st, 12s. 6d. up to 15 kWh and 10d. per kWh for all in excess, and for the quarters ending June 30th and September 30th, 8s. 4d. up to 10 kWh and 10d. per kWh for all further consumption.

Hull Electricity Department has received an inquiry whether there is any possibility of Hull undertaking to supply electricity to Hornsea within the next two years. Hornsea is not included in the proposed added area. The Electricity Committee has promised to discuss the matter if and when approached by the Hornsea Council.—The Committee has asked the Engineer to report on the question of the lighting by electricity of courts, passages and other places not lighted at present by gas.

Owing to the very limited use of electric cooking and heating apparatus by the majority of the hirers at Dover, the Borough Electrical Engineer recommends that the rates charged for hire be increased by 50%, and he considers that a system of hire-purchase would be a better proposition than the present hiring system, as the apparatus would then receive more careful attention from the users. The supply of apparatus on hire for the lighting of shop windows after closing hours is proving a success.

Applications have been made by Messrs. Thomas Wilkinson, Ltd., of Arnside, for the inclusion of the parishes of Warton and Silverdale in the proposed electricity scheme for Westmorland, which has been approved by Carnforth U.D.C. The company intends to utilise the waste gases at Carnforth Ironworks for the generation of electricity, and, when the works are closed, to take supply from the Government's grid. The proposed prices are 1¼d. per kWh for power and 8d. for lighting. The station would be of 12 000 kW.

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COMPANY NEWS.

Appreciation of Electrical Manufacturers' Shares—County of London Co's Shares also Improve—Extension of Perak River Hydro-Electric Power Co's Plant—Wireless Pictures (1928) Statutory Meeting—New Companies Registered.

ELECTRICAL manufacturing shares have been active this week, and most of the favourites have risen in price, under the lead of General Electrics. These, as the result of American buying, right at the end of last week, jumped to 62s. 6d., from which they have since relapsed to 55s., leaving the quotation 11s. 3d. higher on the week. British Insulateds and Callender's are respectively 5s. and 4s. higher, Siemens' 2s. 6d., and Henley's 1s. 3d. Ever Readys have shown especial strength, and at 33s. 6d. are 5s. up. In the supply section, County of London shares are 5s. 6d. higher at £2 10s.

Last Annl. Divd.	Description.	This Week.	Last Week.	1912 to 1927. Highest.	Lowest.
%	**Electricity Supply.**				
(d)	Brompton & Kensington Ord. ..	27/-	27/-	45/-	23/9
4	Central Elec. Sup. 4% Deb. ..	93	93	100	67
(a)	Charing Cross Elec. Ord. (£1) ..	26/6	26/6	60/-	10/-
4½	" " " 4½% C.P. (£1)	17/6	17/6	19/6	10/-
(e)	Chelsea Elec. Sup. Ord.	27/-	27/-	39/6	10/-
10	City of Lond. Elec. L'ting Ord. ..	31/10½	30/7½	52/10½	20/3
6	" " " " 6% C.P.	23/-*	23/-	40/-	15/6
7½	County Lon. Elec. Sup. Ord. ..	50/-	44/6	68/6	14/6
6	" " " " 6% C.P. ..	23/-	23/-	24/9	15/3
(g)	Kensington & K'bridge Ord. (£1) ..	26/6	26/6	104/6	3/-
(b)	Lon. Elec. Sup. Ord. (£1)	26/-	26/-	38/3	5/-
9	Metro. Elec. Sup. Ord.	47/6	46/3	43/-	8/-
4½	" " " 4½% C.P.	17/6*	17/6	18/6	9/6
7½	N'castle & Dis. Elec. Ltg. Ord. ..	30/-	30/-	22/6	7/9
6	N'castle-upon-Tyne Elec. Sup. Ord.	26/3	26/3	26/-	11/6
6	N. Metro. Elec. 6% C.P.	23/-	23/-	23/9	10/1½
6	Notting Hill 6% C.P. (£10) ..	10½*	10½	10½	6/13/9
(c)	St. James & P.M. Ord. (£1) ..	27/6	27/6	62/-	22/-
1/4½	Shrops. Worcs. & Staffs. Power B.Or.	34/4½	34/4½	23/-	20/9
(f)	W'minster Elec. Sup. Ord. (£1) ..	27/-	27/-	52/-	18/-
4½	" " " 4½% C.P. (£1)	17/6*	17/6	21/6	13/-
8	Yorks. Elec. Power Ord.	35/-	35/-	32/9	12/6
6	" " " 6% C.P. ..	24/-	24/-	25/-	14/3
	Railways and Tramways.				
8	Brit. Elec. Trac. Pfd. Ord. Stk. ..	124	124	152½	24
6	" " " 6% Pf. Stk. ..	127½	127½	129½	53
4	Cent. Lon. Ry. Ord. Stk. (asstd.) ..	72½	72½	89½	40½
4	" " " 4% Deb.	82	82	103	56½
4	City & S. Lon. 4% Perp. Deb. ..	79½	79½	102½	50
4	Lon. Elec. Rly. Cons. Ord. Stk. ..	75½	75½	73½	10
4	" " " " 4% Pf. Stk.	73½	73½	84/2/6	43
4	" " " " 4% Deb. ..	81*	80	98½	52
5	Lon. & Sub. Trac. A. Deb. ..	97½	97½	89	65
4	Lon. Un. Trams, 1st Deb.	61*	61	82	30
4½	Met. Elec. Trams, 4½% Deb. ..	70*	70	101½	49
5	" " " 5% Deb... ..	67½	67½	102/17/6	53
3	Met. Rly. Cons. Ord. Stk.	67½	65	84½	19
3½	" " " 3½% Pf. Stk. ..	65	65	88½	40½
3½	" " 3½% Deb. ..	73	73	92½	51
4	Met. Dis. Rly. Ord. Stk.	80½	80½	66½	12½
4½	" " " 4½% 1st Pref. ..	82½	81½	91	45
6	" " " 6% Perp. Deb. ..	115½	115½	146/12/6	80
4	S. Met. Elec. Trams, 4% Deb. ..	77*	77	73½	48½
5	Underground Electric Rlys. Ord.	27/-	27/-	5/3	2/1½
—	Yorks. (W.R.) Trams, Ord. ..	5/-	5/-	27/-	1/-
4½	" " " 1st Deb. ..	59*	59	87	52
	Electrical Manufacturing.				
7	Brit. Elec. Transformer 7% C.P. ..	15/-	15/-	22/1½	11/6
15	Brit. Insulated Cables Ord. ..	87/6	82/6	80/3	26/6
6	" " " 6% C.P. ..	22/6	22/6	25/6	14/6
7	British Thomson-Houston Pref. ..	22/9	23/-	24/6	19/7
7	" " " 7% Deb.	104½	104½	109½	92/-
10	Brush Electrical Ord.	28/9	28/9	29/9	10/-
15	Callender's Cable Ord.	85/3	81/3	86/-	22/-
6½	" " 6½% C.P.	23/9*	23/9	26/7	3/-
7½	" " 7½% B. Pref. ..	27/6*	27/6	27/6	16/6
8	Crompton-Parkinson 8% Cum. Pf.	25/-	25/-	25/-	9/10
6	" " 6% Cum. 2nd Pf.	18/3	18/3	18/-	8/-
10	Edison Swan Elec. Ord. (4/-) ..	12/6	12/6	28/9½	1/11
7½	" " " 1st Pref. ..	25/7½	25/7½	20/-	5/-
7½	Elec. Construction Ord.	26/10½	26/10½	25/9	6/7
7	" 7% C.P. ..	22/6	22/6	25/3½	16/-
—	English Elec. Ord.	7/6	7/6	29/3	7/3
6	" 6% C.P. ..	10/-	10/-	22/1½	10/6
7	Ericsson Telephones 7% Pref. ..	19/-	19/-	22/9½	12/7
35	Ever Ready (Gt. Britain) Ord. ..	33/6	28/3	93/9	18/6
6	Ferranti 6% Pref.	19/-	19/-	19/4½	16/9
7	" 7% 2nd Pref.	19/-	19/-	19/3	13/9
10	General Elec. Ord.	55/-	43/9	59/-	13/6
£25	W. T. Henley's Ord.	116/3	115/-	108/9	23/3
12½	Johnson & Phillips Ord.	36/3	36/3	67/11	14/6
7½	Lon. Elec. Wire & Smith's Pref. ..	23/9	23/9	27/6	17/6
6	Metropolitan-Vickers Ord... ..	30/-	30/-	37/-	13/1
8	" " 8% C.P. (£2)	55/-	55/-	67/10	5/-
7½	Siemens Bros. & Co. Ord.	28/9	26/3	36/6	12/3
10	Telegraph Const. Ord. (£12) ..	25	25	56/2/6	19
	Telegraph.				
3½	Anglo-Am. Tele. Ord. Stk... ..	62½	62½	68½	40
10	Eastern Ord. Stk.	270½	267½	213½	113/2/6
3½	" 3½% Pref. Stk.	67½	67½	84/17/6	49
4	" 4% Deb.	79½	79½	103½	60
10	Eastern Extension Ord. (£10) ..	27	26½	21½	10/12/6
22	Gt. Northern Telegraph (£10) ..	32	34½	42/12/6	19
10	Indo-European (£25)	47½	47½	47½	25
20	Marconi's Wireless T. Ord. ..	78/9	78/9	9/16/3	20/9
12½	" Int. Mar.	72/6	71/3	5/11/3	14/11
10	Western Tel. Ord. (£1)	26½	26½	23	11/3/6

(a) 1s. 7 5/8d. per share. (b) £8 8s. 6·66d. per cent. (c) 1s. 6·949d. per share.
(d) 1s. 8·706d. per share. (e) 1s. 9·3d. (f) 1s. 0.912d. (g) 1s. 7·223d.
‡ Including 1s. bonus. *Ex dividend.

LISBON ELECTRIC TRAMWAYS, LTD.—Intm. div. 3% net on ord. shs (same rate as last year).

METROPOLITAN RAILWAY CO.—Traffic receipts for 1928 were £1 854 000, an increase of £59 000.

SHAWINIGAN WATER AND POWER CO.—Div. of $1½ p. sh. on common shs. for qrtr. ended Dec. 31, 1928, payable Jan. 10.

VICTORIA FALLS and TRANSVAAL POWER CO., LTD.—Net earngs. for qrtr. ended Sept. 30, 1928, £298 169, before providg. for taxation.

ANGLO-ARGENTINE TRAMWAYS CO., LTD.—Divs. of 2s. 9d. p. sh. on 5½% cum. 1st pref. and 3s. p. sh. on 6% cum. 2nd pref. for half-year are announced.

MONTEVIDEO TELEPHONE CO., LTD.—Net pft. for year ended July 31, 1928, £35 809. To res. £20 000 Fin. div. 5%, tax free, makg. 8% for year. Fwd. £3 655.

B.B. PICTURES (1928), LTD.—After paying intm. div. at rate of 2½% p.a., less tax, and transferrg. £1 000 to gen. res., carry fwd. is £1 387, subject to directors' fees.

OHIO EDISON CO.—Regular quarterly divs. h. bn. declared on 6%, 6·6%, 7%, and 5% qrtrly, pfd. stk. and regular monthly divs. on 6% and 6·6% monthly pfd. stk.

S. SMITH AND SONS (MOTOR ACCESSORIES), LTD.—At an extraordinary meeting last week a resolution to subdivide unissued £1 ord. shs. into 1s. dfd. shs. was confirmed.

NORTH METROPOLITAN ELECTRIC POWER SUPPLY CO.—It is proposed to issue 250 000 new £1 ord. shs., part of the additional cap. authoris. by Companies' (Consolidatn.) Act, 1928.

COUNTY OF DURHAM ELECTRIC POWER SUPPLY CO.—Rev. for 1927, £329 793, blce. to net rev. acct. £29 690; div. payable amtd. to £27 546; fwd. £2 589, includg. amt. brt. in from previous acct.

WEST GLOUCESTERSHIRE POWER CO.—This company has acquired the ownership of the Chepstow Electric Lighting and Power Co.'s undertaking by the purchase of over 98 per cent. of its shares.

CONSOLIDATED SIGNAL CO., LTD.—Div. for year to Sept. 30, 1928, 17½%, less tax at 3s. 9½d, in £1, agst, 12½%. Co. owns 391 112 ord. shs. of Westinghouse Brake and Saxby Signal Co., Ltd.

MONTREAL TRAMWAYS CO.—Directors recently authorised issue of 10 000 shs. of $100 par value at $150 p. sh., of which $75 p. sh. must be paid by Jan. 21 to Aldred and Co., 24-28, Lombard Street, London, E.C.

FOUNDATION CO., LTD.—Pft. for year ended June 30, 1928, after provisn. for depreciatn., £21 281, agst. £21 056. Taxatn. required £6 000, and £5 000 has been placed to housing res. Div. on pref. 8% less tax. Fwd. £18 112, agst. £17 431.

AMALGAMATED WIRELESS (AUSTRALASIA), LTD.—Div. of 6% for year ended June 30, 1928 (first div. since 1922), is announced. Pendg. result of wireless cable negotiations, board thinks it desirable to postpone further the ord. gen. mtg.

CLEVELAND AND DURHAM COUNTY ELECTRIC POWER CO.—Rev. receipts in respect of the separate undertakgs. for year to Dec. 31, 1927, £399 732. Workg. costs £380 089; blce. to net rev. acct. £19 643. Int. on deb. stk. and on loans, etc., absorbed £19 644.

EVER READY CO. AND LISSEN, LTD.—Negotiations have taken place in regard to a suggested amalgamation of the Ever Ready Co. (Great Britain), Ltd., and Lissen, Ltd., radio engineers, but we are informed that no definite decision on the matter has yet been reached.

LANARKSHIRE TRAMWAYS CO.—A special general meeting will be held on Jan. 14th, to submit to shareholders draft Provisional Order to change name of co., to make provision as to abandonment of co's tramways, to enlarge powers with regard to running of omnibuses, etc.

UNITED RIVER PLATE TELEPHONE CO., LTD.—It is announced that the holders of over 1 150 000 ord. shs., representg. more than 90% of the voting power, have accepted the offer of Morgan, Grenfell and Co. for the purchase of their shares. The time has bn. extended until Jan. 24 for other holdrs. of ord. shs. to accept the offer.

SOCIETA ITALIANA RADIO MARITTIMA.—Debs. to the amount of 12 061 500 lire are to be issued, and the proceeds used to complete paymt. for apparatus purchased from the Marconi International Marine Communication Co. and the Cie Generale Télégraphie Sans Fils and installed on Italian ships, and to

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ensure regular development of services conceded to the Italian Co.

ASSOCIATED GAS AND ELECTRIC CO.—Regular div. on class A stk. will be payable on Feb. 1 in class A stk. at rate of 2½% of one sh. (or 10% p.a.) for each sh. held, and an extra div. on class A stk. of 40 cents. p. sh. is also announced. Regular div. in stk. will be paid to all stkhldrs. who do not request payment in cash.

BRAZILIAN TRACTION, LIGHT AND POWER CO., LTD.—Co. has offered to buy, at £2 17s. 6d. p. sh. the ord. shs. of the City of Santos Improvements Co., conditionally upon acceptance of the offer by hldrs. of 75% of the ord. sh. cap. by Jan. 15. The purchase price will be payable through Greenwood and Co., 28, Austin Friars, London, E.C.2.

CALCUTTA ELECTRIC SUPPLY CORPORATION, LTD.—Rev. in 1927, £930 291, agst. £779 790 in 1926; houses connected 24 985, agst. 22 200; electricity sold 129 090 227 kWh, agst. 108 895 477. Div. on ord. shs. 12%, plus cash bonus 4d. p. sh., agst. 12%, plus sh. bonus. Sales in 9 months to Sept. 1928, 109 560 177 kWh, increase 12 849 569.

BRITISH COLUMBIA ELECTRIC RAILWAY CO., LTD.—Earngs., including int. and divs. from allied and subsidiary cos., for year to June 30, 1928, £642 051, agst. £611 483, after mtg. depreciatn., sinkg. funds, and renewals. Int. on debs. and deb. stk. £462 747, agst. £431 775. After provisn. for pref. div., directors propose fin. paymt. of 1% on pfd. ord., making 6%, less tax at 2s. 0½d. in £, agst. £6 4s. %, tax free, for 1926-7. Fin. div. is proposed of 3% on dfd. ord., making 8%, less tax, agst. 8% tax free. To res. nil, agst. £130 000. Fwd. £182 228, agst. £70 639.

COMPANIES TO BE STRUCK OFF THE REGISTER.—The following companies will be struck off the register of joint stock companies unless cause to the contrary is shown before March 7: Auto Electrics; Cambrian Electricity Supply Corporation; Elco Electric Manufacturing Co.; Electrical Coils; Electrical Insulating Composition Co.; Electricity, Gas, Share, Debenture, Investment and Guarantee Trust; Halstead Electric Supply Co.; Headphones (Manchester); Lighting and Power Finance Corporation; Magnetic Car Co.; Magneto Accumulator and Generator Services; Radiant Heating; Radio and Electrical Supplies (Bolton); Radio Appliances; Radio Engineering Co.; Roddis Electric; Shaftesbury Wireless and Engineering Co.; Victor Radio; Whitfield Electrical Co.; Willesden Electric. The following will be struck off the register unless cause to the contrary is shown before March 11th: Automobile Electrical Repairers; Bucks Electric Wire and Engineering Co.; Domestic and General Electrical Co.; Perfecta Electric; Sunbeam Lamp Co.; Wireless Experts.

Company Meetings.

BOGOTA TELEPHONE CO., LTD.—Mr. Harry Kahn, presiding at the recent meeting, said there was a cash balance of £72 144, after about £83 000 had been expended in connection with the new extensions, and there were reserves appearing as a depreciation account of £40 700 and a share premium account of £25 400. Profit and loss account was scarcely as satisfactory, for although subscriptions rentals, etc., at £44 535 were £1 043 higher than last year, maintenance and general expenses, at £25 167, showed an increase of £3 443, the working profit being, therefore, £2 400 to the bad, due to the cost of the strike and higher wages. They must hope that the municipality would see the justice of their appeal for higher rates. An interim dividend of 5%, less tax, was paid on April 5th, 1928, and a final dividend of 5%, less tax, was now recommended. The report and accounts were adopted.

PERAK RIVER HYDRO-ELECTRIC POWER CO., LTD.—Viscount Elibank, presiding at the annual general meeting, said a further £50 000 had been received from the Federated Malay States Government in respect of the 500 000 8% preference shares, making them 14s. paid at July 31st, 1928, and since that date the final 6s. per share had been paid. During the year, power demands in the concession area warranted a further extension of the steam station by the addition of a third unit of 6 000 kW, making the total capacity of the station 18 000 kW. On June 19th, the 7% participating debenture stockholders approved the board's proposal to increase the 7% participating debenture stock by £250 000. Applications for power accepted to date represented a demand of about 13 000 kW, or 80 million kWh per annum. Inquiries under negotiation, if they all became contracts, would more than double that output. The station was put into definite commerical operation on December 12th. The hydro-electric station should be able to link in with the steam station by March or April, 1930. During his visit to Malaya, from November to March last, he negotiated the formation of a small local company, the Kinta Electrical Distribution Co., Ltd., with an issued capital of $350 000 (about £41 000), which would retail to certain towns and villages power purchased in bulk from their company. In addition, he negotiated a satisfactory contract with the Federated Malay States Government for the supply of power in bulk to Ipoh, the largest town in the State of Perak. Under this contract the Government would purchase 75 000 of the unissued £1 ordinary shares at par. The report and accounts were adopted.

FOUNDATION CO., LTD.—Mr. J. G. B. Stone, presiding at the general meeting, said the net profit for the year to June 30th, 1928, was £21 281, compared with £21 055 for the previous year, and the balance brought forward from 1927, £17 431, made a total balance available of £38 712, about £1 000 more than last year. After provision for taxation, housing reserve, and dividend on preference shares at the rate of 8 per cent. per annum, the balance carried forward was £18 112, compared with £17 430. An interim dividend for the six months ended December, 1927, was paid on July 1st, 1928, and the final dividend paid on January 1st, 1929. They had expanded considerably in connection with the erection of overhead lines for power transmission under the Government grid scheme, and they had also entered the building trade, as instanced by the new office building at St. James's Park Station for the Underground Railway Co., which was now nearing completion. While they had retained and probably improved their position as contractors for the erection of super-electrical power stations, the delays inevitable from Government control had made the year disappointing, and in respect of general heavy engineering work competition had increased because of the unexpected reduction in demand; but they had specialised in comprehensive works, where mechanical and electrical engineering could be combined with civil engineering, not only in respect of electric generating plant, but also in general factory construction, and to-day they believed they had an organisation almost unique in this respect, which they hoped to utilise to advantage when industrial development became more general. The report and accounts were adopted.

WIRELESS PICTURES (1928), LTD.—Presiding at the recent statutory meeting, Lieut.-Col. Adrian F. H. S. Simpson said there appeared to be some confusion in the public mind as to the difference between the company's activities and what was commonly known as television. Television dealt with transmission and reception of moving pictures, whilst the Fultograph dealt with what they termed still pictures. In the case of television no permanent record was obtained of the transmitted picture. With the Fultograph a visible record was obtained. Captain Fulton had evolved a system of transmission and a receiver which for the first time brought picture reception within the reach of the general public. He had produced a receiver which was being sold for £22, whilst the transmitting apparatus, similar to that employed by the B.B.C. to-day, could be sold for approximately £250. He (the chairman) believed it to be only a question of time and price before its application became general for the reception of broadcast news and for educational and amusement purposes in the home. Experiments were being conducted to apply its principle to the land line, so that illustrations and current pictorial news could be supplied at minimum cost to members of the Provincial Press. The managing director (Mr. W. H. Lynas) said on the formation of the company the only instruments in existence were those manufactured by Fultograph companies in Europe. The companies in Berlin and in Paris, who were actually manufacturing the Fultograph for the Continent, agreed to increase their production considerably, to allow for deliveries to the English market of machines incorporating the necessary modifications. These deliveries were beginning to materialise, and about 250 machines had already been received and distributed in this country. It was not intended to continue importing from abroad any longer than could be helped, but it was thought desirable to make an effort to begin supplying without delay the immediate demand for the picture receiver in this country. Several British manufacturers had already been approached, and many others had asked to be allowed to quote. Within, probably, a few days definite contracts would be placed for manufacture of Fultograph in Great Britain. Negotiations were well under way with regard to the sale of the company's apparatus in Australia and India, or, alternatively, the disposal of their rights, which ever seemed the most profitable way. In Canada and South Africa the directors were also in touch with firms interested in acquiring the rights of handling the apparatus.

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NEW COMPANIES.

W. AND F. WILLS (LONDON), LTD.—Cap., £2 000. Electrical and consulting engineers, etc. Reg. office: 30, College Street, Dowgate Hill, London, E.C.4.

PYE (RADIO), LTD.—Cap., £100. Manufacturers of and dealers in wireless sets and apparatus, electrical appliances, etc. Solicitors: Bartlett and Gluckstein, 199, Piccadilly, London, W.1.

DARLINGTON DRY BATTERY CO., LTD.—Cap., £500. To acquire business of dry battery manufacturers carried on by J. Thompson and W. V. Taylor, at Valley Street, Darlington, Durham.

F. O. COWARD, LTD.—Cap., £1 500. To acquire business of electrical engineer and battery service station proprietor now carried on by F. O. Coward at 21, Lower Castle Street, Bristol.

D. EDWARDS AND SON, LTD.—Cap., £2 500. To acquire business of dealer in electrical instruments, etc., carried on by D. Edwards at Abertillery, Mon, and elsewhere, as "D. Edwards and Son."

KING'S INVENTIONS (ELECTRIC), LTD.—Cap., £7 500. To adopt agreement with W. C. King and to carry on business of electrical and general engineer carried on by him at Liverpool. Solicitor: A. M. Hannay, 41, Castle Street, Liverpool.

POLPERRO ELECTRIC AND COLD STORAGE SYNDICATE, LTD.—Cap., £200. To carry on the business of electric light supply at Polperro and elsewhere. Solicitors: Spring and Co., 12–13, Henrietta Street, Covent Garden, London, W.C.

"NEW ERA" TIME AND TELEPHONE SYSTEMS, LTD.—Cap., £100. To carry on business of financing and installing synchronised time, signalling and automatic or other telephone systems, etc. Secretary: H. R. Hayes, 7, Pall Mall, Manchester.

MARWEB CO., LTD.—To adopt agreement with H. C. Gamble, to carry on the business of electric sign manufacturers, publicity contractors and agents formerly carried on by him as "Marweb Co.," at 36, Causeway Lane, Leicester, and to acquire trade mark "Marweb" and device.

BRECKNELL, MUNRO AND ROGERS (1928), LTD.—Cap., £75 000. To acquire certain property and assets of Thrissel Engineering Co., Ltd., lately known as Brecknell, Munro and Rogers, Ltd., to carry on the business of electrical engineers, electricians, etc. Solicitors: Trower, Still and Keeling, 5, New Square, Lincolns Inn, London, W.C.

WRIGHT (ELECTRIC POWER SPECIALITIES), LTD.—Cap. £6 000. To acquire business of electrical engineers and manufacturers of electrical appliances carried on at Halifax and elsewhere as Wrights Motors, Ltd., and to carry on same and business of cable makers, etc. Solicitors: Hirst, Whitley and Akeroyd, 5, Harrison Road, Halifax.

AEONIC RADIO, LTD.—Cap., £225 000. To acquire the whole or any part of undertakings and assets of J. L. Gottlieb and Co., Ltd., and Aeonic Wireless, Ltd., to carry on business of manufacturers, maintainers and repairers of, and dealers in, wireless, telegraphic and telephonic apparatus, electricians, etc. Solicitors: Jenkins, Baker and Co., 3, London Wall Buildings, London, E.C.2. (Public company.)

GALA RECORDS, LTD.—Cap., £100. **Manufacturers of and dealers in apparatus, machines, instruments or materials for recording, transmitting or reproducing speech or other sounds, or for the transmission or reception of telephonic or telegraphic communications and messages, and the transmission by means of wireless apparatus of pictures, etc.** Solicitors: Herbert Oppenheimer, Nathan and Vandyk, 1, Finsbury Square, London, E.C.2.

GRIPSOK, LTD.—Cap., £2 000. To adopt an agreement with D. Robinson for the purchase of the trade mark "Gripsok" in respect of goods relating to electrical terminals of ordinary metal, and also for the purchase of certain patents granted to him for an invention relating to electrical terminals and any subsequent improvements in or upon their manufacture which may be effected by the said D. Robinson, to carry on the business of electrical engineers, etc. Solicitors: Andrews, Barrett and Wilkinson, 69, St. Thomas Street, Weymouth.

METAL AND CHEMICAL PRICES.

TUESDAY, January 8th.

	Price.	Inc.	Dec.
Copper—			
Best Selected .. .. .. per ton	£76 10 0	£0 15 0	—
Electro Wirebars .. .. „	£78 15 0	£1 5 0	—
H.C. Wires, basis .. .. per lb.	11d.	⅛d.	—
Sheet .. .. „	10 11/16d.	⅛d.	—
Phosphor Bronze—			
Wire (Telephone) basis .. per lb.	1s. 2d.	1/16d	—
Brass 60/40—			
Rod, basis .. .. .. per lb.	8¼d.	—	—
Sheet „ .. .. .. „	10⅜d.	¼d.	—
Wire „ .. .. .. „	10⅜d.	¼d.	—
Pig Iron—			
Cleveland Warrants .. .. per ton	£3 8 6	—	—
Galvanised Steel Wire, basis 8 S.W.G. .. .. .. „	£14 15 0	—	—
Lead Pig—			
English .. .. .. per ton	£23 10 0	5 0	—
Foreign or Colonial .. .. „	£22 2 6	2 6	—
Tin—			
Ingot .. .. .. per ton	£223 5 0	—	£2 15 0
Wire, basis .. .. .. per lb.	2 11	—	— ¼d.
Aluminium Ingots .. .. per ton	£95 0 0	—	—
Spelter .. .. .. „	£26 2 6	—	£0 15 0
Mercury .. .. .. per bottle	£22 8 6	—	—

Sulphur—Flowers, Ton £12 0 0 *Copper Sulphate*—Ton £25 to £25 10 0
„ Roll, „ £10 10 0 *Boric Acid* (Crystals) „ £30
Sulphuric Acid (Pyrites, 168°) Ton £6 15 0 *Sodium Chlorate*—Per lb. 2½d.
Sodium Bichromate—Per lb. 3½d.
Rubber—Para fine, 10½d.; plantation, 1st latex. 8 13/16 d.

∴ The metal prices are supplied by British Insulated Cables, Ltd.

ELECTRICAL TRADE MARKS.

RIALTON (SIGN).—493 621. Class 8. Wireless telephonic apparatus and parts thereof. H. and S. Scott, Ltd., Bradford House, 21A, Barbican, London, E.C.1; export merchants. July 26th, 1928.

CLARMAC.—494 666. Class 8. Fitted electrical switchboards. The Clarmac Engineering Co., Ltd., 108, Douglas Street, Glasgow; engineers. September 1st, 1928.

PENTOFORMER.—495 881. Class 8. Instruments and apparatus for use in wireless telephony and telegraphy. Igranic Electric Co., Ltd., 147, Queen Victoria Street, London, E.C.4; electrical engineers. October 12th, 1928.

ROTUNDA.—495 991. Class 50. Electrical insulating materials. Rotunda, Ltd., 260, Manchester Road, Denton, near Manchester; manufacturers of insulating materials. October 16th, 1928.

490 903. Class 50. Artificial flowers, combs (for the hair); steam and hydraulic packing, and electrical insulating substances of asbestos. Radium-Gummiwerke mit beschrankter Haftung (a company duly incorporated under the laws of Germany), Grafenmuhlenweg 109, Koln-Dellbruck, Germany; manufacturers. April 27th, 1928. (To be Associated. Sect. 24.)

BALLIT.—492 562. Class 50. Plastic composition for use as substitutes for wood for manufacturing shaped articles or for application to articles of furniture and other wooden articles for filling holes and cracks or for modifying the shape of such articles; and articles manufactured from such compositions, namely, picture frames; buttons; handles for razors, knives, forks, files, taps, doors, dishes, jugs, pots and kettles; brush backs; ornaments (not being jewellery); candlesticks; trays; door-plates; panels, mouldings, picture rails and the like for walls; piano insulators; bases, knobs, formers, bolders, frames, panels and boxes for philosophical, scientific and like instruments and apparatus; cases for watches and clocks; statuettes; busts; shoe-lasts and similar articles, and adhesives (for celluloid, for leather, for mending broken articles, for tipping billiard cues) and dressings for leather, for belting, for floorcloth and for india-rubber goods. I.G. Farbenindustrie Aktiengesellschaft (a joint stock company organised under the laws of Germany), Mainzerlandstrasse 28, Frankfort-on-Main, Germany; manufacturers. June 20th, 1928.

AUTOCYCLE.—493 696. Class 8. Instruments, apparatus and parts thereof for use in wireless telegraphy and wireless telephony; and talking machines, gramophones and sound reproducing appafatus and parts thereof and accessories therefor. Frank Cory Yeo, Shinfield Lodge, Shinfield, near Reading, Berkshire; colliery proprietor. July 30th, 1928.

AUDIOVISOR.—488 775. Class 8. Philosophical instruments, scientific instruments and apparatus for useful purpose, instruments and apparatus for teaching. Radiovisor, Ltd., 26, Church Street, Cambridge Circus, London, W.C.1; manufacturers. February 22nd, 1928. (To be Associated. Sect. 24.)

PHONESTRAD.—495 788. Class 8. Sound-reproducing apparatus and parts thereof. Stanley Brookham, Brook Mills, Westgate, Cleckheaton, Yorkshire; maker of sound-reproducing apparatus. October 10th, 1928.

THERMATRON.—490 021. Class 8. Apparatus and instruments for use in wireless telephony, wireless telegraphy and television and parts thereof. Albert Edward Wilberforce Finch, 22, Swinburne Avenue, Manor Park, London, E.12; importer. October 16th, 1928.

ELECSON.—496 046. Class 8. Apparatus and parts thereof for use in wireless telegraphy and telephony, talking machines, parts thereof and accessories therefor, and talking machine records and apparatus for the reproduction and amplification of sound. Société Anonyme Elecson (a joint stock company organised under the laws of France), 178, Faubourg Saint Honore, Paris, France; manufacturers. October 17th, 1928.

PHANTOM.—492 706. Class 8. Electrical sound-reproducing and sound-amplifying apparatus for use in connection with gramophones and with wireless telephonic receiving sets. Louis George Sylvester, 1645, Nqrth Washington Avenue, Scranton, Pennsylvania, United States of America; manufacturer. June 25th, 1928.

KODALITE.—496 041. Class 8. Philosophical instruments, scientific instruments and apparatus for useful purposes; instruments and apparatus for teaching. Kodak, Ltd., Kodak House, Kingsway, London, W.C.2; manufacturers and dealers. October 17th, 1928. (To be Associated. Sect. 24.)

PEP (Sign). 486 883. Class 8. Electric cells and batteries. **Etablissements** Veuve P. Delafon and Cie, 82, Boulevard Richard Lenoir, Paris, France, manufacturers.—December 16th, 1927. Registration of this trade mark shall give no right to the exclusive use of the word "Pep."

LASWOR. 495 156. Class 8. Electric batteries (not for medical purposes). Bernard Braunstein, 109, Guilford Street, London, W.2; exporter and importer.—September 19th, 1928.

AVVERLYTE. 495 225. Class 13. Electric lamps (ordinary). Harry Winter, 20, Hampstead Road, London, N.W.1; dealer in electric lamps.—September 21st, 1928.

Opposition to the registration of the following trade marks can be lodged up to January 12th.

KYMORE. 495 331. Class 5. Wire for electric transmission lines. The Kymore Syndicate, Ltd., Balfour House, Finsbury Pavement, London, E.C.2; manufacturers.—September 25th, 1928. (To be Associated. Sect. 24.)

LECITON. 491 235. Class 8. Cables for electrical purposes. The Liverpool Electric Cable Co., Ltd., Linacre Lane, Bootle, Liverpool; manufacturers.—May 8th, 1928. (To be Associated. Sect. 24.)

TRAFCAND. 494 608. Class 8. Apparatus for use in connection with wireless telephony. Alfred Thomas Smee, trading as the Junction Engineering Co., 146, Dukes Avenue, Muswell Hill, London, N.10; and 149A, Junction Road, London, N.19; manufacturer.—August 30th, 1928. (To be Associated. Sect. 24.)

Opposition to the registration of the following trade marks can be lodged up to January 19th.

ARLITA.—495 262. Class 8. Philosophical instruments, scientific instruments and apparatus for useful purposes. Naamlooze Vennootschap Philips' Gloeilampenfabrieken, 1A, Emmasingel, Noord-Brabant, Eindhoven, Holland; manufacturers. September 24th, 1928. (To be Associated, Sect. 24.)

PERMINVAR.—495 367. Class 8. Philosophical instruments, scientific instruments, and apparatus for useful purposes; instruments and apparatus for teaching. Electrical Research Products, Inc., 195, Broadway, New York City; merchants. September 26th, 1928. (To be Associated, Sect. 24.)

UTILUX.—495 806. Class 13. Chandeliers, lamp shade frames, lamp shade supports, lamp shades, lamp holders, lamp standards, reflectors, and electric light fittings. Louis Dernier and Hamlyn, Ltd., 23, Newman Street, Oxford Street, London, W.1; manufacturers. October 10th, 1928.

LEAD MARKET REPORT.

According to James Forster and Co., the lead market opened last week with strength, the prices advancing 10s. per ton, followed by a further 5s. on Wednesday, the next market day. At the opening on Thursday prices were again higher by 3s. 9d. per ton, April selling at £22 17s. 6d., but from this point the market receded, and at the close on January 4th had fallen 7s. 6d. per ton from the top.

The price in New York was put up on January 2nd to 6.65 cents. in sympathy with London.

Closing prices on January 4th were £22 1s. 3d. for January, £22 6s. 3d. for February, £22 8s. 9d. for March, and £22 10s. for April.

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COMMERCIAL INFORMATION.

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debt. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

BROWNING, T. E., 28, Pleydell Avenue, Stamford Brook, wireless factor. £19 15s. October 31st.

CROSS AND CO., 32, Church Street, Baldock, radio engineers. £10 19s. 10d. November 7th.

INSOLL, H. F., 57, Charlton Road, Keynsham, wireless dealer. £21 19s. 10d. November 6th.

PARKES, William Thomas, 102, Lichfield Street, Walsall, electrical engineer. £30 4s. 10d. November 14th.

WEBB AND ROGERS, 34, King Street, Queen Square, Bristol, electrical engineers. £24 15s. 10d. November 24th.

WESTON ELECTRICAL CONTRACTS CO., 17, George Street, W. £20 1s. 4d. November 6th.

WILLIAMSON, John, P., 6, Belgrave Road, Colwyn Bay, radio engineer. £10 3s. 6d. October 22nd.

Bills of Sale.

THOMAS, Ernest William and THOMAS, Ernest William Benjamin (trading as NORTH EASTERN ELECTRICAL WIRE AND CABLE CO.), 75a, South Street, Ponders End, electrical engineers. Dated December 18th, filed December 22nd. £75.

WOOD, William Frederick, 12, Esk Road, Norton-on-Tees, electrician. Dated December 18th, filed December 27th. £70.

Deed of Arrangement.

TAYLOR, Alfred Robert, trading as A. R. TAYLOR at Lydney, and at 118, John Street, Porthcawl, electrician. Dated December 31st, filed January 4th. Trustee, E. H. Hawkins, 4, Charterhouse Square, E.C., I.A. Liabilities unsecured, £148; assets, less secured claims, £95.

Private Meetings, etc.

[***Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.***]

NEW WILSON ELECTRICAL MANUFACTURING CO., LTD., 18, Fitzroy Street, Fitzroy Square, London, W.1, wireless and electrical factors. In pursuance of the provisions of the Companies (Consolidation) Act, a meeting of the creditors of the above was held on January 2nd, at the offices of the liquidator, Mr. R. Y. Rickard, I.A., 65, Basinghall Street, E.C. He reported that the liabilities amounted to £1 569, and the assets totalled £1 134. From that amount had to be deducted £308 for preferential claims, leaving net assets of £826. The assets included stock in trade on consignment and in the hands of customers, valued at £700; and book debts £378. The liquidator reported that the company was incorporated on July 1st, 1925, to acquire certain rights in patent articles. The company commenced trading almost immediately and was marked by success in the first two years, when profits of £1 516 and £1 816 respectively were made. In the third year, however, there was a loss of £916. Since that date, to the time of liquidation a further loss had been sustained. The sales during the whole time of the company's trading were £20 565, and there was a gross profit of £10 843. After deducting expenses, etc., that figure showed a net profit of £1 820. Included in the liabilities was a claim of £489 by the Inland Revenue. It was also stated that the stock largely consisted of patented articles some of which were partly manufactured, and were valueless if sold in the present condition. There were a number of partly made wireless amplifiers. It was resolved to confirm the voluntary liquidation of the company with the present liquidator.

Mortgages.

[NOTE.—*The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—allowed by the date of the Summary, but such total may have been reduced.*]

ANTI-VIBRATION ELECTRIC LAMP CO., LTD., London, E.C.—Registered December 20th, agreement increasing rate of interest in respect of debentures already registered; charged on property charged by the debentures. *——. December 14th, 1927.

BAILEY AND INCLEDON, LTD., London, S.W., electrical engineers. Registered December 5th. £2 000 debentures; general charge. *Nil. October 31st, 1928.

BAYLISS, MARCH AND NEWEY, LTD., Birmingham, electrical manufacturers.—Registered December 17th, £300 debentures, to J. S. Cooke, 31, Solihull Lane, Hall Green, C.A.; general charge (subject to prior charge). *£300. March 7th, 1928.

CARLISLE AND DISTRICT TRANSPORT CO., LTD. (late CITY OF CARLISLE ELECTRIC TRAMWAYS CO., LTD.), London, E.C.—Registered December 20th, Trust Deed dated December 18th, 1928, securing £60000 prior lien debenture stock; charged on tramways in and about Carlisle, etc., also general charge. *£40 000. May 25th, 1928.

EPOCH ELECTRICAL SOCIETY, LTD., London, E.C.—Registered December 18th, £350 debenture, to A. H. Hurst, Holland House, Bury Street, E.C.; general charge.

EPOCH RADIO MANUFACTURING CO., LTD., London, E.C.—Registered November 20th, £300 debentures, to Freda B. Laserson, 88, Woodstock Avenue, Golders Green; general charge.

HENDON ELECTRIC LAMP CO., LTD.—Registered December 29th, £750 debenture, to J. W. Kilby, 7, Newlands Avenue, Thames Ditton; general charge. *Nil. June 26th, 1928.

"K.N." ELECTRICAL PRODUCTS, LTD., London, W.—Registered December 21st, £1 000 debenture, to P. Ferguson, The Garth, Grange Road, Highgate, N.; general charge.

LEACH (S. G.) AND CO., LTD., London, E., electricians.—Registered December 14th, £3 000 (not ex.) debentures, to M. W. Woods, Ltd., Denmark Street, Colchester; general charge, ranking in priority to certain debentures, already registered. *£14 000 debentures. March 14th, 1928.

LISBURN ELECTRIC SUPPLY CO., LTD., Belfast.—Registered December 17th, £1 450 mortgage, to Ministry of Commerce Northern Ireland; general charge.

NANTWICH ELECTRIC, LTD.—Registered December 18th, £66 mortgage, to G. A. Racklyeft, Pillory Street, Nantwich, furniture dealer; charged on 5, Hospital Street, Nantwich.

RUSHDEN AND DISTRICT ELECTRIC SUPPLY CO., LTD.—Registered December 18th, £250, £1 000, £200 and £1 050 debentures, part of £50 000; general charge. *£25 000. March 6th, 1928.

Satisfactions.

ALDERLEY AND WILMSLOW ELECTRIC SUPPLY, LTD.—Satisfactions registered December 20th, £10 000 outstanding July 1st, 1908, and £5 000 registered June 1st, 1911.

BOWER ELECTRIC (1926), LTD., London, W.—Satisfaction registered December 14th, £1 500, registered March 12th, 1926.

DELABOLE ELECTRIC LIGHTING AND SUPPLY CO., LTD.—Satisfaction registered December 18th, £200, registered September 27th, 1915.

ORIENTAL TELEPHONE AND ELECTRIC CO., LTD., London, E.C.—Satisfaction registered December 17th, £6 965, part of amount registered July 11th, 1905, and June 20th, 1907.

PARK WIRELESS, LTD., Birmingham.—Satisfaction registered December 15th, £100, registered November 27th, 1928.

UNDERWOOD (MANCHESTER) LTD., electricians. Satisfaction registered December 7th, £1 500, balance of amount registered April 29th, 1927.

London Gazette, etc.

Companies Winding-up Voluntarily.

MOHAWK RADIO, LTD.—By reason of its liabilities, December 27th. A. A. Reeves, incorporated accountant, 2, Tyrrel Street, Bradford, appointed as liquidator.

USYM LAMPS, LTD. By reason of its liabilities, December 22nd. G. L. Campbell, 20, Conduit Street, W.1., Chartered Accountant, appointed as liquidator.

Bankruptcy Information.

RITCHIE, James Gray, 54, Woodsley Road, Leeds, electric lamp dealer. Receiving order, January 3rd. Creditor's petition.

Notices of Dividends.

LAWRIE, Andrew, trading as HOUCHIN AND LAWRIE, 9, Melbourne Parade, Palmer's Green, electrical engineer. First and final dividend, 1s. 2¾d. per £, payable, January 23rd, Official Receiver's Office, 29, Russell Square, London, W.C.1.

POOK, Bernard Edwin Mark, 53A, Albert Road, Southsea, wireless dealer. First and final dividend 3⅝d. per £, payable January 12, Official Receiver's Office, 87, High Street, Portsmouth.

Application for Discharge.

DOUGLAS, Henry David, engineer, contractor, merchant and wireless factor, 32, Queen Victoria Street, E.C.4, trading as H. D. DOUGLAS AND CO. Hearing, January 30th, 11 a.m., Bankruptcy Buildings, Carey Street, London, W.C.2.

Partnership Dissolved.

AIRD AND SCOTT (William AIRD and William SCOTT), electrical engineers at 1036, Argyle Street, Glasgow, as at December 25th, 1928, by mutual consent, by the retiral of W. Aird. W. Scott will continue the business under his own name at 1036, Argyle Street, Glasgow.

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PATENT RECORD.

The following information is prepared from the Illustrated Official Journal (Patents) by permission of the Controller of H.M. Stationery Office. Printed copies of full Patent Specifications, when accepted, may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at 1s. each.

Specifications Accepted.

302 187 J. L. Baird, and Television, Ltd. High-speed commutator switches in television apparatus. (11/6/27.)
302 373 Pirelli-General Cable Works, Ltd. and H. T. Werren. Method of balancing telephone cables. (16/6/27.)
302 200 Associated Telephone and Telegraph Co. and J. Wicks. Automatic or semi-automatic telephone systems. (9/8/27.)
302 202 M. A. Bolton and J. W. Walker. Electrical conductors and cables. (12/8/27.)
302 256 S. Z. De Ferranti and Ferranti, Ltd. Electric radiator fires. (3/9/27.)
302 259 Creed and Co., Ltd., F. G. Creed, W. H. Storey and R. D. Salmon. Electromagnetic apparatus suitable for use as a relay, switch, motor, or like device. (8/9/27.)
302 296 J. D. Sartakoff. Liquid supply devices for electric batteries. (9/9/27.)
277 362 Telefonaktiebolaget L. M. Ericsson. Fire-alarm systems. (11/9/26.)
284 202 C. M. Longbottom. Protective systems for electrical circuits. (24/1/27.)
302 264 C. F. Burton and H. Burton. Variable condensers. (13/9/27.)
302 298 C. F. Burton and H. Burton. Rheostats. (13/9/27.)
302 301 Siemens Bros. and Co., Ltd., H. E. Humphries and R. G. Dixon. Call-finding arrangements in automatic telephone systems. (14/9/27.)
302 389 British Thomson-Houston Co., Ltd. and J. C. Read. Electric arc-rectifier systems. (15/9/27.)
302 392 Collinson's Precision Screw Co., Ltd. and F. E. Collinson. Holders for thermionic valves. (15/9/27.)
302 394 W. S. Smith, H. J. Garnett and J. A. Holden. Magnetic alloys. (16/9/27.)
302 396 Aronwerke Elektrizitats Ges. and W. Stern. Electrical signalling or control systems. (16/9/27.)
302 397 H. D. Symons. Insulation material for electric apparatus. (17/9/27.)
302 405 A. Kirk. Electrical terminals, contacts, or connectors. (20/9/27.)
302 407 G. A. Mathieu and S. B. Smith. Thermionic-valve holders. (20/9/27.)
302 409 Automatic Telephone Manufacturing Co., Ltd. (C. E. Lomax). Fire-alarm systems. (20/9/27.)
302 418 E. Y. Robinson, E. J. E. Hubbard and Metropolitan-Vickers Electrical Co., Ltd. Vacuum electric tube devices. (23/9/27.)
302 422 Relay Automatic Telephone Co., Ltd., F. W. Davis and F. A. Wilding. Electric relay arrangements. (27/9/27.)
302 424 J. B. Sanderson. Electric lighting systems for road vehicles. (24/1/28.)
302 432 Callender's Cable and Construction Co., Ltd. and A. E. Wilson. Covers for joints in electric cables. (6/10/27.)
302 433 L. Barrett. Switches for electric circuits. (6/10/27.)
302 441 Siemens Bros. and Co., Ltd. and A. E. Caswell. Circuit arrangements in automatic and semi-automatic telephone systems. (12/10/27.)
279 497 Siemens and Halske Akt.-Ges. Cathodes for gas-discharge vessels. (23/10/26.)
281 239 W. Eschbach and W. Friederich. Ignition pellets for electric blasting-fuses. (23/11/26.)
302 463 J. Birch and Sons, Ltd. and C. Birch. Electric switches and fittings therefor. (8/11/27.)
302 466 G. H. Fletcher, A. Tustin and Metropolitan-Vickers Electrical Co., Ltd. Electric motor generators. (9/11/27.)
302 469 Oldham and Son, Ltd. and W. D. Wilde. Lids or covers for galvanic batteries. (10/11/27.)
302 472 Chloride Electrical Storage Co., Ltd. (Electric Storage Battery Co.). Secondary or storage batteries. (21/11/27.)
302 473 S. G. S. Dicker (N. V. Philips' Gloeilampenfabrieken). Direct-current excitation of synchronised asynchronous motors. (21/11/27.)
302 474 H. Tinsley and D. C. Gall. Method of and means for balancing cables and land lines, provided or not with compensating leads and earth cables. (21/11/27.)
281 320 M. Fleischmann. Automatic control switch for radio receiving apparatus. (27/11/26)
302 482 R. Deason. Apparatus for receiving, transmitting, and amplifying high-frequency and low-frequency electrical currents. (29/11/27.)
302 483 English Electric Co., Ltd., R. D. Ball and H. A. Brown. Construction of dynamo-electric machines. (29/11/27.)
302 490 H. S. Hatfield. Electrodes for indication and determination of the chemical composition of liquids. (5/12/27.)

Applications for Patents.

December 6th.

36 023, 36 024 Ferranti, Ltd., and E. D. T. Norris. Lightning absorbers.
36 067 General Electric Co., Ltd. Mountings for electric switches.
36 051 W. H. F. Griffiths and H. W. Sullivan, Ltd. Inductance coils.
35 942 B. Hesketh. Variable condensers.
35 953 G. Hezez, and Soc. l'Appareillage Electrique de la Seine. Electric switches. (12/4/28, France.)
35 959 J. A. Kuyser, and Metropolitan-Vickers Electrical Co., Ltd. Ventilation of electrical machines.
35 985 J. W. Mears. Dimming switch.
36 017 Metropolitan-Vickers Electrical Co., Ltd. Circuit interrupters. (9/12/27, U.S.)
36 001 E. A. Petithory and Siemens Bros. and Co., Ltd. Electric impulse transmitters.
35 968 J. T. Rankin. Electric signalling systems.
35 935 H. Schönecker. Electric hand signal lamp.
35 996 Siemens-Schuckertwerke A.G. Insulating oil for electrotechnical purposes. (7/12/27, Germany.)
36 027 Suddeutsche Telefon-Apparate Kabel u. Drahtwerke A.G. Electric rectifiers. (6/12/27, Germany.)
35 951 M. Wilson. Electric signalling apparatus.

December 7th.

36 167 Akt. Ges. Brown, Boveri et Cie. Mercury vapour rectifiers. (19/12/27, Germany.)
36 193 Automatic Telephone Manufacturing Co., Ltd., H. S. Deyes, F. Kessler and J. Scowcroft. Telephone systems.
36 194 Automatic Telephone Manufacturing Co., Ltd., and S. R. Smith. Telephone instruments.
13 134 Benjamin Electric, Ltd., and H. T. Harrison. Searchlights, etc.
36 215 British Thomson-Houston Co., Ltd. Mounting filaments. (7/12/27, U.S.)
36 087 W. Brown. Electric cables.
36 160 Butlers, Ltd., and A. Reeves. Vehicle electric lamps.
36 213, 36 214 A. Esau, and C. Lorenz Akt. Ges. Apparatus for influencing substances by high frequency electric energy. (8/12/27, Germany.)
36 156 G. Ferrabino. Voltaic cell. (9/12/27, Italy.)
36 094 H. F. McLoughlin and Simplex Conduits, Ltd. Electric switches.
36 123 H. D. E. Saunders and R. W. Thompson. Light sensitive control.
36 128 F. G. L. Scott and A. W. Sharman. Electric signalling apparatus.
36 129 F. G. L. Scott and A. W. Sharman. Apparatus for electro-medical treatment.
36 153 Siemens-Schuckertwerke A.G. Firedamp-proof housing for electric fittings. (9/12/27, Germany.)
36 159 Siemens-Schuckertwerke A.G. Three-phase generator safety device. (9/12/27, Germany.)
36 115 O. Solberg. Incandescent lamps.
36 121 P. Virij. Rotary automatic electric heaters. (12/12/27, France.)
36 122 P. Virij. Electric heating installations. (12/12/27, France.)
36 212 S. F. Warren. Combined television and sound reproducing apparatus.
36 182 Westinghouse Electric and Manufacturing Co. Frequency changers. (8/12/27, U.S.)
36 183 Westinghouse Electric and Manufacturing Co. Radio transmitting systems. (9/12/27, U.S.)

December 8th.

36 255 G. B. Burnside. Electric signalling systems.
36 264 P. S. Coyne. Adjustable electric lamp and adaptor for motor cars.
36 275 W. Dornig. Electric generators.
36 286 G. E. Haefely, and Micanite and Insulators Co., Ltd. Insulators.
36 280 E. J. E. Hubbard, Metropolitan-Vickers Electrical Co., Ltd., and E. Y. Robinson. Vacuum electric tube devices.
36 276 International General Electric Co., Inc. Electric switches. (8/12/27, Germany.)
36 295 Luth and Rosens Elektriska Aktiebolag. Electric driving aggregates. (1/3/28, Sweden.)
36 279 Metropolitan-Vickers Electrical Co., Ltd., and E. Y. Robinson. Vacuum electric tubes.
36 236 H. S. Nowell. Electric irons.
36 233 E. P. Nye. Remote control for wireless apparatus, etc.
36 265 C. W. D. Peel. Cord grips for electrical apparatus.
36 283 E. A. Pye and R. C. E. Vanderzee. Electric signs.
36 299 Siemens-Schuckertwerke A.G. Electrically-driven knitting machines. (10/12/27, Germany.)
36 303 Siemens and Halske A.G. Production of plate shaped electrodes from galvanic batteries. (9/12/27, Germany.)

December 10th.

36 422 Akt.-Ges. Brown, Boveri et Cie. Pillar switches. (15/12/27, Germany.)
36 318 Austinlite, Ltd. Automatic light-changing mechanism for lighthouses.
36 319 Austinlite, Ltd., and C. B. Walker. Apparatus for generating electric power.
36 452 Automatic Telephone Manufacturing Co., Ltd., and R. Taylor. Telephone systems.
36 419 C. R. Belling. Imitation fires.
36 456, 36 457 British Electrical and Allied Industries Research Association, E. B. Wedmore and W. B. Whitney. Circuit breakers.
36 376 British Thomson-Houston Co., Ltd., and F. P. Whitaker. Mercury arc rectifiers.
36 380 British Thomson-Houston Co., Ltd. Electric discharge devices.
36 368 L. G. H. Cantle and C. J. H. Thornton. Wireless receiving apparatus, etc.
36 455 L. G. H. Cantle and C. J. H. Thornton. Wireless receiving apparatus, etc.
36 423 Cie Générale Française de Tramways. Electric automatic network. (16/12/27, France.)
36 414 General Cable Corporation. High voltage bushings. (12/3/28, U.S.)
36 430 J. R. Harding and Pirelli-General Cable Works, Ltd. Means for supporting overhead lines, etc.
36 377 International General Electric Co., Inc. Electric indicating instruments. (9/12/27, Germany.)
36 466 Kalle and Co. Akt.-Ges. Production of light sensitive layers. (10/12/27, Germany.)
36 445 Marconi's Wireless Telegraph Co., Ltd. Radio signalling systems. (8/12/27, U.S.)
36 446 Marconi's Wireless Telegraph Co., Ltd. Radio signalling systems. (10/12/27, U.S.)
36 447 Marconi's Wireless Telegraph Co., Ltd. Radio signalling systems (9/12/27, U.S.)

Coming Events.

Friday, January 11th.

Institution of Electrical Engineers (London Students' Section).—Institution, Savoy Place, Victoria Embankment, London. Paper by Mr. J. A. H. Lloyd on "Telephone Repeaters." 7 *p.m.*

Saturday, January 12th.

Association of Mining Electrical Engineers.—60, Wind Street, Swansea. Paper by Mr. Gordon Rutter on "Cables and Control Gear for Use Underground."

Monday, January 14th.

Electrical Contractors' Association (Hastings Branch).—Lewcock's Restaurant. Ordinary meeting.
Institution of Electrical Engineers (Western Centre).—Grand Hotel, Bristol. Annual dinner 6.30 for 7 *p.m.*
Electrical Contractors' Association (Liverpool Branch).—Ordinary meeting. 7 *p.m.*
Institution of Electrical Engineers.—Institution, Savoy Place, Victoria Embankment, London. Informal meeting. Discussion on "Electric Trolley Omnibuses." (Opened by Major A. Jenkin.) 7 *p.m.*

Tuesday, January 15th.

Institution of Electrical Engineers (East Midland Sub-Centre).—Technical College, Derby. Paper by Mr. F. H. Rosencrantz on "Practice and Progress in Combustion of Coal as Applied to Steam Generation." 6.45 *p.m.*
Institution of Mechanical Engineers.—Swansea. Paper by Mr. J. W. Burr on "The Electrification of a Small Railway."
Electrical Association for Women (Manchester Branch).—Visit to the Salford Corporation Electricity Department Showrooms, Chapel Street. 2.30 *p.m.*
Institution of Electrical Engineers (North Midland Centre).—Hotel Metropole, King Street, Leeds. Paper by Mr. J. L. Carr on "Recent Developments in Electricity Meters, with Particular Reference to those for Special Purposes." 7 *p.m.*
Institution of Electrical Engineers (Students' Section of the North-Western Centre).—Engineers' Club, Albert Square, Manchester. Paper by J. Solomon on "Condenser Bushings." 7.15 *p.m.*
Paisley Association of Electrical Engineers.—Town Hall. Lecture by Mr. T. Robertson on "Engineering Insurance." 7.30 p.m.

Wednesday, January 16th.

Electrical Contractors' Association (Sussex Branch).—Midland Bank Chambers, Brighton. Ordinary meeting.
Overhead Lines Association.—Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London. Paper by Mr. G. W. Molle on "The British Climate and Overhead Lines." 5.30 *p.m.*
Institution of Electrical Engineers (Mersey and North Wales—Liverpool—Centre).—The Temple, Dale Street. Joint meeting with the Liverpool Engineering Society. 7 *p.m.*
Institution of Electrical Engineers (Sheffield Sub-Centre).—Royal Victoria Hotel. Paper by Mr. T. W. Sampson on "The Electrical Engineer and Medical Science." 7.30 *p.m.*
Royal Society of Arts.—John Street, Adelphi, London. Lecture by Prof. C. R. Darling on "The Domestic Smoke Problem—A Practical Solution." 8 *p.m.*

Thursday, January 17th.

Institution of Mechanical Engineers.—Leeds. Paper by Dr. H. W. Swift on "Power Transmission by Belts: An Investigation of Fundamentals."

Friday, January 18th.

Electrical Development Association.—Royal Society of Arts, John Street, Adelphi, London. Conference on "Electric Heating and Cooking Developments." Speaker, Mr. C. H. Rayner. 7.30 *p.m.*

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THE ELECTRICIAN

Established 1861. The Oldest Weekly Illustrated Journal of

Electrical Engineering, Industry, Science and Finance.

Bouverie House, Fleet Street, London, E.C.4. Telegrams: "Benbrotric, Fleet, London." Telephone: City 0244 (Ten lines).

No. 2642. [No. 3. Vol. CII.] Friday, January 18, 1929. Annual Subscription, 25s. Overseas, 30s.

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Current Topics.

Engineering Economics.

DURING his year of office as President of the Institution of Electrical Engineers, Mr. FRANK GILL made use of every possible occasion to point out that the real function of the engineer is not merely to apply science, but to apply science economically. In Mr. GILL'S view the modern engineer should know the elements of accountancy, and should know something about balance sheets, interest charges, depreciation, and related matters which are generally thought to be the exclusive province of the accountant. Although at the time the idea met with some opposition —from those who contended that it was wrong to attempt to direct the mind of the technical man into commercial channels, and that he should continue to roam over his interests without troubling about commercial values, on the off chance that great commercial value would often result—there is evidence that the fundamental idea is beginning to sink in. The words Engineering and Economics are coupled together in a new way, and many engineers are realising that as time goes on the need for some economic knowledge becomes increasingly apparent in jobs which were formerly carried on by means of engineering knowledge in association with the somewhat uncertain faculty called judgment. The rapid development of the electrical industry in this country has, of course, been an important influencing factor. Generating stations and distribution systems planned by rule of thumb methods may become obsolescent within a few years because the potentialities were not properly anticipated at the outset, and the gulf between distribution costs and revenue increases with every extension of the network, because the site chosen for the erection of the generating station and/or sub-stations was not economically the right one. Multiplication of these instances shows that the engineer's judgment alone is not sufficiently accurate when large capital expenditures on plant and distribution systems are involved, and we are glad to see that two papers on the anticipation of demand and the economic selection, provision, and lay-out of plant were discussed at last week's meeting of the Institution of Electrical Engineers. Capt. J. M. DONALDSON, who dealt with the subject from the electricity supply point of view, mentioned considerations which place difficulties in the way of strict estimation of future demand; but, so far as he went was able to show the value of economic studies to a supply undertaking. Mr. J. G. HINES, who dealt with telephone systems, went very much more fully into these matters, and outlined the ingenious methods employed by the British Post Office in making telephone development studies, framing layout schemes, and determining the economic period for which to provide plant. We hope that these discussions will not only serve to emphasise the importance of economics in engineering, but will also stimulate thought in the direction of improved and more economical methods of anticipating demand.

Overseas Trade in 1928.

THE Board of Trade returns show that total imports into the United Kingdom during 1928 were valued at £1 196 940 354, a decrease of £21 400 796 on those for 1927, while exports of United Kingdom goods at £723 427 455 show an increase of £14 346 192. It will therefore be seen that the exports are increasing while the imports are declining. The advance in exports was largely due to an increase in machinery and vehicles sent overseas. Imported steel and iron cost this country £9 873 500 less than in the previous year, which seems to indicate that Britain can now compete more effectively than hitherto as regards prices in that trade. With an adverse trade balance for the year of £353 160 408 it would be foolish to suggest that our foreign trade, as a whole, is yet in a flourishing condition, but, as the balance is lower by £33 246 600 than that of 1927, 1928 at least shows some improvement on the previous year. The movement in this country in the direction of reducing operating costs, the comparative freedom from industrial disputes that has characterised the past year, and the expediting of railway rate reductions make the immediate outlook more promising than it has been for some years past. With regard to the electrical industry, while the total exports of electrical goods at £18 333 623 show a decrease of £255 469 on last year's figures, this represents a comparatively small proportion of the total, and can hardly be said to justify the pessimistic prognostications of the B.E.A.M.A. Trade Surveys. There is, after all, a certain amount of solid comfort in the knowledge that the British-made exports of such goods exceeded the value of imports of similar commodities by nearly £12 000 000. British exports of motors and generators, other than railway and tramway motors, increased by £91 330, submarine telegraph and telephone cable by £82 303, and electrical goods and apparatus classified as "all other

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sorts" by £194 167. On the other hand, imports of rubber insulated cables and wires, other than telegraph or telephone, increased by £63 503, telegraph and telephone instruments and apparatus by £239 388, and electrical goods and apparatus, "all other sorts," by £178 531. Although the electrical industry is shown by the statistics to be in a better position than most with regard to the balance of overseas trade, it is to be hoped that during the coming year the export set-back, slight though it is, will spur exporters of British electrical goods to still more energetic efforts to establish a new high record. When it is remembered that so recently as 1922 our electrical exports only totalled about £11 500 000, the progress made in six years appears to justify a little restrained optimism.

The Electric Fittings Committee.

NINE months after the completion of its first session—also of nine months—the Electric Fittings Statutory Committee, appointed by the Commissioners in 1927 to determine questions raised under Section 48 of the Electricity (Supply) Act, 1926, as to the recognised retail or trade prices of electric fittings, has issued its first report. Although it was expected that this influential and representative committee was destined to have a busy and somewhat uncomfortable time, there is little evidence of it in the report. Abandoning the original design of keeping an up-to-date record of current prices in favour of determining, as and when required, what the prices were at a date on which a particular transaction took place, the Committee found no occasion to operate in either direction as no complaint of underselling had been received. A similar lack of incident characterises the initial period of the Installations Sub-Committee, which was appointed to ascertain whether, and, if so, on what terms agreement could be reached between the municipal and contracting interests as to the prices to be charged for installations. The matter, it appears, was still in discussion at March 31st, and further official information on the development of a discussion, the result of which greatly interests a large section of the industry, is presumably unavailable at the present time. The freedom from complaints which the report records, suggests either that the previously warring factions have buried the hatchet more readily than was anticipated, or that the existence of the Committee was not very widely known.

Contractors and Compulsory Registration.

IN our efforts to raise the status of the electrical installation trade we have repeatedly "pilloried" examples of "jerry" wiring which have come to light. These exposures, which have been illustrated by photographs of the actual work, have shown that there are still in existence quite a number of so-called installations which are revelations of untutored effort and misplaced ingenuity. Evidence has not been lacking that the publicity given to this shoddy work has brought home to many supply engineers and others—and in a way that no amount of argument would—the folly of entrusting unqualified people with the important work of connecting up buildings to a public source of electricity supply. Now that a rapidly increasing proportion of the reputable electrical installation engineers is enrolled under the voluntary registration scheme of the National Register of Electrical Installation Contractors there is no excuse for anyone to be a party to the employment of the "kerbstoner." The further example of dangerous workmanship which is exposed on a later page of this issue by Mr. H. Moss reinforces the arguments of those who desire the immediate introduction of compulsory registration for electrical installation contractors. On practical grounds, it will be remembered, we have doubted the wisdom of pressing for compulsion until the voluntary system has attained its maximum development. The experience of the plumbers, as disclosed at the livery dinner of the Worshipful Company of Plumbers on Monday, supports our view. As long ago as 1883 the Company extended to those plumbers who were able to prove their ability and sound workmanship an opportunity to take advantage of a scheme of voluntary registration. Much time and money has been spent on educational purposes, and though the registration scheme has in practice, and within its limits, worked extremely well, full State recognition of the Register has not yet matured. Nevertheless, the existence of the Register itself, and the good work that is being done by the Registration Council and the local committees in harmony with the Institute of Plumbers, has shown that great value is attached by plumbers to the privilege of being allowed to affix the letters "R.P." to their names. Taking the experience gained by the plumbers with their registration scheme, we feel, with one of our correspondents in this issue, that the first definite step towards State recognition of the National Register of Electrical Installation Contractors will be possible when that organisation can say that its roll includes the names of all the reputable contractors in the kingdom. There might be found a short cut in the form of combined action with the Worshipful Company of Plumbers, but, even so, the electrical case would be materially strengthened by a National Register of something like 5 000 contractors. The figure may seem optimistic, but the present rate of development of the Register, both in influence and numbers, offers real ground for hope. The matter is undoubtedly of grave importance, and though our own views are well known, we are anxious to give publicity to any suggestions which are likely to assist in the solution of the problem.

Domestic and Colour Lighting.

ACCORDING to the E.D.A. publicity calendar, January is the month in which special attention is being drawn to domestic and colour lighting possibilities. The organisers have certainly done their part, with special advertising, posters, and a variety of suitable booklets, not to mention two very simply arranged, but most effective, window displays for contractors' and other electrical showrooms. The trade response, on the other hand, does not, so far, seem to have been overwhelming, judging by the absence of the special displays from most of the windows observed in London and several other important centres. The E.D.A. is right, if a little late, in its insistence on the fact that in selling, as in many other things, "it pays to specialise," but the idea of devoting a whole window to a single well-defined purpose does not yet seem to have been thoroughly "sold" to the electrical trade. The vague fear that a member of the public, seeing a window filled with a special display of lamps, will not realise that he can buy an electric fire or a percolator inside, seems to be at the back of this conservatism. In these columns we have frequently pointed out the fallacy of such views, and have, from time to time, presented practical suggestions for specialised seasonal and topical displays. We therefore hope that every supply undertaking and electrical contractor with a display window will make fuller use of the window schemes put forward by the E.D.A. during the coming year. The January programme is full of possibilities for business in ordinary lamps alone, but from the domestic point of view the coloured lamp potentialities have barely been touched as yet. Handled in the right way, the coloured light campaign, both for shops and houses, can be made very profitable indeed.

Neglected Lamp Business.

IT would be interesting to know the total of the sales of electric Christmas tree lamps in this country last month, and also the number of contractors who did not sell any. Such speculations may seem trivial, but they achieve some importance when one considers that more than 50 000 000 of these lamps were available for sale in the U.S.A. during December. Dividing this huge total by the figure necessary for true comparison, the potential sales in this country were tremendously greater than the actual turnover. And so it is with so many of the so-called side-lines of our industry. Given their proper quota of sales and publicity effort these small items would add materially to the revenue obtained from domestic electrical appliances.

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DOMESTIC TARIFFS.

Foundations of a Sound Policy—Encouraging Maximum Consumption—Some Results from Amsterdam—Objections to "Restricted" Periods—Two Interesting Tariffs.

By DR. LULOFS (Director of the Amsterdam Electricity Works). Translated by H. HORWOOD.

THE foundation for the construction of a sound tariff policy is a radical investigation into the costs and into the relationship of all factors affecting the generation and distribution of electricity, that is, of all factors affecting the price charged for current.

There are many engineers who do not sufficiently recognise how important is a thorough and scientific study of this matter and how necessary this study is, to attain the highest possible degree of perfection in the management of the undertaking and at the same time to serve in the best way, both directly and indirectly, the population of the current distribution area.

Many believe that the fixing of tariffs can be done exclusively by estimation and by intuitive business spirit; the danger of this is only exceeded by the danger caused by the authorities believing that they can fix tariffs spontaneously on their own initiative.

I still remember how formerly the contract price for large power users had to be first discussed and passed by a municipal committee: here I always met resistance—that caused by a member of the committee, an accountant, who as such was very self-conscious and who was considered an authority on selling prices by his fellow committee members. He always met my tariff proposals by comparing them with the average cost of production, taken from the preceding annual report, a figure which was always higher than that proposed by me as the contract price for the future large power user.

I could only overcome this resistance by convincing the accountant that it was actually because the selling price was lower than the cost of production, that high profits could be attained.

The mathematical proof of this theory, which, although apparently strange, is nevertheless true, is given by the following numerical example:—

Assuming that the production of 40 million kWh cost "y" pence per kWh, the total cost of production becomes $40 \cdot 10^6 y$ pence.

Let us say that owing to extensions of the electrified area, the production can be increased to 60 million kWh, whilst on account of this increase, the cost per unit falls to "$y - x$" pence, the total cost of production would become $60 \cdot 10^6 (y - x)$ pence. The difference is therefore $20 \cdot 10^6 y - 60 \cdot 10^6 x$ so that when the greater output is sold at the lower price still no loss is incurred.

For 20 million kWh one can therefore demand $20 \cdot 10^6$ "$y - 60 \cdot 10^6 x$" without suffering any loss, i.e., "$y - 3x$" per kWh, whilst the cost of production amounts to "$y - x$," which is $2x$ higher; in other words, if one sells current at "$y - 2x$" one remains at "x" pence per kWh under self cost and secures thereby a profit of "x" pence.

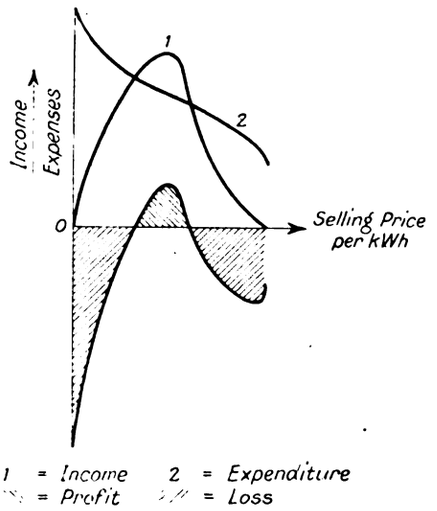

Fig. 1.—Income and expenses dependent on price of current.

If one allows representatives of the authorities too great an influence in the fixing of charges, it generally results in damage to the organisation, caused by the mistakes made by incompetent people who consider the fixing of high charges to be careful policy and who do not consider that too high charges,

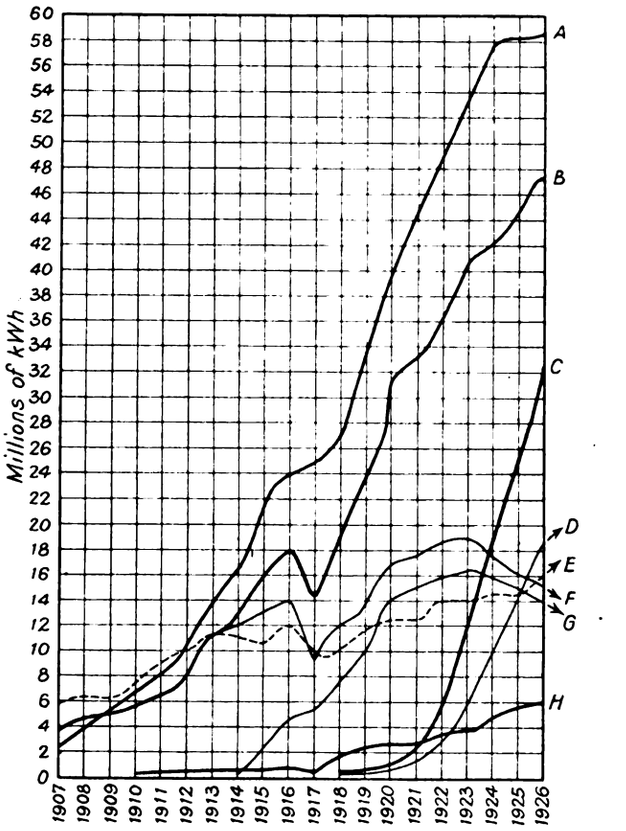

Fig. 2.—Consumption in Amsterdam between 1907-1926.

A—Power Consumption; B—Total lighting consumption in houses, shops etc., (excluding public lighting); C—Heating and power consumption (domestic) at fixed charge tariff; D—Lighting consumption (domestic) at fixed charge tariff; E—Electric traction; F—Lighting consumption through ordinary meters; G—Lighting consumption through prepayment meters; H—Public lighting.

similarly to too low charges, tend to losses or reduction of profit.

Income and expenses in their relationship to price per kWh are represented graphically in Fig. 1. The income line must pass through zero, since for a kWh price=zero, the income also =zero; it then rises with the price of current. In spite of that, however, the rising income line again falls to zero, because the consumption becomes zero as soon as the price per kWh has risen so high that no one will buy at the price.

The expenses line commences very high at a selling price of zero, since the consumption would in that case be very high. The expenses will gradually become less, according to the increase in the kWh price, until they fall to the amount of the overhead charges, when the consumption has decreased to zero. The difference between income and expenses gives the extent of profit or loss. From Fig. 1 it can be clearly seen that losses occur at too low a price, just as they do at too high a price.

One can conclude from this that too high prices cause danger of losses to the same extent that too low prices do. One must, therefore, beware of too high tariffs.

As already stated, the fixing of the two limits between which the tariffs may swing demands a thorough study of the subject on the part of the competent manager.

The following remarks are intended to serve as a small contribution to this study, which, however, is limited to the tariff question for low tension house installations. Endeavours should be made to fix the prices in such a manner, that a

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maximum result and maximum profit per installation result in a maximum consumption of current (Fig. 2).

The graphical representation, Fig. 3, shows how extensively the household consumption can be cultivated by the introduction of a suitable tariff.

This curve shows how it was possible in Amsterdam, by

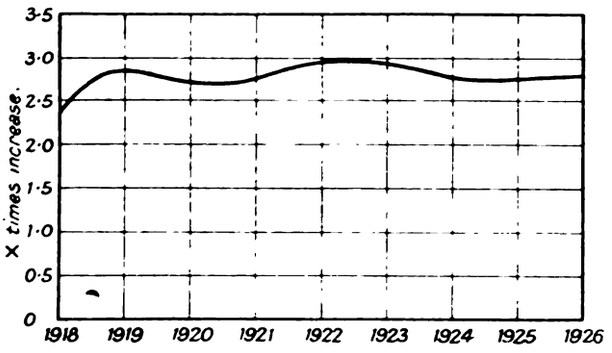

Fig. 3.—Consumption increase $\frac{\text{Total consumption}}{\text{Lighting consumption}}$ by means of a fixed charge tariff.

means of the introduction of a fixed charge tariff to increase the ratio of total household consumption to pure lighting consumption 2·8 times (average).

A Concrete Example.

I believe my remarks will be made much clearer if I work out a concrete numerical example. For this I take as a basis the working results obtained in the electricity works which I conduct. I must emphasise that the figures are solely intended as an illustration to show how the various parts, of which the costs are built up, are related to one another.

Let us take an electricity works with production costs of 5os. capital charges per kW and 0·025s. per kWh.

I propose to divide the distribution charges into three main groups, viz. :—(*a*) distribution costs per kW, (*b*) distribution costs per kWh, (*c*) distribution costs per installation.

To (*a*) belong the costs of the h.t. mains and the h.t. transformation, i.e., the 10 000 V and the 3 000 V mains as well as the corresponding 10 000/3 000 V transformer stations, since capacity, and therefore the costs of the plant, are as good as entirely dependent on the maximum loading introduced to the 3 000/220 V transformer stations.

The costs of the necessary l.t. installation (*b*) bear quite a different character. Neglecting the small power consumption connected to the l.t. mains, and which in cities constitute a comparatively small percentage of the house lighting load, one can say that the whole l.t. cable network and house service boxes, etc., are installed with the sole object of providing the dwelling-houses with light.

In the towns we need a greater cable length per dwelling for large houses than we do for small houses, firstly, because as is the case in Holland, the large houses often contain less—i.e., only one or two dwellings, than the small houses which often contain four or five dwellings; secondly, because the larger dwelling-houses have a greater frontage.

Since the copper cross section of the l.t. ground cable for both does not vary much, the larger dwelling-houses, i.e., each installation, have higher l.t. cable costs, although, on the other hand, a greater lighting load per dwelling house.

Figures have proved that these factors generally approximately equalise one another, so that the capital outlay for the l.t. mains is equal per kWh for all sorts of small consumers. The same remarks apply for the l.t. transformation.

In addition to the costs of the cables, sub-stations, and transformers, there are other distribution costs, viz. :—(2) Installation department; (3) technical checking, mainly meter department; (4) calculating staff, mainly for charging for current, meter reading, collection, etc.; (5) general services, i.e., management, secretary's office, sales department, purchasing department, correspondence office, record office, etc.; (6) social obligations; (7) miscellaneous expenses. I should like to group these items under the heading "Estimating Administration." In practice, these costs are entirely dependent on the number of installations that must be served, and neither the consumption in kWh nor the maximum load in kW have the slightest influence on these costs: they come, therefore, under (*c*) as costs per installation.

The numerical example can now be given as follows :—

The total distribution costs are divided into seven parts as per Table 1.

TABLE I.

Total annual distribution costs in millions of shillings.

(1) Mains, sub-stations and transformers . 3·02	H.T. = 1·55	H.T. cable 1·10	*a*
		H.T. trans. 0·45	
	L.T. = 1·47	L.T. cable 1·15	*b*
		L.T. trans. 0·32	
(2) Installation Dept. .. 1·73			
(3) Technical checking (meter reading, etc.) .. .. 0·17*			
(4) Calculating staff .. 0·87			
(5) General services .. 0·53			
(6) Social obligations .. 0·63			
(7) Miscellaneous .. 0·65			
Total .. 7·60		Total 4·58 (*c*)	

*After deducting meter rent at 1s. 4d.

Let us investigate what influence the above costs have had on the average self cost price per lighting kWh in the house.

The average lighting load per dwelling-house amounted, according to measurement, to 131 kWh per annum, whilst various measurements showed that the average working time of this lighting load was 1 570 hours, so that the maximum load per dwelling-house amounted to 0·0835 kW. (Here the working time of 1 570 hours does not apply to any individual consumer or group of consumers, but to all the dwelling-houses together, and gives the relationship between the total lighting consumption of these dwelling-houses and their total lighting load at the time of the peak load of the electricity works.)

We shall now consider Tables 2 and 3. On the assumption that the average current consumption per installation stands at 131 kWh, the average total self cost price per lighting kWh is 0·338s. This amount is built up with the factors in columns I, II, and III, of Table 3. From this it is seen that not less than 0·235s. of the total self cost price per kWh or, roughly, 70% are absolutely firm expenses.

Now the amount of 0·0535s. (column II) is dependent on the manner in which the current is consumed, i.e., the duration of the consumption, although this dependence is merely relative, as is seen from the following :—

TABLE 2.

Costs of Production.

On the busbars 50s. per kW and 0·025s. per kWh.
On the installation 55s. per kW per annum and 0·0275s. per kWh.

(*a*) H.T. distribution costs per kW.—
57 000 kW max. supplied to H.T. mains = 53 000 kW at the installations.
Costs 1·55 million shillings (see Table 1*a*), i.e. :

$$\frac{1\,550\,000}{53\,000} = 29\cdot3\text{s. per kW and annum.}$$

(*b*) L.T. distribution costs per kW :—
1. L.T. transformation :
109×10^6 kWh* transformed per annum (excluding household).
Costs 0·32 million shillings (see Table 1*b*), i.e. :

$$\frac{320\,000}{109\,000\,000} = 0\cdot003\text{s. per kWh.}$$

2. L.T. mains :
60×10^6 kWh (excluding household) supplied per annum.
Costs 1·15 million shillings (see Table 1*b*), i.e. :

$$\frac{1\,150\,000}{60\,000\,000} = 0\cdot019\text{s. per kWh.—Total } 0\cdot022\text{s. per kWh.}$$

(*c*) Distribution costs per installation :—
Number of installations—148 700.
Costs of the "Estimating Administration" (items 2–7 of Table 1).
4·58 million shillings, i.e., $\frac{580\,000}{4\,148\,700} = 30\cdot8$s. per installation and year.

*Of which 49×10^6 kWh is sold direct at the L.T. busbars.

As already stated, it is found that the average consumption duration of the domestic lighting load is roughly 1 500 hours. Within the very wide limits of 1 000 to 2 000 hours, that part of the kWh price which refers to the maximum load, varies only between 1·0 and 0·5 pence. That is to say, therefore, that a lighting consumer, who only has 1 000 hours' consumption,

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has an average total lighting kWh price of roughly 4·4d., and for a very good consumer with 2 000 hours of consumption it amounts to 3·95d., so that, should it be possible by means of special precautions to increase the average lighting consumption period from 1 500 hours to 2 000 hours, you would then reduce the costs from 4·05d. by 0·14d., i.e., by only 3·4%.

From this it follows that the effect of the period of duration of the lighting kWh on the total lighting current distribution costs has, between very wide limits, not much importance, so that two conclusions can here be drawn :—

It is useless to try by artificial means to increase the number of consumption hours, particularly since here the remedy is usually worse than the evil.

A much used method is to increase the price of current considerably during the restricted hours and thus keep as many lighting kWh as possible outside the restricted period. The word " restricted " shows that the electricity supplier is on the wrong track, for what other supplier adopts means to limit under any circumstances the disposal of his products ?

I am, on the contrary, generally of the opinion that it is the duty of the electricity supplier to further the consumption of electricity wherever possible, and to do so with the greatest possible convenience to the consumer.

I have, too, very serious objections against the " double tariff " which has the result of increasing the price of current during certain hours and thus, not so much as a main purpose but still as a secondary one, to restrict the current consumption during certain periods.

In general it must be pointed out that this procedure is not at all sound, for where one can only save a few per cent. on the production costs by a greater improvement in the consumption duration, one runs the risk that through this restriction in the peak period the average lighting consumption gets less per installation, and thus the permanent charge per kWh of 0·235s. is directly influenced.

Each per cent decrease in current consumption per dwelling-house and year caused an increase in the production costs of 0·7%, or nearly 0·03d. It does not pay to risk this for a gain of 0·14d., which is only obtainable by an increase of the average lighting period from 1 500 hours as normal to 2 000 hours, which must be considered as the maximum attainable.

Further Disadvantages.

Further disadvantages are that, apart from the fact that one hereby encourages the reduction in consumption, the consumption of electricity is made a burden to the consumer ; also this system opposes the general use of a large variety of apparatus.

Finally, it must be noted that such a system costs the suppliers a good deal of money, for the double tariff meter with time element raises the capital expenses per installation not inconsiderably.

The only form in which a double tariff meter should be used is in the opposite manner, viz., to supply current at very low prices during certain hours, i.e., during the night hours.

I shall return to this later.

TABLE 3.

Average Total Cost for Lighting in Dwelling Houses.

	I. Costs per installation.	II. Costs dependent on the maximum load.	III. Costs dependent on the kWh consumption.	IV. Total costs.
Generation ..	—	0·0835 kW at 55s. per kW : 4·59s.	131 kWh at 0·0275s. per kWh : 3·6s.	8·19s.
Distribution dependent on current supplied	—	0·0835 kW at 29·3s. per kW : 2·45s.	131 kWh at 0·022s. per kWh : 2·88s.	5·33s.
Distribution, not dependent on current supplied	30·8s.	—	—	30·8s.
Total, per house installation for 131 lighting kWh	30·8s.	7·04s.	6·48s.	44·32s.
Total per lighting kWh	0·235s.	0·0535s.	0·0495s.	0·338s.

I now propose to explain which form of tariff I recommend.

As we have seen (from Table 3), the costs per consumer per annum for the average lighting consumer, one who consumes 131 kWh with 1 500 consumption hours, amounts to 30·8s., plus 7·04s., plus 0·0495s. per kWh. The first factor is independent of the individual current consumption. From this it is seen that the supply costs per kWh vary for each consumer,

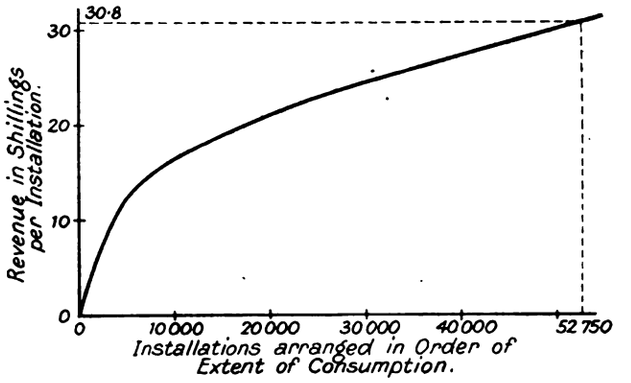

Fig. 4.—Average revenue per installation of the smallest lighting consumers.

depending on his consumption, for where, for a consumer of 100 kWh, the lighting current price is :—

$$\frac{3\,080}{100} + 5{\cdot}35 + 4{\cdot}950 = 0{\cdot}411\text{s.}$$

The price, on the other hand, for a 200 kWh consumer is :

$$\frac{3\,080}{200} + 5{\cdot}35 + 4{\cdot}950 = 0{\cdot}257\text{s.}$$

And now we must ask ourselves whether it is right, when fixing tariffs, to treat each consumer individually, and to keep the lighting price demanded in line with the costs, i.e., inversely proportional to the extent of consumption, or to put all lighting consumers (dwelling-houses) in one group and charge each consumer the average kWh price. The latter system is usual, and in fact is justified : it constitutes a social tariff, and other arguments (which can hardly be gone into now) support the maintenance of this as a general principle.

Assuming that the lighting current price must be equal for all dwelling-houses and must be built up from the average cost price, which can be expressed by : 0·235s. as firm costs, 0·0535s. as maximum load costs, and 0·0495s. as variable costs, in the case where the lighting consumption duration for dwelling-houses can be assumed as being practically constant, the amount of 0·0535s. can be taken as constant, so that the supply costs per lighting kWh may be separated thus : 0·2885s. as firm costs and 0·0495s. as variable costs.

From calculations it is known that the supply costs per kWh for household purposes amount in total to roughly 0·05s., an amount which is of the same order as the variable amount of the lighting kWh. The total supply costs per annum and per installation for x–kWh for light and y–kWh for household purposes are therefore (28·85 multiplied by $x + 5\,x + 5\,y$) ÷ 100 shillings.

TABLE 4.

Sales of Apparatus made by the State Electricity Works of Amsterdam in 1926.

Nature of apparatus.	Quantity.	kW.	Revenue in shillings.
Vacuum cleaners	9 500	1 800	1 937 000
Fires	5 600	6 600	192 000
Hot water accumulators (night load)	900	800	148 000
Ordinary water heaters (six litre capacity)	600	300	51 000
Flat irons	4 000	1 500	31 000
Kettles and saucepans	1 200	600	190 000
Hairdriers	700	350	14 000
Toasters	500	200	11 000
" Instantaneous " water heaters ..	100	300	10 000
Boiling plates	500	400	9 000
Tea warmers	400	50	6 000
Various (fans, warming plates, pastry ovens, foot warmers, washing machines, cookers, etc.)	600	200	20 000
Total	24 600	13 100	2 619 000

Two tariffs can be developed from this :—

(1) 33·8 x + 5 y, i.e., one charges for all kWh for ordinary lighting consumption at one selling price, basing this on the total costs of 0·338s., whilst the total remaining consumption is built up on the costs of 0·05s.

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(2) One demands the payment of a fixed sum per annum, built up of the normal lighting consumption per annum, which is put down as x, and bases the price on 0·2885s. firm costs, whilst the total consumption, both for light and household purposes, is charged at a price built up from the average total costs amounting to 0·05s.

In using these two tariffs it is therefore necessary to know the individual consumption per dwelling-house. Now there exists an unmistakable connection between the annual consumption in light and the designation and size of a dwelling-room, whereby, at the same time as the size, the status of consumer is taken into consideration. When this connection is reduced to figures, it is possible to calculate the normal lighting consumption for every dwelling-house.

When one has determined the number of lighting kWh for a dwelling-house, one can, with the aid of a " dark hour table," also determine the lighting consumption for each month.

The first tariff therefore arranges that for each month a number of kWh is fixed which are payable at 0·338s. plus profit, whilst each kWh over and above this number in the corresponding month is charged at only 0·05s., plus profit.

In this case, the condition must be made that, should the consumption in any one month not reach the fixed number of kWh, the balance must be added to the lighting consumption for the following month, before the lower tariff based on 0·05s. takes effect.

One objection against this tariff is that considerable office work is entailed and a punctual monthly meter reading is essential. In this respect, the second tariff is better, in which an annual payment of a fixed charge is made, proportional to the lighting consumption x multiplied by 0·2885s. One can demand payment monthly, viz., $\frac{x}{12}$ multiplied by 0·2885s., plus profit, or one can vary it with each month's consumption. The total consumption, i.e., lighting and domestic kWh, will then be charged at the low tariff based on 0·05s.

Now there is still the question to settle as to whether the use of the prepayment meter principle is influenced by the introduction of these tariffs.

From Table 3 it is seen that the firm expenses, independent of the current consumption, amount to 30·8s. per installation.

From statistics we learn that from the 120 000 installations it is just the 52 750 smaller ones that have this amount of revenue per annum, so that more than a third of the consumers bring just this amount in, without paying for their current at all, let alone giving a profit.

Prepayment Meters.

From these figures it becomes clear how important it is to reduce the firm expenses of 30·8s. (Fig. 4). This is possible by using prepayment meters, which should be considered mainly as cheaper collectors, for from this 30·8s. 5·66s. fall away immediately as wages for collectors, meter reading and the appropriate office work. This amount can, by the general use of prepayment meters, be lessened also for these tariffs.

It is now possible to construct prepayment meters for both these tariffs; for tariff (1) a slot meter, which, after it has collected during one month the quantity allotted in that month at the lighting tariff, automatically changes over to the lower tariff. At the beginning of the next month the meter commences to work at the high tariff again, and does not change over to the lower tariff until the allotted quantity of lighting kWh belonging to that period, as well as any arrears from the previous period, have been consumed, whilst at the beginning of a new year all arrears that may be outstanding are cancelled, so that the consumer can start again without arrears.

For tariff (2), the necessary mechanism is limited to an apparatus which, besides the collection for current consumption at a low but constant tariff, simultaneously collects a prescribed fixed charge during a certain period, this charge being quite independent of the consumption.

Table 4 gives a summary of the sales of apparatus at the stores of the Amsterdam State Electricity Works in 1926. This table does not embrace the sales of lamps, flex, fittings, accessories for apparatus, etc.

The consumption will increase considerably as a result of the recent introduction of a night current tariff of 0·033s. per kWh (0·396d.); this serves mainly for water heating on the accumulator principle during the night hours, for the domestic hot-water requirements during the daytime. This tariff, which is exceedingly popular, is allowed between the hours of 11 p.m. and 7.30 a.m.

BOOK REVIEWS.

Classified Examples in Electrical Engineering (2 Vols.). By S. G. MONK. (London: Sir Isaac Pitman.) Vol. I. Pp. viii+77. 2s. 6d. net. Vol. II: Pp. viii+115. 3s. 6d. net.

Questions in Electrical Engineering, taken mainly from the examination papers set during recent years, at the London B.Sc. (Eng.) degree, the A.M.I.E.E., the final City and Guilds and the Whitworth Examination of the Board of Education, form the subject of these volumes. Although mainly questions of a numerical character, the author has included also descriptive questions dealing with important principles. The questions are classified under various headings, and in many cases the examples are fully worked out. References have also been given to enable the reader to obtain further information upon the subject.

Vol. I deals with d.c. work generally, including d.c. machine design, whilst Vol. II is of a more advanced character, covers mainly a.c. work, and includes machinery, transmission and distribution. Generally speaking, these volumes survey a wide field, and should prove of value not only to the student but also to lecturers.

W. S.

Text Book of Telegraphy. By A. E. STONE. (London: Macmillan and Co.). Pp. vii+455. 20s. net.

The author's long experience as a teacher of this subject, has, no doubt, enabled him to appreciate the difficulties which beset the path of the student, for whom this book is primarily intended. The first seven chapters are devoted to the elementary principles of electricity, with which the student should be thoroughly conversant before commencing the study of telegraphy. The following chapters deal with universal battery working, the simpler key systems, double current, duplex telegraphy, central battery and concentrators, quadruplex, Wheatstone automatic, repeaters, type printing systems, line construction, protection, testing and submarine telegraphy.

Modern telegraphy is first met with in the chapter dealing with type printing systems, the text being thoroughly up to date, and descriptions of all apparatus recently tested, and that operated by the Post Office, are included. Although, as the author states, submarine telegraphy and radio telegraphy can only be fully dealt with in manuals exclusively devoted to these branches, the value of the book would certainly have been materially increased by a fuller description of these two systems. Again, it is a pity that the author has not included the system now operated with excellent results by the cable companies, viz., the system of regenerative repeaters.

Worked examples are given to illustrate the use of the various formulæ given in the chapter dealing with alternating currents and propagation of signals. Two appendices are included at the end of the book, one giving a table of exponential and hyperbolic logarithms, which will facilitate the working of examples, whilst the other is a brief résumé of voice frequency telegraphy.

Generally speaking, the book can be thoroughly recommended to students, both elementary and advanced. The formulæ are clearly stated and also evolved from first principles, and the theoretical matter is very carefully dealt with.

C. C. W.

BOOKS RECEIVED.

" Ought We to Save?" By Sir George Paish. (London: Ernest Benn, Ltd.) Pp. 27. 6d. net.

" Labour and the Community." By W. M. Citrine. (London Ernest Benn, Ltd.) Pp. 32. 6d. net.

" Religion Interferes." By Dr. Hewlett Johnson. (London: Ernest Benn, Ltd.) Pp. 40. 6d. net.

" The Meaning of Trade." By Margaret Bondfield, M.P. (London: Ernest Benn, Ltd.) Pp. 32. 6d. net.

" The Way of Peace." By L. Woolf. (London: Ernest Benn, Ltd.) Pp. 30. 6d. net.

" The All Europe 'Three.'" By C. M. R. Balbi. (London: Sir Isaac Pitman and Sons.) Pp. 24. 6d. net.

" Centrales Électriques." By F. Drouin. (Paris: Librairie J.-B. Baillière et Fils.) Pp. viii+602. 85 francs.

" Englische Elektrizitätswirtschaft." By Dr. Gunther Brandt. (Berlin: Julius Springer.) Pp. v+112. 6 marks.

The " Wireless Trader " Year Book and Diary, 1929. 5th Ed. (London: The Trader Publishing Co.) 5s. 6d. net.

" An Introduction to Electrical Drawing." Part II. By E. H. H. Gibbins. (London: Blackie and Son.) Pp. 63. 3s. net.

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SAFEGUARDING THE CONTRACTING TRADE.

An Appeal to the Electricity Commissioners—More Examples of Shoddy Workmanship—Protecting the Public—An Exposure of Daily Risks of Fire—Value of Compulsory Registration as a Safeguard against Bad Work.

By HARRY MOSS, A.M.I.E.E.

THE safeguarding of industries is a matter that has loomed large on the political and trade horizon for some considerable time, and is, at the present moment, exercising the brains of many trade representatives in various spheres of our national life. Now, if the safeguarding of industries for the protection of trade is such an important national matter, how much more important is the safeguarding of life and property, which is being jeopardised, not by foreign competition, but by want of skill and training, in an industry which has grown by leaps and bounds during post-war years.

If there is one branch of trade that requires safeguarding to-day, it is the electrical contracting trade, because, I believe, it is the one that is more abused than any other at the present time. It is a trade that brings either its benefits or its dangers into our homes, churches, shops, factories, and every other class of building. It is a trade that has an open door for any to enter by, be he wise man or fool, skilled or incompetent, old or young, trained or untrained. It is a trade that has no protection whatever, and its ranks have been swollen beyond all reason with thousands of undesirables.

It is a trade that can be dabbled in by anyone who knows a switch from a piece of wire, and cares to style himself an "Electrical Engineer" or "Electrical Contractor."

Isn't it a farce that any incompetent, unskilled person, who cares to have a few cards printed and buy a few shillings'-worth of wire and electrical accessories, should be allowed to style himself an electrical engineer?

Some of these men are neither electricians with a knowledge of the science of electricity, nor engineers with the knowledge of engineering as it is known to-day, and yet they are allowed to proclaim themselves to the public at large, by means of printed matter, posters and signboards, newspaper advertisements, etc., as electrical engineers. These men are gulling and robbing the public daily.

These are the class of men who are laying veritable death-traps in the homes and shops of this country by the way in which they are installing wires and fittings that are called electrical installations, which, in hundreds of cases, are a positive danger to the community. These men have no idea of rules and regulations, of earthing, carrying capacities, loading, etc., yet they keep doing the jobs, and these are connected up to supply systems, either public or private; dangerous extensions are also added to otherwise good installations.

A lot of this work has been exposed of late, and more keeps coming to light, but nothing short of national or Government action can stop the dangerous practices that are now being carried out.

The rapid growth of standardised a.c. supply at 230 V is adding daily to the dangers and risks that are being run with the class of work previously hinted at, and it is being carried out by men who have not the remotest right to call themselves by a name that should command the respect of the public generally.

Government Action.

The safeguarding of the electrical contracting industry can, to my mind, only be brought about by Government action, and this could easily be done by the passing of a short Bill, forbidding anyone to carry out electrical wiring work in connection with the equipment of buildings, other than National Registered Electrical Installation Contractors or members of the Electrical Contractors' Association. Steps should also be taken, at the same time, to prevent anyone styling himself an electrical engineer who has not passed some acknowledged examination or proved his fitness for membership of some one or other of our acknowledged electrical associations or institutions.

Every impostor would have to destroy all his printed matter, take down his false and misleading signs, etc., under very heavy penalties, or be liable to imprisonment; thereafter the style "electrical engineer" and (or) "contractor" would mean something which, to-day, it does not.

Further, there are quite a number of extensions to installations carried out by incompetents, such as so-called "handy men," schoolboys, and dabblers in wireless who do not understand anything more about the work they are doing than the fact that wires will carry current from one point to another, if connected up somehow.

During the last few days the writer has come across several

This remarkable example of shoddy wiring is referred to in the accompanying article. The fuses were not fixed, but hung up, being held together by a piece of twisted wire clamped under the covers. The wire on the left is single lead covered. It is badly joined to one flex, but the other flex is simply twisted around the lead covering. Holes near the free end of the lead covered wire show where arcing had occurred. The separate piece illustrated shows the fuse wire for connection to the switch plug.

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dangerous examples. In one case wires were run loose like pieces of string across walls and through doorways, so that the door nipped the wires every time it was closed, and the bare wires were exposed, within reach from a wet stone floor. The tube system for some lights fed by these wires had not been earthed. On the same job about 8 yd. of flexible cord had been used to extend a light for a distance of about 6 ft., and all the spare wire had been wrapped round hooks, screws, nails, etc., all around the walls, to take up the extra length.

An Ironing Point.

Another case was an ironing plug that had been added to an otherwise good installation, carried out on the metal sheathed system. The culprit had got a supply from a d.p. fuseboard and connected up to two 5 A bow cut-outs of a type not approved by the supply authority; then, from the cut-outs, two single pieces of flexible about 1 ft. long had been used to connect up to a single 1/18s metal sheathed wire, one flexible going to the conductor, and the other twisted round the metal sheathing to form part of the circuit.

At the other end of the run the copper conductor had been taken to one side of the switch plug and the metal sheathing had been connected to the other terminal by a piece of 1/18s lead fuse wire twisted round the sheathing several times.

No attempt at earthing, bonding, soldering, or proper jointing had been made, and the cut-outs were hung up with another piece of wire, not fixed to a baseboard by screws.

All the above items constituted extensions to jobs that had already been passed and approved by the supply authority; no notices of extensions are ever given, and the supply authority knows nothing of these dangerous alterations by fools, who ought to be prosecuted as dangerous criminals.

Needless to say, both jobs gave trouble, and the second one burnt itself out and could easily have "fired" the place. Why should this kind of thing be allowed to continue?

Is it beyond the power of the Electricity Commissioners to make a strong recommendation to His Majesty's Government to safeguard the electrical contracting industry and confine electrical wiring and installation work to approved and competent firms, and thus protect the public from the dangers that exist through the shoddy work that is regularly being connected to the supply mains?

To my mind, the time has also arrived when every supply authority should depute some of their inspectors to go round and make an examination and test of all installations now connected to their mains. When any were found (and thousands would be) where such work as I have described has been installed or added to originally sound installations, they should cut off the supply until the defects were remedied, and should, furthermore, insist on the customer making a declaration of the name of the person who did the faulty work, thereafter taking such action as they might deem advisable against such persons.

I, personally, have condemned lots of additions that I have found grafted on to what was my original installation, and in such cases have told the consumers that unless they gave me an undertaking that such additions were disconnected at once, I would report them to the supply authority, with a view to having the supply cut off. In most cases, when the dangers have been pointed out, consumers have had the reinstatement done in a proper manner.

The ever-increasing uses to which electricity is being put at the present time demand that only safe, reliable work be carried out by "authorised" persons or firms, and the protection of electricity consumers from the "dabbler" who is daily laying "fire risks" and "death traps" for the ignorant unsuspecting public.

The "penny wise and pound foolish" policy in connection with electrical installations has gone far enough, and it is high time that very drastic steps were taken by the highest authorities to call a halt. Otherwise fires and inquests will be a far more common occurrence in the future than they have been in the past, although in this enlightened age everything reasonably possible is "supposed" to be done to reduce their number.

DESIGN OF DOMESTIC APPARATUS.

Discussion on Electric Irons, Kettles, Cookers and Other Apparatus—Possibilities of the Electric Washer—Some Views on Hotplates.

IN a paper before the London Local Technical Group of the E.P.E.A. on January 8th, Mr. F. H. H. Bellamy discussed the design of domestic electrical appliances and some of the latest developments, and intimated what he believed would be the trend of future development. Mr. W. J. Oswald presided.

Dealing with electric irons, Mr. Bellamy referred to various types including one having an element consisting of a spiral wound round a heavy non-corrosive material and embedded in solid metal, the element being insulated from the protective metal case by means of magnesium oxide. He illustrated an iron of this type which was thermostatically controlled, and having an indicator fixed in a convenient place under the handle, which may be set at any point, according to the type of material to be ironed. By means of this heat throttle, the proper temperature for every ironing requirement may be maintained. The lower end of the throttle has a lock-nut which raises and lowers the thermostat blade, which latter extends almost the entire length of the iron, is directly connected to the sole plate, and follows the temperature of the sole plate at all times. The blade is made of two pieces of carefully annealed and heat-treated alloy metal. The lower section is made of a metal which expands more readily than the other metal when sujected to heat. As the iron heats, the thermostat blade bends upwards throwing a rocker spring off the centre. To the rocker spring is attached a rocker arm, at the end of which are suspended the contact points. The rocker arm is made of special alloy spring steel, and it is always under tension when the electric contact is made, ensuring a firm positive contact. The rocker arm is designed with a quick make and break. The contact points are well insulated, and in this iron any temperature between 350 and 520 deg. F. may be maintained with accuracy. When the heat falls below the desired temperature, the thermostat blade contracts and bends downwards, re-making the contact.

Protective devices for kettles took several forms. In one type of kettle a switch had been fitted in the connector box, a bearing arm projecting through a slot underneath. This was a very sound practice, because the user was obliged to put the switch to the "on" position before setting the kettle down on the table, to ensure that the current was on, and the kettle itself rested on the arm and kept it in position. When the kettle was tilted, in order to pour the water out, the switch arm was automatically released, and the current switched off. Another type of kettle was fitted with an automatic cut-out which broke the circuit if the kettle was allowed to boil dry.

Still another type of kettle was fitted with a self-regulating automatic safety device, which did not necessitate the replacing of the fuse, etc., should it boil dry.

Cleaners with Floor Polishers.

Dealing with vacuum cleaners, Mr. Bellamy described a type which is now on the market, and with which is supplied, as an additional attachment, a floor-polishing brush, at very little extra cost. The attachment is fitted to the nozzle of the machine, after removing the belt which drives the revolving brush from the armature shaft of the motor, and releasing the brush from its seating in the nozzle, by clipping on to the wheels of the machine two bands attached to the ends of the floor polishing brush.

Mr. Bellamy expressed the view that electricity supply authorities have not given the electric washing machine as much attention as they should have done, no doubt owing to the fact that the quantity of electricity consumed thereby is practically negligible, most of the machines being operated by a ¼ H.P. motor, and used approximately four or five hours per week. In his view, the revolving drum type was not as efficient as the type having a gyrator fitted in the wash tub. The latter was also quicker in operation, and it was significant that most manufacturers were now producing models on these lines. In an average family of six people, the weekly wash can be carried out efficiently in two or three hours.

Stressing the importance of the electric water heating load, Mr. Bellamy said he had heard it stated that it was of even greater value to supply undertakings than the cooker load. The tendency appeared to be in favour of a well-lagged tank with a heater of not more than 700 or 800 W loading, controlled by an automatic switch.

After discussing the various types of electric radiators available, Mr. Bellamy dealt with electric cookers, and in

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emphasising the importance of the cooking load, pointed out that in one particular area last year over 45 per cent. of the total units sold were for heating and cooking; the load curves showed that there was very little difference in the character of the Sunday and week-day station load.

Dealing with the construction of the boiling plates, he said that at the moment the general opinion seemed to favour the totally enclosed type. Discussing enclosed types of boiling plate which have been designed to avoid as far as possible loss of heat by conduction from the element to the utensil, he mentioned one embodying an element consisting of a helical coil of resistance wire surrounded by powdered magnesium oxide within a seamless steel tube, the diameter of the tube being then compressed so that the magnesium oxide becomes very hard. The element was not cast into the top plate itself, but could be run in atmosphere. It would seem, he said, that the solution of the boiling plate problem would be found, not in the totally enclosed or the open type plate, but in a compromise between the two. The type mentioned gave all the advantages of a glowing red hot plate on to which utensils could directly be placed, whilst, at the same time, the element was entirely protected from damage due to foods and liquids boiling over. The tubes in which the elements are sealed are calorised, as the result of which a coating is formed of practically infusible metal, impervious to oxidation, carbon, sulphur, and the products of combustion of all common fuels at actual melting temperatures up to 1 800 deg. F. Even if the coating was removed by severe abrasion, it would be reformed automatically when the bare surface was exposed to heat. A plate of this description, with an effective diameter of 6¾ in., and an area of 35·78 sq. in., with a loading of 1 450 W, boiled three pints of water, from an initial temperature of 50 deg. F., in 15¼ minutes—an efficiency of 48·5 per cent. There were great possibilities with this type of construction.

THE DISCUSSION.

Miss C. HASLETT expressed disappointment that Mr. Bellamy had not referred to dish washing machines, because she was frequently asked whether a perfect dish washing machine had been produced. She also suggested that the design of electric kettles might be improved. The lid on the electric kettle which she used daily had a tendency to fall off when the kettle was tilted, and often the lids were too small. With regard to safety, Miss Haslett advocated the more liberal use of insulating material; for instance, the handles of vacuum cleaners might be better insulated. One of the reasons why washing machines were not used more in this country was that drying was difficult, particularly in small flats, and it was preferred to send the clothes to the laundry.

Mr. W. E. ROGERS stressed the importance of providing really robust material for the connections from the terminal to the internal elements of apparatus, and exhibited a sample of a specially insulated wire made by the Liverpool Cable Co. He said he had placed the end of it into the flame from a blow lamp in order to see if it would burn, and he had also baked it up to red heat for two hours, but the insulation still appeared to be fairly good.

Mr. A. F. HARMER, speaking with regard to vacuum cleaners and the possibilities of users receiving shocks from them, suggested that the safest type was that in which the nozzle was fitted to a rubber tube, so that the user was more or less insulated from the electrical part of the machine. The electricity supply authorities were not so much to blame as had been suggested for lack of development of the use of washing machines, because, especially in some parts of London, very few people did their own washing.

Alderman Mrs. HAMMER complained that manufacturers did not give sufficient instructions to householders as to the proper use of their apparatus. She herself was frequently in trouble through over-oiling her apparatus.

Mr. EDINBOROUGH, referring to the author's remarks on the type of hot plate consisting of an element coiled inside a metal tube and insulated with magnesium oxide powder, suggested that there might be difficulty due to the breathing of the element wire. Naturally, there would be expansion and contraction as the wire was heated and allowed to cool, and he believed the movement of the wire would cause the particles of magnesium oxide to disintegrate, and breakdown would occur. On the other hand, if magnesium oxide crystals were used, the crystals dovetailed into one another. A plate of the latter type, with a load of 2 000 W, had been proved to have an efficiency of 50%, whereas the efficiency of the plate mentioned by Mr. Bellamy, in which magnesium oxide powder was used for insulating, was 45% when loaded to 1 760 W. The plate with the magnesium oxide crystals would boil two pints of water in less than 7 minutes.

Miss READING said she had often been asked if there existed an immersion heater which could be plunged into a bath of water and left there for a certain time until the required temperature was reached. Would it be possible to evolve such a heater?

Mr. DARLING claimed that in respect of the electric oven and the grill we had got the gas industry beaten. The boiling plate was not yet perfect, but progress was being made. With regard to irons and kettles, he urged the necessity for keeping their price down to a reasonable level.

Adaptor Irons.

Miss NORVICK recalled that when in Paris last summer she had visited the flat of a well-known Frenchwoman who was leading a big, women's, domestic movement there, and one of the special innovations in that flat was an adaptor iron described as being popular in France. In some cases there were two irons, so that while one was in use the other was being heated automatically to the correct temperature, and all one had to do, when the temperature of one iron became too low, was to change it for the other iron.

Mr. W. E. ROGERS said that nearly 20 years ago in Marylebone that type of iron was used. The iron was pushed on to live contacts in a shielded chamber, and the arrangement had worked admirably.

Mr. GRAVES suggested that the flexible connections on kettles were cumbersome, and that it might be possible to have bare sprung contacts for kettles, similar to those used in the older type of iron mentioned. It would then be possible to dispense with thermostatic control. With regard to boiling rings, he asked why we should not replace them by a heating element to be placed inside the cooking utensils, as in the case of the element in the kettle.

Mr. SKINNER suggested that it would be more practical if the flex attached to an electric iron entered the iron at the side instead of at the back, to avoid risk of shock to the user in the event of a "short." With regard to heaters, he suggested it was wrong for manufacturers to pay so much attention to the ordinary stove type. A room should not be heated from one point, but from points distributed about the room. With regard to boiling on electric cookers, he suggested that a kettle should be supplied with each cooker as part of the complete unit.

Capt. DURTNALL asked why manufacturers provided for the attainment of such very high temperatures as about 2 000 deg. in electric cooking apparatus; the temperature necessary for cooking was not nearly so high, and he suggested that if more moderate temperatures were attained, the efficiency of the apparatus would be greater.

Mr. THOROGOOD pleaded for the organisation of a domestic electrical exhibition in London which would have electrical apparatus only exhibited. He also suggested that the award of prizes for the best types of apparatus would be valuable, in that it would encourage research in the industry.

Mr. WILLIAM F. ANDREWS described a coating of composition for the bottoms of electric kettles which brought water to the boil more quickly. A 6-pint polished copper kettle boiled in 25 minutes on an ordinary element of about 1 500 W. When coated with a black enamel, which gave it a semi-egg-shell finish, the time was reduced to 19 minutes.

Mr. BRYAN said he had found that a well-lagged 20-gallon water tank with an immersion heater of 500 W would give all the hot water required in the household in the usual way.

Mr. BELLAMY, replying to the discussion, said an immersion heater which could be placed directly in the bath might be dangerous, unless the apparatus were enclosed in some chamber and thoroughly well earthed. With regard to the strain on the flexes of irons, he said there were irons into which the leads entered from the sides, and there were others fitted with a ball socket, so that it would swivel and protect the wire of the flex at the point at which it entered the iron. Generally speaking, the supply authorities recommended that kettles should be supplied with cookers, and this was done in a large number of cases.

The Royal Sanitary Institute has asked Sheffield Corporation to arrange an exhibit showing various forms of electric heating, lighting and power appliances at the Cutlers' Hall, Sheffield, during the annual congress to be held in July. The General Manager of the Electric Supply Department has been instructed to arrange an exhibition at a cost not exceeding £200.

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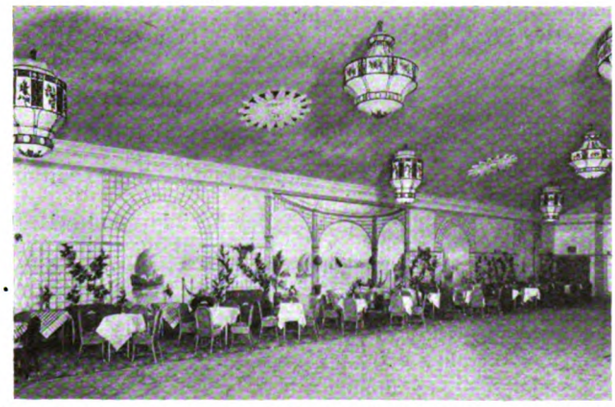
DIFFUSED LIGHTING IN THE BALLROOM.

Cheap and Effective Schemes which Electrical Contractors may Instal—Choice of Coverings for Lamp Shades—Exploiting Possibilities of Colour Lighting.

By AN INSTALLATION ENGINEER.

RAPID strides have been made recently in the lighting of the modern ballroom and cinema, the tendency being to utilise lighting methods which are termed, somewhat loosely perhaps, indirect or concealed lighting. Competition between the older type of building and those newly erected and equipped with all the most up-to-date fittings, however, is very keen, with the result that the older hall has to be brought into line, as far as possible with the new buildings.

The introduction of indirect or concealed lighting involves



Diffused lighting used in the new Rialto ballroom, Liverpool. The decorative scheme of the architects (Gray & Evens, Liverpool) has been carried out in the lighting fittings, of which several shapes are used.

considerable expense in most cases, and the electrical engineer is frequently called in to suggest a method of bringing old buildings more into keeping with modern practice, without the expense associated with an entirely new method. One way of doing this, and in fact the most effective way available, is to use the gigantic lamp shades which are very popular for ballroom lighting at the present time.

With the aid of these large lamp shades, several important advantages are gained. They give a diffused, instead of a direct light: coloured lighting can be employed, in an extraordinarily wide variety of shades; there is an entire absence of naked lights, or "spots."

Owing to the heat which is generated by twenty or more lamps, silk is extremely unsatisfactory as a covering for those shades. The best fabric is a strong, filament-proof calico, which can be treated so as to render it fireproof, and so meet any local by-laws which may have to be complied with. This fabric can be sponged without doing any damage to the shade, so that it can be cleaned regularly. It outlasts silk by two or more years.

When illuminated, this fabric is indistinguishable from silk. It does not require a lining. Parchment or vellum may also be used for covering large lamp shades, but both of these are inclined to buckle with the heat, and in addition to this drawback, they absorb more light than calico. Nacrolaque has been used, but it is difficult, if not impossible, to carry it over curved surfaces.

A diffused light is ideal for a ballroom. Shadowless, free from glare yet giving ample light, soft and kindly to the eye, it is a tremendous improvement on older methods.

Obtaining Colour Effects.

By grouping three colours and white in each shade, some beautiful colour effects can be had. Dimmers are fitted with each colour, and as there are several groups, each consisting of two, four or six shades, it will be realised that there are a great number of colour combinations available. So many, in fact, that in a ballroom of ordinary size, it is possible to have a different combination of colours for every dance, every evening, for a week, without repeating any combination.

The manipulation of the complicated switchboard is becoming somewhat of an art, and operators who can use the combinations with initiative and ingenuity are rare.

The absence of "spots" in the lighting of a ballroom is an effect which is worth striving for. The relief to the eye, once experienced, will fix diffused lighting for ever afterwards in the mind as the ideal way of securing a satisfactory result in the ballroom.

The greatest advantage of the giant lamp shade method, however, lies in the fact that the lighting scheme can be definitely linked up with the decorative scheme. With ordinary methods the architect has had to introduce lighting arrangements as best he could—the source of light in a building had to be provided for, but it was an offence to the eye, a difficulty which for practical reasons, could not be overcome.

By grouping all the lights and enclosing them in a shade, however, the lighting system becomes an artistic triumph instead of an insurmountable difficulty. There is no limit to the size or shape of the shades. They can be made to emphasise the architect's dominant motif; they can be placed in any position; by using appropriate sizes, a low ceiling can be made to appear higher than it really is, or a ballroom can be made to look longer, or shorter than in reality. The architect who plans the building, the furnishing, the decorative scheme, the walls and the ceiling, also decides about the lighting, and the result is one complete whole, as planned and carried out by one and the same artist.

Applied Decoration.

Some type of decoration is usually applied to the shades in the form of stencilled work, or hand painting. The designs are executed in a paint which does not run when the fabric is cleaned, and owing to the varied shapes of the shades, hand painting is more usual than stencils, the latter not being entirely satisfactory on large curved surfaces. The architect also decides what type of decoration is applied, and what colours will be most suitable; for the exterior decoration must not be permitted to interfere with the effect which is to be obtained from the coloured lighting inside the shade.

In view of the luxurious and elaborate ballrooms which are springing up all over the country, a decorative scheme must be correct historically, and architecturally. French styles—Louis XV and Louis XVI—are widely favoured because of the intricate detail which they allow, and for their peculiar appropriateness to the ballroom. With a Louis XV ballroom, the shades can be made in elaborate shapes, and in the decoration full use can be made of the delicate scroll work which is a feature of all the furniture and draperies of the period. The colours of Louis XVI, too, lend themselves to ballroom use, being rose, gold, yellow, ivory and gilt. In the same way, the great English periods are treated. Adam, Hepplewhite and Sheraton "styles" are all ideal for ballroom decoration. Italian, Byzantine, and similar styles are used because of their ornate character and the opportunity they give for display; these periods are perhaps not quite so refined as the English styles mentioned, but nevertheless, they are extremely effective for the purpose.

When the electrical installation engineer is consulted about ballroom lighting, this diffused method ought to be kept in mind. From the electrical point of view, it is perfectly simple. It must be remembered, however, that the fabric of which the shades are made absorbs a good deal of light, and consequently the wattage must not be under-estimated for each shade. In the very large shades, there is a series of rings firmly fixed in the framework, and each ring is fitted with lamp holders for six, ten, twelve or more lamps. There may be four, six or ten rings. The total wattage for each shade is calculated in white lamps; if the total is 1 000 W of white, then there must be at least 2 000 of amber, 3 000 of red and 4 000 of blue, if the colour lighting is going to be correctly proportioned.

Not only should each shade have the colours in those proportions, but each ring should have the proper proportion of white, blue, amber and red lamps; otherwise the shade will not be evenly illuminated for colour lighting.

Where, for financial reasons, a completely new installation cannot be carried out, in this method of lighting results bringing an old building up to date at no great expense, and, in the provinces at least, it is still something of a novelty. The electrical installation engineer who carries out such a scheme will always have an artistic job to which he can refer clients, and he will be able to secure a wide publicity locally, from the fact that the scheme has been carried out by him.

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SHOWROOM RADIO DEMONSTRATIONS.

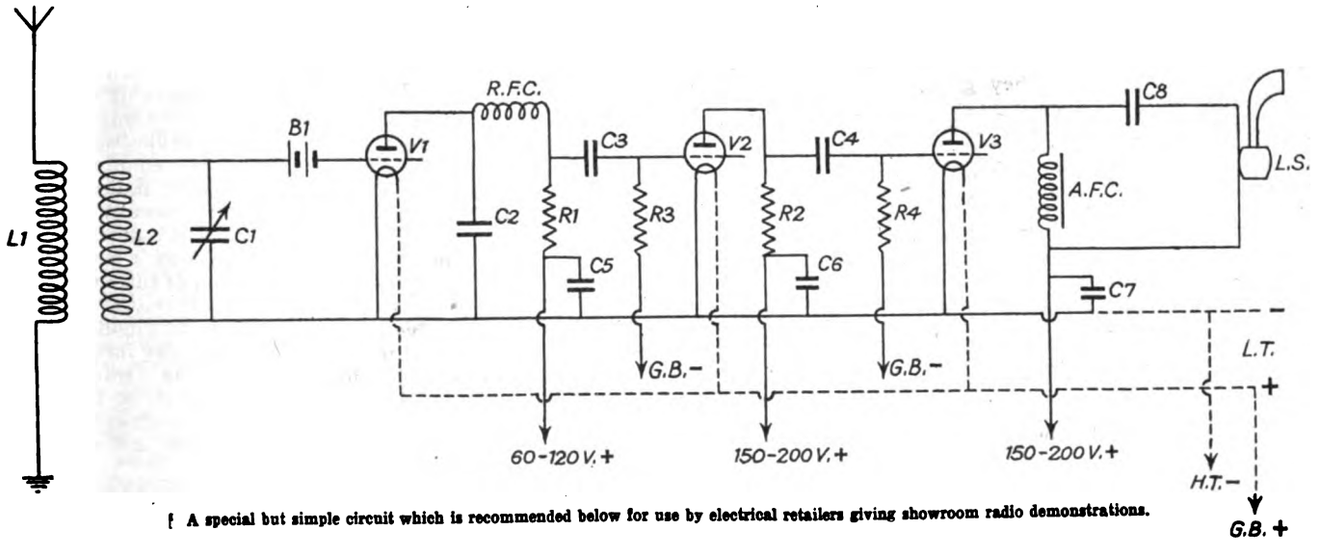
Problem of Securing Good Showroom Reproduction with Ordinary Receiving Sets—A Practical Solution of the Difficulty—Choosing the Loud Speaker.

By A RADIO ENGINEER.

A NOT too critical listener walking near those radio stockists in whose showrooms are given demonstrations during broadcasting hours, is at once impressed by the poorness of quality of most of them. No matter whether it be in London or the provinces, the main object appears to be volume, with little regard to quality and truth of either vocal or musical reproduction.

Of the dangers of such demonstrations, of the losses in sales which result from such unfaithful reproduction little need be said; but of the remedy there is much to say. Demonstrations as given by most showroom attendants are made with the aid of complete receivers of one or the other manufacturers' in conjunction with a cone or moving coil type of loud speaker. Ostensibly, this is the correct procedure, but when it is remembered that the majority of these showrooms are also showrooms for lighting fittings, or are else used with show cases, counters, store cupboards and so on, the acoustics of the room are not conducive to good reproduction with the ordinary type of manufactured receiver.

For showroom demonstration purposes something cleaner and sharper is required, and since, unlike the manufacturers' sets, distance ability may be neglected, the problem is not impossible of solution. After all, the manufacturer is severely handicapped in the matter of receiver design, for he has not only the question of reproduction to consider, but also selectivity, ability to receive foreign stations, a wavelength range up to 3 000 metres, and so on, with the result that the finished article is nothing less than a compromise; an excellent compromise it is true, but nevertheless a compromise. The demonstration of such receivers should therefore be carried out in the home of the prospective purchaser with a temporary indoor or other aerial arrangement, when it will be found that the acoustics of the rooms of the average house are more in keeping with the abilities of the set, and less subject to cause the resonance so prevalent in a showroom.



† A special but simple circuit which is recommended below for use by electrical retailers giving showroom radio demonstrations.

Returning to the latter, the object of giving a lunch-time or other demonstration is generally to attract customers, and for this purpose a special, though extremely simple, circuit should be used. Such a circuit is shown in the drawing above from which it will be understood that three valves are recommended. Four may, of course, be used if desired, but with the volume obtainable with the circuit as given, additional valves are unnecessary.

It will also be seen that reaction is purposely avoided and the reason for this is that every possible cause for distortion shall be eliminated; similarly the grid battery applying potential to the anode rectifier is connected at high potential to earth, the purpose of which is to ensure that the potential is constant, and not subject to a voltage drop as a result of the battery being placed upon a damp bench or other partially earthed object. In the event of this latter happening, the battery will be short-circuited by the earth contact of the accumulator and the earth connection proper. A high resistance earth by comparison with the intentional earth connection perhaps, but still decidedly unfavourable for introduction into the circuit if the best results are desired.

The coils L1 and L2 should, of course, be of such inductance as may be required for the station whose transmission it is intended to use for demonstration purposes. The condenser C1 is of the ordinary type for tuning purposes, of 0·0005 mfd. The valve V1 should be of a high μ value and in its plate circuit in series with the resistance R1 is a radio frequency choke for preventing the high frequency component appearing in the anode circuit from being passed on and amplified by the next valve. Whatever high frequency current may find its way to the anode circuit of the rectifying valve will thus be by-passed by the condenser C2, the capacity of which may be about 0·003 mfd.

The resistance R1 should be of a good robust construction and its ohmic value should be 500 000. The coupling condenser C2 is of a value which experimental results show to be consistent with good volume of all audio frequencies, namely 0·01 mfd,; while the grid leak is of the 2 megohm variety.

The second valve or first amplifier should also have a high μ, while R2, C3, and R4 are of the same value as for V1. The second amplifier V3 should have an impedance of from 4 000 to 6 000 Ω, and for this reason may be one of the many power valves now obtainable. The audio choke calls for no special instruction, save that it should be of good make having an inductance of not less than 80 Henries and should be used with a condenser C4, of 0·01 mfd.

On the subject of loud speakers one could almost pass a multitude of opinions, but for good results consistent with showroom practice, with plenty of volume to overcome traffic noise, and without the possibility of "dithering," it is fairly safe to use one of the moving coil variety. On the other hand, any of the recognised cone makes will also stand up to really loud signals, so long as a cone of ample diameter is chosen. Of the horn type of loud speaker there are, again, many good ones, but for showroom work experience seems to show that the necessarily small diameter air column given by the horn is not suitable for the trying conditions obtaining in most, if not all, showrooms not specially considered from an acoustical point of view. The position of the loud speaker in respect to the remainder of the contents in the showroom is another item of importance, for though few demonstrators appear to recognise the fact, the amount of resonance set up by the sound or air waves with local ornaments, suspending fittings and so on is very considerable, and often mars an otherwise good reproduction.

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PHYSICAL AND OPTICAL EXHIBITION.

Further Review of the Electrical Exhibits—X-Ray Equipment—Current Transformers—Recording Rotational Speed of Machinery—Apparatus for Insulation Testing.

(*Continued from page* 34).

A NUMBER of interesting exhibits were seen on the stand of PHILIPS LAMPS, LTD., including examples of the 220 kV "Metalix" X-ray tube, type "F." This is a convenient high voltage tube for deep therapy and radio-metallography. It has a maximum continuous rating of 880 W and embodies its own protection. The cooling of the anti-cathode is effected by means of a thermo-syphon cooling attachment, the whole forming a compact unit. In view of the increasing popularity of valve rectification for X-ray transformers, a high-tension

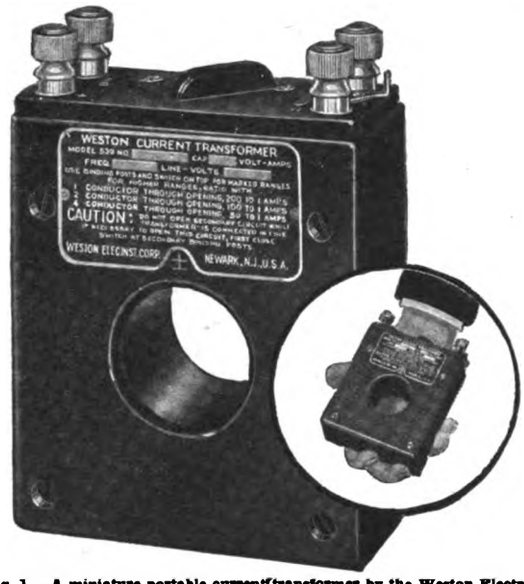

Fig. 1.—A miniature portable current transformer by the Weston Electrical Instrument Co.

valve of a type used by most instrument makers in this country was also shown. Demountable X-ray tubes for pump operation were again shown. These are so designed as to permit the easy insertion of anti-cathodes of different atomic numbers. The body of each tube is composed of a chamber of chromium iron, which alloy possesses the same coefficient of expansion as glass. This permits of a direct glass to metal seal which is vacuum tight. The X-radiation is thus generated entirely within a metal chamber. A screwed union is provided for connection to the pump, whilst the anti-cathode can be removed by unscrewing a nut. Of those displayed, type "A" is arranged with a central window, and is so proportioned that the applied potential is evenly distributed along its length. The central metal portion is, therefore, practically at zero potential, and under favourable conditions may be earthed. The tube has a maximum capacity of 1 kW, i.e., 20 mA. at 50 000 V, r.m.s. Type "B" is only half the overall length of type "A" and is, therefore, only suitable for lower tensions. In this instance, the anti-cathode is arranged at the bottom and may be cooled from the water main, provided that the transformer can be earthed at the anode end. Both types can be supplied with one or three windows as desired. A new form of hot cathode was also on view. Fitted with a Lindemann glass window, this tube emits soft X-rays from 0·8-2 A.U. in wavelength and is constructed for operation at potentials between 8-12 kV. In addition to a wide range of measuring instruments, electroscopes and electrically maintained tuning forks, W. G. PYE AND CO. displayed an X-ray spectrophotogoniometer. This instrument is a combination of a spectrograph and a goniometer for crystal setting, using a collimator and tele-microscope in place of the plate holder and X-ray aperture. All four of these last are readily interchanged and replaced exactly into any definite position. Both half and quarter-plate records may be taken, and there is an attachment for a circular camera. Special attention has been given in the design so that the intensity of the X-ray beam is as strong as possible, so that the extent of adaptability of the apparatus is unimpaired. There is a swinging arm which is so designed that it cannot drop or sag during rotation, and its adjustment is not upset when clamping in any definite position; also, its motion is limited only by the size of the plate holder. Verniers are provided for reading the angle of rotation of both crystal and the swinging arm. The RADIO COMMUNICATION CO., LTD., again showed its wireless direction finding and other nautical equipment, while the RECORD ELECTRICAL CO., LTD., again displayed "Cirscale" measuring instruments. The chief electrical exhibits of SIEMENS BROTHERS AND CO., LTD., were a thermo-electric potentiometer for the measurement of thermo-couple E.M.F.'s, the instrument having five ranges, namely, 7·5, 15, 30, 60 and 75 millivolts; thermo-electric pyrometer stems of various types; thermo-electric pyrometer switchboards and temperature indicators, including one with a 10 in. scale. The principal exhibit of SCHALL AND SON, LTD., was closed-iron core transformer apparatus designed to operate continuously at 90 kV 30 mA. A second item was a transformer designed to operate the filament for a hot cathode rectifying valve, and it may be noted that currents at voltages up to 200 000 may be rectified by this means.

The Codd cell shown by SHIMWELL ALEXANDER AND CO. was of the single fluid type, using ferric chloride as the depolariser, the elements being arranged with the zinc at the bottom of the cell and the carbons depending from the lid. The charge of ferric chloride contains a small amount of inert powder which falls to the bottom of the cell, covering the zinc and acting as a mobile porous septum. The discharge from these cells is extremely constant, the voltage being maintained at a working level till within a few hours of complete exhaustion, and the watt hours are proportionately high. E.M.F. = 1·52 volts. The exhibit consisted of various types of cells suitable for uses in signalling, valve filament heating, railway work, etc., the sizes ranging from 1½ to 6 pints in size, with capacity of from 36 to 144 ampere hours. A small battery of cells having a capacity of 6 ampere hours for h.t. anode current was also shown, together with the cartons containing the necessary recharges.

Electrostatic Voltmeters.

Electrostatic voltmeters in models ranging up to 6 000 V for a.c. and d.c., and up to 15 000 V for a.c. were to be seen on the stand of the STONEBRIDGE ELECTRICAL CO., LTD. These can be made with internal series condenser, as was shown by the instrument exhibited. Between 15 000 V and 120 000 V, external series condensers, preferably combined with protecting fuses, are used for wall mounting. For higher pressures, up to 400 000 V, with multiple ranges, the instruments are built on insulating supports mounted on the floor. Special features are electric distance indicator and electrostatic three-phase earth-detectors. Electric distance indicator or recorder of angular displacement equipment was shown under working conditions. This forms a simple and accurate means of transmitting the position of turbine valves, discharge and throttle valves, switches, automatic discharge apparatus, or any other apparatus having an angular movement. It has a continuous scale and shows any intermediate position. The equipment consists of one transmitting instrument and one receiver instrument, both of the ferro-dynamic type and both exactly balanced electrically. The usual step-resistances of similar equipments are dispensed with.

The exhibits of the WESTON ELECTRICAL INSTRUMENT CO., LTD., included laboratory standard instruments with a 12 in. scale and an accuracy of at least $\frac{1}{10}$th of 1%. Model 5 (exhibited) is a permanent magnet-pivoted moving coil instrument for d.c. circuits only, and is supplied with this accuracy as either voltmeter, ammeter, or volt-ammeter. Model 326 is a dynamometer type that has this same accuracy if used upon d.c. circuits or a.c. of any power factor or frequency up to 133 cycles per sec. These instruments are supplied as ammeters, voltmeters, and wattmeters, and form useful transfer instruments from d.c. to a.c. as they can be checked against a d.c. potentiometer. Standard portable testing instruments with 5¼ in. scales and an accuracy of ½% were also shown. For a.c. testing, a group of dynamometer ammeters, voltmeters, and wattmeters are available that are equally accurate upon d.c. circuits or upon a.c. circuits of any power factor and frequency up to 133 cycles per sec., and can be supplied for frequencies up to 600 and 1 000 cycles per sec. with the same degree of accuracy. A group of smaller portable a.c.

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testing instruments with an accuracy of ½%, and which may also be used on d.c. circuits, is found in Model 432 wattmeters having the same accuracy for the dual service. A further interesting instrument was Model 539 miniature portable current transformer, by the introduction of which it is possible to measure a.c. currents ranging from 0·2 A to 200 A with small instruments. This equipment consists of the Model 539 transformer weighing only 2⅝ lb., having self-contained primary ranges of 2/5/10/20 A with inserted primary ranges of 50/100/200 A—and a miniature a.c. ammeter, Model 528, having a full scale reading of one ampere. The Model 539 has a one-ampere secondary with a secondary burden of 2 volt-amperes maximum. This transformer, in combination with the Model 528 one-ampere instrument, covers a wide and useful range of current measurements. The transformer has an accuracy of 1% on frequencies of 25 to 150 cycles.

Speed Indication.

Another exhibit was the Weston speed indicator, an electrical device for indicating the speed of rotation of any type of revolving machinery. It consists of a magneto or generator that generates a voltage directly proportional to its speed, connected to an indicating instrument, calibrated to indicate revolutions per min., miles per hour, or any other units desired. The magneto is driven from the machine whose speed is to be measured and is connected to the indicating instrument by means of electric cables. The apparatus has no complicated moving parts, is light, occupies little space, and may be easily installed on machines and devices where the use of more bulky and complicated apparatus would be practicable. It follows variations in speed smoothly and without the jumping which sometimes occurs in speed indicators of the mechanical type.

EVERETT EDGCUMBE AND CO., LTD., displayed extra low a.c. ammeters and voltmeters for the measurement of small alternating currents and of low a.c. voltages. The instruments are available in ranges down to 1 mA for full scale deflection, and as voltmeters can be constructed to take as small a current as 0·001 A at full scale deflection. The instruments are dead-beat, the scales are evenly divided, and the indications are independent of frequency up to 2 000 cycles per second or more. "Precision" moving-iron ammeters and voltmeters were also shown, and these can be relied upon to substandard accuracy on a.c. and on d.c., and even at 500 cycles per second the difference is stated to be negligible. The scale is almost evenly divided from 1/10th of the maximum reading upwards. They are made up in the form of single or multi-range portable "precision" instruments, or combined into multi-range testing sets. A special form of moving-iron a.c. switchboard ammeter has been developed, in which the power consumption has been reduced to a fraction of its usual value, without any sacrifice in working forces, dead-beatness, or other desirable characteristics. These instruments are particularly useful in connection with e.h.t. systems where "single-turn" current transformers are involved. The open scale is noteworthy. The Everett-Edgcumbe-Warren master frequency meter, Warren synchronous motors, synchronous time interval meters, protective relays, etc., were also shown. Many of the latter were shown for the first time, and certain of them are specially suitable for use in connection with e.h.t. single turn current transformers, for which purpose the volt ampere consumption of the relays must be reduced to a minimum, consistently with reliability in action. These relays are made for over- and under-current, balanced, directional (reverse) instantaneous and time lag protection.

Sets for Flash Tests.

EVERSHED AND VIGNOLES, LTD., this year exhibited for the first time the "Dionic" salinometer, an electrical instrument operating on the same principle as the "Dionic" water tester, giving the salinity of a solution directly in grains of chlorine per gallon. The "Megger" earth tester, the applications of which have developed considerably during the past year, was again shown, this time with a number of diagrams illustrating typical applications. An interesting use of this instrument, developed during the past year in America, has been its employment as an aid to geological surveyors. A 6 000 V d.c. motor-driven testing equipment was also shown, this being supplied for flash and other high voltage tests. It is understood that several sets have been supplied to manufacturers for the flash test of insulation of parts, and similar motor generators to university and other testing laboratories for cathode ray and other research work. The Midworth distant repeater was exhibited in three patterns, for transmitting "mechanical" information, such as changes of level in reservoirs, for transmitting "electrical" information, such as total load in power stations, and for distant control of power-driven apparatus, all these being shown in operation. Several minor refinements have been incorporated in the transmitter since last year's exhibition. A number of recording instruments—portable and switchboard—were exhibited, in addition to indicating ammeters, voltmeters, etc., of portable and switchboard patterns. FERRANTI, LTD., again showed a range of thermal instruments, the lowest range being 25 mA. Another exhibit was made up of 2½ in. rectifier instruments for power supply frequencies. The lowest ranges are 1·5 mA and 1 V. The low milliampere range is obtained with a low resistance which requires about 0·4 V only. The low range voltmeters are especially suitable for use with filaments of valves, etc., run from a.c., the current for full scale being either 1·5 or 7·5 mA. This current does not vary with the range. The well-known valve testers, instrument transformers, load levellers, portable a.c. voltmeters and standard switchboard instruments were also shown.

Fig. 2.—A hardness testing machine by Wild-Barfield Electric Furnaces, Ltd.

The exhibits of the FOSTER INSTRUMENT CO., LTD., included an automatic signalling system with four-way strip recorder. This apparatus makes four records on one chart from four thermo-couples by means of an automatic commutator having rare-metal incorrodible contacts. The production of the record is by the usual depression mechanism, which is without detrimental effect upon the moving system owing to the incorporation of the "Resilia" spring mounting. In parallel with the recorder circuit there is also an indicator whose connections are changed by the commutator at the same time as the recorder. The indicator is intended to be fixed in a position remote from the recorder. A second synchronised commutator actuates relays whereby lamp signals show above the indicator which particular thermo-couple is connected at the moment. Another interesting instrument was a "dial recorder" resistance thermometer. The stilus of the apparatus at the end of the recording arm is normally out of contact with the chart, and is therefore free to take up its true deflection. It is periodically tapped forward against the carbon paper behind a translucent chart, which is brought thus in contact with the glass door and leaves a dot on the back of the chart, visible on the front.

Hardness Testing Machines.

A Vickers-Pyramid hardness testing machine was shown by WILD-BARFIELD ELECTRIC FURNACES, LTD. This machine is designed to provide a universal test for the hardness of all metals, etc., from lead to the hardest of heat-treated steels. A single scale is used for all work, and the readings are identical with Brinell numerals which have been scientifically corrected for deformation of the steel ball and other inconsistencies. The readings are truly proportional to the hardness at all points on the scale, independently of what load is used for the test. The application, duration, and release of the load are all automatically controlled. An attachment was shown for testing the hardness of gear teeth on the pitch line, and it is claimed that finished work is not damaged by the test. The ZENITH ELECTRIC CO., LTD., displayed a large range of new tubular adjustable rheostats on heat-resisting steel and porcelain tubes, including patterns fitted with several independent sliding contacts, and arranged for bench and switchboard mounting, incorporating a patented end bracket clamp. Adjustable resistances on slate formers, vitreous embedded wire-wound resistances, carbon plate compression rheostats, box and frame type rheostats with radial contact controlling switches, h.t. and l.t. transformers, etc., were also shown.

Accumulators of all types, trickle chargers, dry and inert cells were shown by the FULLER ACCUMULATOR CO., LTD., while GAMBRELL BROS., LTD., exhibited a range of standard condensers, high tension bridges, vibration galvanometers, etc. Among the apparatus shown by ADAM HILGER, LTD., was Dr. Jean Thibaud's X-ray grating spectrograph for the study of soft X-rays, and of the extreme ultra-violet. In this vacuum spectrograph, a ruled grating is placed so that the incident rays fall almost tangentially upon its surface.

(*To be continued.*)

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CORRESPONDENCE.

The Editor welcomes the free expression in these columns of genuine opinion on matters of public interest, although he disclaims responsibility alike for the opinions themselves and the manner of their expression.

The Rating of Electrical Machinery.

[To the Editor.]

Sir,—The article by Mr. Wallace Ford in your issue of December 21st is a useful contribution, calculated to stimulate consideration and discussion of this important question.

The establishment of a common and uniform basis of rating for all electrical machinery is a most desirable object, but is not a simple matter to achieve, especially considering that the ideal aimed at is an international basis.

No one will disagree with the pertinence of the query," Why not retain one arbitrary basis for all machines ? " Mr. Ford's comment, however, that the six ratings endorsed by the B.E.S.A. " do not really represent service conditions," though perhaps literally true, does not quite do justice to the spirit of the new B.E.S.A. rating specifications. In the new Specifications for Electrical Performance of Electrical Machinery and Transformers the different classes of ratings do apparently endeavour to approximate, as far as possible, to the service conditions, so that a purchaser can buy a machine to a B.E.S.A. test rating which represents the service duty of the machine sufficiently well for practical purposes.

Mr. Ford's comments on B.S.S. 171 (Transformers) convey the impression that the Transformer and Motor Specifications cannot be used in conjunction with one another, owing to differences in the basis of rating. This is not really the case. In the Transformer Specification, B.S.S. 171, an attempt has been made (for the first time I believe) to provide for the various classes of rating and co-ordinate them with the continuous maximum rating which is reserved as the main basis of rating.

In the specification there are given (Appendix II, Clause 62) tables of overload durations with the transformer starting cold, which give the necessary information for cases of short time rating ; also tables of sustained overloads after running continuously at B.S. rating (continuous maximum rating), which give the necessary information for load plus overload rating. The latter apply for ambient temperatures of 35 deg. C. and less, which condition lines up with that laid down for the sustained overloads applicable to motors, B.S.S. 168, Clause 72.

The information given in the specification makes it usable both for power station transformers, where the continuous maximum rating is preferable and usual, and for industrial transformers for use in conjunction with motors, rotary converters, etc., where sustained overloads are required ; in fact, it effectively provides for all kinds of service. That this is not apparent on the surface may point to the desirability of preparing a series of explanatory notes (similar to the " Erlauterungen " to the V.D.E. Rules ; but the labour of preparing the specifications themselves has, however, already been great.—I am, etc.,

A. G. Ellis, A.C.G.I., M.I.E.E.,
Chief Engineer, Transformer Dept.,
Metropolitan-Vickers Electrical Co., Ltd.

"American Broadcasting."

[To the Editor.]

Sir,—I cannot refrain from commenting on the paragraph entitled " American Broadcasting," which appeared in The Electrician of November 9th, 1928. I refer particularly to the sentence, " Part and parcel of the daily life of the (American) people it certainly is ; they can never escape the blatant blare of the advertiser on the air, and the individual effort and keen imagination only help to make the Americans long for a broadcasting system as free from the defects of super-showmanship and unwanted advertising, etc."

I believe this sentence is an exaggeration, to say the least. I admit that certain of the less prominent broadcasting stations may at times radiate programmes containing objectionable advertising. This is not true, however, of the large majority of the programmes available to the listener, and it is always possible to escape the blatant blare of the advertiser, in the rare case when it is encountered, by the simple process of turning the dial and tuning in on a station connected to one of the large broadcasting networks (one of the National Broadcasting networks, or the Columbia Broadcasting chain of stations).

There is no power that can compel a person to listen to a programme containing any features, such as advertising, which he thinks objectionable, especially when he can find a less objectionable programme by turning a dial. The competition thus set up has resulted in exceptionally high-grade programmes, especially in the case of those broadcast from one of the large chains of stations referred to above. The only advertising is usually the mere mention, at the beginning and close of the broadcast period, of the name of the commercial firm responsible for the programme.

Of course I am not in a position to compare British with American broadcast programmes. However, I do want to correct the impression that American radio listeners suffer from inescapable and objectionable advertising.—I am, etc.,

87, 28th Street, D. K. Gannett.
Jackson Heights,
New York, U.S.A.,
December 27th, 1928.

"Electrical Fires and Hand Extinguishers."

[To the Editor.]

Sir,—I note Mr. Wilson's communication in your issue of December 28th, and thought it might prove of interest to your readers to know that there has been on the market for the past two years a most efficient powder extinguisher, which does not require any mechanical action whatever, and therefore is more simple in use ; and further can break electrical arcs of many thousands of volts and isolate at its source any incipient outbreak. This extinguisher, moreover, is a British-made article, and though it sells for much less than the Continental article, is equally as reliable on electrical fires.—I am, etc.,

W. H. Hodson.

Bury, Lancs.
January 3rd.

Compulsory Registration.

[To the Editor.]

Sir,—As one of the first contractors to be enrolled by the National Register of Electrical Installation Contractors, I have followed its progress with considerable interest, and careful observation has shown that this purely voluntary scheme has, in the comparatively short time in which it has operated, exerted a not inconsiderable effect upon the installation trade as a whole. While it is admitted that unqualified contractors are still giving trouble, those possessing the necessary qualifications are gradually but surely entering the ranks of the registered contractors. In my opinion it would be preferable for the advocates of compulsory registration to concentrate on " roping in " all the remaining eligible contractors for the National Register. Having done this, the difficulties standing in the way of compulsory registration will be greatly reduced. —I am, etc.,

" Registrician."

Liverpool,
January 12th.

LOOKING BACKWARD.

Death of Michael Faraday's Widow Recalled.

FIFTY years ago, according to The Electrician of January 18th, 1879 :—

Mrs. Sarah Faraday, widow of Michael Faraday, died, aged 79 years.

The danger from the breakage of overhead telegraph wires was being hotly discussed.

Liverpool Town Council decided to promote a Bill making provision for the lighting of the borough by electric light.

The Langham Hotel, London, was giving a trial to an electric lighting system with the Serrin burner, and electricity was proposed as the illuminant for several rooms of the Reform Club.

* * *

Twenty-five years ago, it was recorded in The Electrician, dated January 15th, 1904, that :—

Bristol obtained sanction to a £10 000 loan for " free " wiring.

The Great Northern and City " tube " railway was put into service.

The production of a new kind of glass which largely transmits ultra-violet light was announced from Jena.

Mr. A. C. Cramb was appointed borough electrical engineer of Croydon, in succession to Mr. J. Gray Scott, who left to become general manager of the Hong Kong Electric Traction Co.

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NEWS IN BRIEF.

Shardlow and Fylde Institution Lighting—New Plant at Horsham—Electrical Engineers' Dance—Worcester Electricity Showroom—Okehampton School Lighting—Henley's Effort for the E.T.B.I.

MONDAY, January 7th, was the second anniversary of the inauguration of the Atlantic telephone service.

The Metropolitan Asylums Board is to improve the electric lighting at the Northern Hospital at a cost of £120.

Shardlow Board of Guardians is to obtain tenders for the electric lighting of the institution, including the infirmary.

The Cheltenham technical school authorities intend to instal two or three motors for their engineering workshops at the Lypiatts.

The change of system at Cheltenham has progressed satisfactorily; up to the present 1 050 consumers have been put on the new system.

New generating plant installed at the electricity works of Horsham U.D.C. was formally started on January 1st by Mrs. N. V. Laughton.

Manchester Corporation Rivers Committee has decided to adopt electricity as the motive power for the whole of the Davyholme works and the extensions.

The Borough Electrical Engineer of Cheltenham is making experiments with regard to improving the public lighting in the promenade, and he is to submit estimates to the Electricity Committee.

East Ham Corporation has decided to instal electric pumping machinery at the sewage works, at a cost of £2 750. The Electricity Committee has obtained a site in Church Road for the erection of a sub-station.

Walton-on-Thames U.D.C. has, as a temporary measure, authorised the electrical engineer to purchase bungalow cookers, as and when required, to let them out on hire-purchase at 7d. per week, and to allow consumers to have kettles on hire for 1½d. per week.

Regulations for directing traffic at street corners and other places in Edinburgh where electrical or mechanical traffic control apparatus may be in operation came into force on Tuesday. Fines not exceeding £2 are to be imposed for contraventions of the regulations.

The Electrical Engineers' dance will be held at the Grand Hotel, Harrogate, on February 1st, as a result of which it is hoped to hand a donation to the Benevolent Fund of the I.E.E. Special arrangements have been made for guests wishing to stay the night at the hotel. The hon. sec. is Mr. H. Cecil Fraser, 36, Park Place, Leeds.

Fylde Board of Guardians has decided to enter into an agreement with Preston Corporation for a supply of electricity for the illumination of the poor law institution and offices at Kirkham, to take the place of the existing gas supply, which has been costing £450 per annum. There is to be a fixed annual charge of £250, plus 1d. per kWh.

Automatic traffic control apparatus is to be used experimentally in London. The first installations will probably be erected in about two months' time at the Albert Gate crossing at Knightsbridge and at the junction of Baker Street and Marylebone Road. The three-light method will be used. It is not proposed to dispense with point policemen.

Newcastle-on-Tyne Watch Committee proposes to proceed with the gradual installation of automatic signals for controlling street traffic. Mr. F. J. Crawley, chief constable, estimates that the expenditure of £1 675 upon 53 lights at certain specified points, plus £265 for cost of wiring and installing, would enable 25 police officers to be released from point duty, representing an annual cost to the city of £6 375.

The annual dinner of the Illuminating Engineering Society will be held at the Trocadero Restaurant, London, on February 13th, when Mr. C. C. Paterson, president, will preside. Amongst those who have accepted invitations to be present may be mentioned Lady and Sir Gerald Bellhouse, Mr. J. H. Colquhoun, Lt.-Col. K. Edgcumbe, Sir Joseph Petavel, and Mr. and Mrs. H. T. Tizard.

Worcester Corporation is establishing an electrical showroom in Queen Street, and instituting a system of hire-purchase for wiring of small houses and sale of electrical apparatus on direct cash or hire-purchase terms; a lady demonstrator at a salary of £160 per annum, rising to £200, and two juniors, are to be appointed. The Commissioners are to be asked for sanction for a loan of £4 000 for assisted wiring and purchase of apparatus for sale or hire, and £1 000 for the purchase of other apparatus.

Electric lighting is being adopted at Okehampton Senior School.

Swansea Electricity Committee has obtained a site at Brynsifi for the erection of a sub-station.

The electrical decorations for the Accrington Hospital Ball, on January 11th, were carried out by Mr. A. W. Clegg, borough electrical engineer.

Col. T. C. Ekin, on behalf of the Electricity Commissioners, will hold an inquiry on January 29th into the application of Glasgow Corporation for consent to the extension of its Pinkston tramways power station.

At the Birkenhead Corporation electricity showroom last week, Mr. J. Huxley, of the General Electric Co., Ltd., gave demonstrations of electric cooking apparatus, particularly those styles most suitable for cafés, hotels, restaurants, and baking establishments.

In the Battalion Orders of the 27th A.A. Battalion, R.E. (London Electrical Engineers), it is announced that the Easter Camp has been provisionally fixed to take place at Biggin Hill from March 29th to April 1st. Recruiting has been good for the time of year, and members are urged to keep at it. A Battalion dance will be held at Headquarters, Rochester Row, London, S.W.1, to-morrow, January 19th, commencing at 7.30 p.m.

The informal meeting of the Television Society and the exhibition of members' apparatus which were to have taken place on February 5th, are postponed until the annual general meeting, to take place on March 5th. The next meeting of the society will take place at the Engineers' Club, Coventry Street, London, W.1, on February 5th, at 8 p.m., when Mr. R. R. Poole will read a paper on "Methods of Light Modulation in Receivers."

The Western Union Telegraph Co. announces the introduction, as from January 13th, of a new service for overnight letters of a lengthy nature at greatly reduced rates between Great Britain and Ireland on the one hand and the United States, Canada and Mexico on the other hand. The chargeable prefix "N L T" must be inserted before the address. The charges range from 8s. 4d. to 25s. for a minimum of 50 words, and from 2d. to 6d. for each additional word.

The current issue of "Distribution," published by W. T. Henley's Telegraph Works Co., Ltd., contains the following paragraph: "The price of this issue is sixpence. We do not ask you to send this increased subscription to us, but if you feel you have had sixpennyworth of interest or amusement out of 'Distribution,' you can send your sixpence, or more if you like, to the Editor, who will hand the total received to the Electrical Trades' Benevolent Institution."

At the meeting of the Physical Society at the Imperial College of Science, London, on January 25th, papers will be read by Prof. G. Vernon Boys, F.R.S., on "A Fused Quartz Pendulum Rod for Clocks," by Mr. G. W. Sutton on "A Method for the Determination of the Equivalent Resistance of Air Condensers at High Frequencies," and by Mr. L. Hartshorn on "The Measurement of the Anode Circuit Impedances and Mutual Conductances of Thermionic Valves."

Marconi's Wireless Telegraph Co. announces that the new night letter service at the reduced rate of twopence a word between Great Britain and New York, with corresponding reductions to other places in the United States of America and Mexico, is also available by wireless "Via Marconi." The new service commenced at midnight on Sunday. Under present arrangements telegrams for the new service will have to be handed in at the Marconi Co.'s own offices in London, Liverpool, Manchester and Bradford, but the facilities will shortly be extended to any postal or railway telegraph office.

The Electrical Association for Women announces a course of evening lectures to be given at the E.L.M.A. Lighting Service Bureau on the dates mentioned, at 7 p.m.: "How Electricity is Generated at West Ham," by Mr. F. W. Purse, with Mrs. Ll. B. Atkinson in the chair, on January 29th; "Radio Progress, and its Connection with the Thermionic Valve," by Mr. H. de A. Donisthorpe (General Electric Co.), with Miss A. Tomlinson-Lee in the chair, on February 12th; and "Some Elementary Facts concerning Electric Motors," by Mr. H. Bourne (Hendon Electric Supply Co.), with Miss D. Vaughan presiding, on March 19th.

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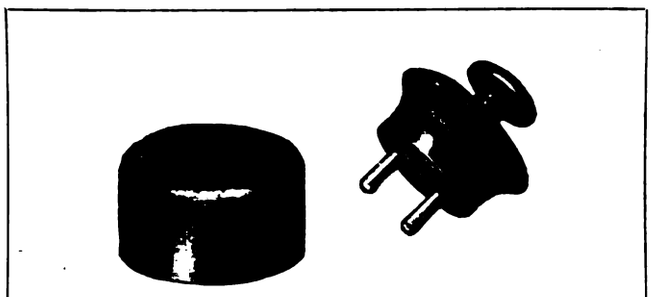
DOMESTIC APPLIANCES AND FITTINGS.

A Neat Socket and Plug with Rotatable Hand Shield—Removable Fire Elements—Self-regulating Safety Kettles—A New Cooking Cabinet.

IN order to meet a widely expressed demand for a 5 A wall socket and plug of somewhat smaller dimensions than the usual type, the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C., has placed on the market an attractive accessory which complies in all respects with British Standard Specification No. 73/1927, and which will undoubtedly appeal to both installation engineers and users. The socket is designed to supersede the company's



A new 5 A socket and plug by the General Electric Co., Ltd.

5 A socket, which measured 2⅛ in. dia. by 1⅛ in. projection. By a rearrangement of the socket tubes and terminals the new socket, which consists of English vitreous porcelain with polished bakelite drop-on cover, measures only 1 11/16 in. dia. by ⅞ in. projection, this result being achieved without sacrifice of material necessary for perfect insulation of the metal components. The new socket has a much neater appearance than its predecessor, with a perfectly smooth surface devoid of dust-collecting ridges. The plug used in conjunction with the socket is also an improved type. Its chief features are (1) solid hexagonal terminals and circular pins (turned from the hexagonal bar); (2) terminals bedded in recesses moulded into the bakelite disc (replacing the orthodox fibre disc); and (3) a Home Office pattern hand shield top which can be rotated to four positions, for reception of the disc, and therefore allows for any one of five different sizes of flexible to be connected and gripped externally between the disc and cover.

"Alto" Electric Fires.

The WHOLESALE FITTINGS CO., LTD., 23/37, Commercial Street, London, E.1, has sent us particulars of the "Alto" range of electric fires. These are made in a variety of designs including a highly ornamental model with four removable elements. Each of these latter is rated at 750 W, and switches are provided so that one, two, three or four elements may be used as desired. Other models incorporate one or two similar elements with separate switches, while still others of different external appearance incorporate three elements. A special point of interest concerning these fires is in connection with the removable elements. These are made with single split pin plugs mounted at the ends of each element bar, and by means of a slight pull both element and guard can be removed for replacement or cleaning. A semi-circular fire with four elements, each of 750 W, is also made by the Wholesale Fittings Co. This is again fitted with separate switching, and is finished in oxidised copper or silver as desired.

METRO-VICK SUPPLIES, LTD., 155, Charing Cross Road, London, W.C.2, has introduced a self-regulating electric automatic safety kettle for use on standard voltages. The appliance is fitted with three heating elements, each of 350 W. One of them is permanently connected to the terminals of the kettle, while the other two are connected to the main terminals through the medium of a small mercury switch of 10 A capacity. This switch is of a standard type and makes or breaks the current when tilted one way or the other. The switch is mounted by means of a spring clip on a helical spring made of bi-metal strip about ¼ in. wide, and having half its thickness made of brass and the other half of an alloy, which does not expand under heat. Such metal, when heated, bends with the brass side outwards, and when wound into a spring, as in this particular case, the spring tends to uncoil itself when heat is applied. The use of bi-metal in a spring in this way is patented. The mercury switch is so mounted on the free end of the bi-metal spring that the rotation of this end tilts the switch into the "on" or "off" position. The other end of the spring is fixed in a tube, which is capable of rotation (for adjusting purposes) in an outer tube, which projects into the kettle near the bottom. As the water in the kettle gets hotter, the spring uncoils itself slightly, the free end rotating in a clockwise direction. The adjusting lever is set so that just before the water boils the mercury switch breaks contact, leaving only one element in circuit, which is sufficient to keep the kettle boiling gently. If the kettle is switched off and allowed to cool down, or is refilled with cold water, the spring coils itself up again, causing the free end to rotate in an anti-clockwise direction, thus tilting the switch the other way and making contact again. The spring itself is strong enough to render it difficult to force the free end round by hand more than one eighth of a turn. Hence the device is robust and positive in action. By mounting the mercury switch directly on the spring there is no appreciable friction, and the switch is cushioned against any shocks such as might be sustained if the kettle were dropped. This, it is claimed, makes it possible to adjust the device so that it will cut out regularly at 99 deg. C.

Setting of Cut-out.

All kettles are set to cut out at 97–98 deg. C. when filled within an inch of the top. When the kettle is used, say, half full, the cut-out will take place about 40 seconds after it has come to the boil. This does not matter, as it cannot possibly boil over with so little water in it. Of course when the kettle is full the cut-out will take place a few seconds before it comes to the boil, and the heater element remaining in circuit is sufficient to bring it gently to the boil and keep it there.

We have received from GEORGE H. SCHOLES AND CO., LTD.,

The No. 46 cooking cabinet, by the Jackson Electric Stove Co.

Blantyre Street, Hulme, Manchester details of the "Wylex" switch plug. These plugs are made of bakelite throughout, and are so designed that they will take a large three-core flexible without cutting away, or a small twin flexible. In the case of the 7/10 and 15 A plug the cord grip will cover any superfluous space. In those plugs for the latter capacities flat contacts are fitted. There are four types of switch plug and three sizes in each, thus, surface pattern, 7/10, 15 and 15/25 A; sunk, ironclad and flush types in similar

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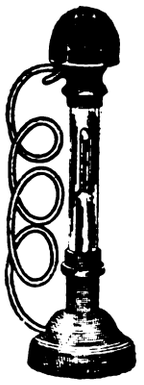
capacities. The same company also manufactures a fuse plug with 7/10 A capacity. The fuse, which is the "Slydlock" type, is fitted in the socket and is easily replaceable. Its purpose is to enable a socket to be fitted where it is most convenient, a loop being taken from the nearest radiator plug, thereby dispensing with trailing flexibles across the floor.

The new Jackson cooking cabinet, illustrated on page 68, which has just been produced by the JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, London, S.W.1, possesses several features of interest, notably the placing of the hob and oven top on one level, an arrangement which is claimed to give greater hob space than on any other "table" model yet produced. The cooker is strongly constructed in cast iron and steel, and the oven, in common with all the new series of Jackson cookers, is constructed in one piece, and all corners are rounded. The oven interior is vitreous enamelled throughout. The cooker can be supplied with all external parts in white and mottled grey vitreous enamel finish. The oven is of the same size as the No. 56, i.e., cooking space 15½ in. high by 13½ in. wide by 15½ in. deep, and a hot cupboard approximately 22½ in. wide by 17 in. deep by 8 in. high. The hob is fitted with two No. 86 hotplates, and a grill 10½ in. by 8 in. The hotplates are loaded to 1·5 kW each, and the grill 1·8 kW. The loading of the hot-cupboard is 500W. The elements are controlled by three-heat switches mounted in the front of the range, and each circuit is fused. The overall dimensions are: Width, 48 in.; depth, 23½ in.; and height, 37 in. without the splashplate.



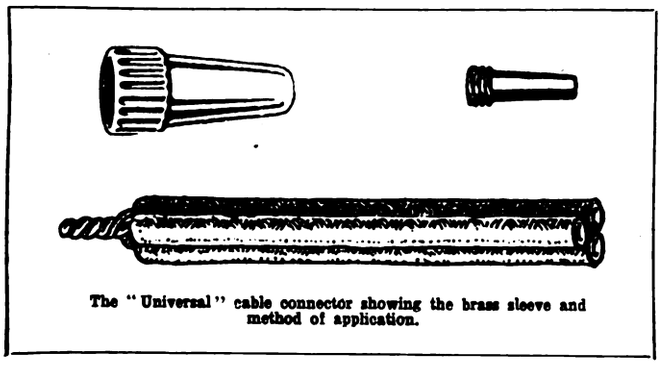
The "Break-not" hydrometer, by F. J. Gordon and Co.

An interesting radio line is the "Break-Not" hydrometer, for which FREDERICK J. GORDON AND CO., LTD., 92, Charlotte Street, London, W.1, have just been appointed sole British agents. This appliance stands only 7½ in. high, and is protected against breakage should it be dropped. It is a useful appliance for testing radio or automobile batteries *in situ*, as well as in the shop or service station. The instrument retails at 7s. 6d.

The ELECTRIC HEATING CO., George Street, Croydon, have just put on the market a complete range of "Elect" polishing irons, from 3 lb. up to 7 lb. in weight. The finish is in nickel plate, highly polished, and the demand, we understand, is already very brisk. The "Elect" ambulance urn made for service in Red Cross stations, private surgeries and hospitals, is of stout copper, highly polished, the loading being a steady 24-hour service of water.

New Cable Connector.

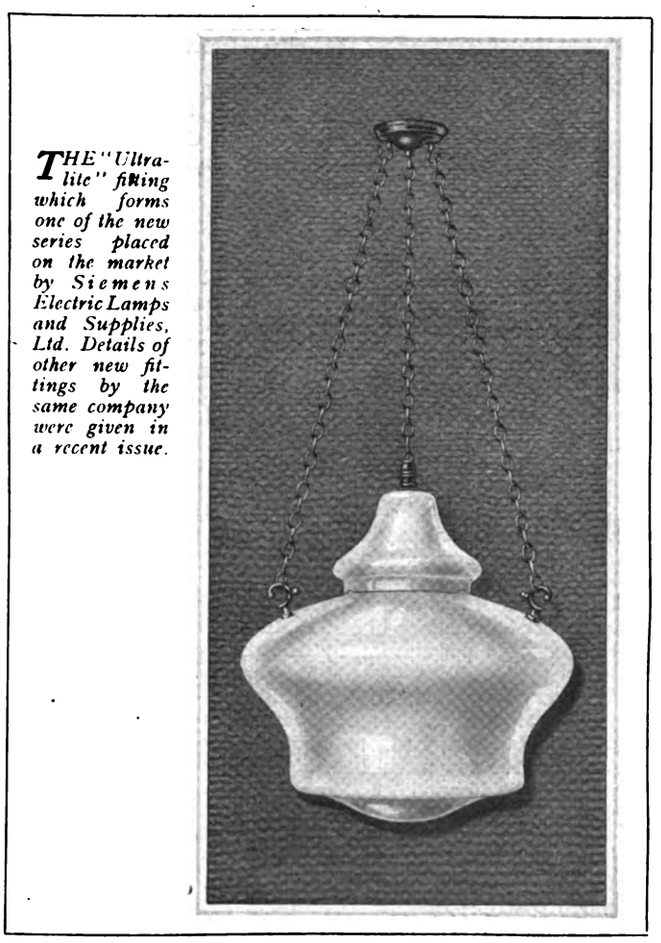
We illustrate below the "Universal" cable connector which is being marketed by Messrs. HUGO SCHLEPER, 4, Bloomsbury Square, London, W.C.1. For connecting wires



The "Universal" cable connector showing the brass sleeve and method of application.

without soldering or other troublesome means, this connector serves a useful purpose. The device consists of a conical porcelain cover threaded inside, containing a conical brass sleeve which is threaded inside and out. The wires to be joined are bared and twisted together, then trimmed to length. The complete connector is then screwed on to the twisted wires by hand and the connection is complete. The connector cuts a thread on the wires, thus giving a perfect grip. The connector can be removed and used again if required. There are four sizes of connector for wires from 1/044 to 7/036, but each size will take from two to four pieces of the appropriate size of wire.

An addition to the already extensive range of valves marketed by the GENERAL ELECTRIC CO., LTD., of Magnet House, Kingsway, W.C.2, is the Point 8 group, consisting (at present) of the H. Point 8, HL. Point 8 and P. Point 8. These



THE "Ultra-lite" fitting which forms one of the new series placed on the market by Siemens Electric Lamps and Supplies, Ltd. Details of other new fittings by the same company were given in a recent issue.

valves have rather unusual filament characteristics, the voltage being of 0·8 V and the current 0·8 A. It has been found that a short thick filament with these characteristics can be supplied with a.c. direct from the mains through a suitable step-down transformer. Unlike the "K" valves, which have indirectly-heated filaments, the Point 8 valves resemble ordinary accumulator-fed valves, inasmuch as the heated element is also the electron-emitter. The H. Point 8 valve is suitable for use with a resistance-capacity coupling in its anode circuit; the HL. Point 8 is a general-purpose valve, while the P. Point 8 is intended for use as a low-frequency valve. With a.c. mains of a reasonably good wave form, the HL. Point 8 may also be used as an anode bend rectifier with success. (Leaky grid rectification should not be employed with these directly heated valves.) The only departure from general practice in such a combination is in the grid-return connections. Thus, whereas gb+ and h.t.− are usually connected to l.t.−, in the Point 8 circuit g.b.+ and h.t.− must be taken to the slider of a low resistance potentiometer, the winding of which is shunted across the 0·8 V filament transformer. Another point of difference is the necessity for filament leads of sufficient thickness to carry the total filament a.c., which, in a three valve set with all Point 8 valves, amounts to 2·4 A.

BRITISH INSULATED CABLES, LTD., Prescot, have published leaflet P. 243 dealing with single-phase meters. P. 221 has been withdrawn.

A price list of receivers, h.t. supply units, loud speakers, battery chargers, and all radio components has been published by PHILIPS LAMPS, LTD., 145, Charing Cross Road, W.C.2. The same firm has also issued new leaflets dealing with trickle chargers, cone loud speakers, and electrical pick-ups.

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PERSONAL.

MR. T. Smalley has been appointed manager of the Barrow-in-Furness tramways and omnibus undertaking.

Mr. H. Ford has been appointed manager of the Kirkwall electricity undertaking, in succession to Mr. W. C. Roy.

Mr. J. N. Waite, hitherto deputy city electrical engineer, Hull, took up his new duties as city electrical engineer on Monday.

Mr. A. J. Macphail, recipient of a long service medal from British Insulated Cables.

Mr. R. L. Horsfield has arrived in Leeds, to take up the management of the Corporation tramways and omnibus undertakings.

Hull Electricity Committee has recommended the appointment of Mr. E. H. Taylor, at present employed as assistant shift engineer, as charge engineer.

Mr. S. R. Mullard, chairman and managing director of the Mullard Radio Valve Co., has joined the board of Everlite, Ltd., the subsidiary of the Metropole Gramophone Co.

Mr. D. E. Bell, manager of St. Helens Corporation Tramways, has been appointed to succeed Major F. J. Chapple, as manager of the Yorkshire (Woollen District) Electric Tramways, Ltd.

Middlesbrough Gas and Electricity Committee recommends an increase of the salary of Mr. R. H. Scotson, electrical engineer, from £750 per annum, by annual increments of £50, to £1 000.

Mr. Mervyn Saunderson, second assistant engineer with the Manx Electric Railway Co., Ltd., has accepted an appointment with John Jackson, Ltd., as electrical engineer on the construction of the new naval base at Singapore.

At Brierfield Council, on December 13th, Mr. G. F. Naylor, Nelson Electrical Engineer, was appointed consulting engineer for the electricity conversion scheme at a fee of £150. He was asked to present his scheme at an early date.

Major F. J. Chapple, formerly manager of the Yorkshire (Woollen District) Electric Tramways, who is leaving to take up a position at Harrogate, was recently presented by the Woollen District tramway employees with a bookcase, dinner wagon and clock.

Bedwellty U.D.C. has fixed the salary of the electrical engineer, Mr. Ben Jones, at £425 per annum. This was the commencing salary when Mr. Jones became electrical engineer about 12 months ago, but the figure was reduced to £371 a month ago, in accordance with the general policy of the Council.

Mr. W. F. Vinehill, of the staff of the Tunbridge Wells Corporation Electricity Works, who has obtained an appointment at the Coventry city power station, has been presented by his colleagues with a hide suit case. The presentation was made on November 30th by the chief engineer, Mr. R. N. Torpy.

With the approval of His Majesty's Government, which has consulted the other Governments represented at the Imperial Wireless and Cable Conference, 1928, the boards of the Eastern and Associated Telegraph companies have nominated Sir Basil Phillott Blackett and the Earl of Clarendon to be chairman and a director, respectively, of the proposed Communications Company.

Members of the staff of the Bristol Electricity Department held a social last week, to mark the retirement of Mr. F. W. Prosser from the position of secretary and sales manager. In the absence, through illness, of the chief engineer and general manager (Mr. H. Faraday Proctor), Mr. A. J. Newman, deputy general manager, presented Mr. Prosser with a pedestal desk and tea trolley.

At the Prescot works of British Insulated Cables, Ltd., 463 employees have put in over 20 years' continuous service, and of this number 75 have had over 30 years. On January 11th a presentation of long service medals was made by Mr. Dane Sinclair and Mr. G. H. Nisbett. It is interesting to note that Mr. Nisbett, Mr. W. Kerfoot, Col. Bates, Mr. A. J. Macphail, Mr. Wolburn, Mr. Nash, Mr. J. L. Packer, and Miss A. Bradbury have all had more than 30 years' service. The above number only applies to the Prescot works of the company, the total number of medals being 813 (see page 77).

MR. JOHN LEE.

An Appreciation by Sir Charles Bright.

WE are glad to publish the following appreciation of the late Mr. John Lee, by Sir Charles Bright. Mr. Lee's death was recorded in our issue of January 4th.

"For a man who started life from the lowest rung of the ladder, to reach the position he did with H.M. Post Office naturally implies much. But had John Lee been spared to us, he would undoubtedly have achieved a great deal more, for he was an essentially stirring personality of a remarkable outstanding character.

"His industry, ability and imagination were all of an immense order—especially in the matter of organisation. Probably his undoing for this life was that he could never spare himself properly—despite doctors' warnings—owing to a profound enthusiasm for work.

"With a rare gift of sympathy, he naturally made countless friends amongst all classes in various walks of life. Those who attended the crowded memorial service in his honour had striking evidence of the real affection, as well as admiration, that he had commanded.

"As an instance of John Lee's wide sympathies, coupled with an innate desire to make himself acquainted with all his subordinates, I may, perhaps, mention that whilst Postmaster at Belfast he was, I understand, in the habit of exchanging a kindly word, even with the messenger boys.

"In John Lee we had a truly remarkable man, such as was by nature peculiarly well adapted to presiding at International Telegraph Conferences. Again, there cannot be many high officials who would take the infinite pains that he took in showing visitors over the Central Telegraph Office at St. Martin's-le-Grand.

"John Lee was also an admirable example of the good work that a layman can do as a Christian Churchman. Many will wish to keep him vividly in mind. His memory will always be worth cherishing as an example of everything that is good."

OBITUARY.

MR. GEORGE T. BAKER, in London, on January 10th, aged 59 years. Mr. G. T. Baker was for many years London representative of Messrs. J. H. Tucker and Co., Ltd. He first became associated with the electrical industry in the early days, with Messrs. Woodhouse and Rawson, with whom he remained for several years. He joined Messrs. J. H. Tucker and Co., Ltd., about 35 years ago, and has represented them in London ever since. He was widely known in London electrical trade circles, where his genial personality and unfailing kindliness will be sadly missed, especially among the older school of contractors. Mr. Baker, who had suffered from an internal complaint during the last three months, is survived by his widow and three sons. The funeral was at Forest Hill Cemetery on Tuesday.

The late Mr. G. T. Baker, of J. H. Tucker & Co.

MR. FRANK HARRY BASTIN, of F. H. Bastin and Son, electrical contractors, Cheltenham on December 14th.

M. LOUIS POULAINE, aged 63 years. He was vice-director of the International Telegraphic Union, Berne.

MR. DAVID FULTON, at Monte Video. He played a prominent part in the transfer of the National Telephone Co. to the Post Office.

MR. FREDERICK RICHARD EDWARDS, aged 50 years. He was in business in London Road, St. Albans, trading under the style of the Herts Electrical Co.

MR. FREDERICK TUNBRIDGE, who, among many other business activities, was associated with the Reading Radio Supplies. He was one of the best-known Freemasons in Berkshire.

MR. ABRAHAM EDWARD GODRICH, aged 64 years. He was for many years actively identified with the public life of Aston. He was a member of the District Council, and subsequently served on the Aston Town Council, being chairman of the Electricity Committee. He continued his membership of the Council until the borough was absorbed by Birmingham.

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THE SOCIAL SIDE.

THE Badminton Section of the G.E.C. Social Club held their annual dance in the Lecture Room at Magnet House on December 21st, when there was a large attendance.

On January 4th, the A.T.M. (Automatic Telephone Mfg. Co.) Male Voice Choir acted as hosts to a party of over 300 of the poorest children in the Fairfield district of Liverpool. In the Strowger works canteen was a giant Christmas tree, and here a substantial meal was served, followed by an entertainment.

The sixth annual G.E.C. Junior Social was held in the Lecture Hall at Magnet House, London, on January 4th, when over 200 members of the junior staff were entertained by the directors. Mr. J. Y. Fletcher and Mr. L. C. Gamage, directors of the G.E.C., were present, and Mrs. L. C. Gamage presented prizes to the best dancers of the evening.

At the annual dinner of the Western Centre of the Institution of Electrical Engineers at Bristol, on Monday, with Mr. W. J. Bache in the chair, Mr. Frank Hodges said the Institution had now 13 000 members. It had the good fortune to be assisted by an industry which had a phenomenal growth. Lt.-Col. K. Edgcumbe, in reply, said he thought the phenomenal growth of the Institution came from the local centres.

ELECTRICAL WOMEN.

THE Electrical Association for Women (London) paid the last visit of the season on December 17th, when a party of nearly 40 members visited the new showrooms of the Battersea Electricity Department. Members were received by Mr. Thompson, the deputy engineer, in the absence of Mr. Bond, and were conducted round the showrooms by Mr. Howell.

The spring programme of the Electrical Association for Women includes a visit to Messrs. Troughton and Young's showrooms and a short lecture by Mr. A. B. Read on "Modern Decorative Lighting of Interiors," on January 23rd; a Social Sub-Committee Special "At Home" at 46, Kensington Court, London, W.8, on January 30th; a visit to the School of Cookery, 20, Soho Square, London, W.1, with a lecture demonstration on "A Five-Course Dinner" by Miss Mabel Collins, on February 7th: a visit to the Singer Sewing Machine Co., Ltd., 159, Great Portland Street, London, W.1, on February 19th; a Social Sub-Committee "At Home" at Kensington Court on March 6th; a visit to the Ideal Home Exhibition, Olympia (by invitation of the British Thomson-Houston Co., Ltd.) on March 13th, and a luncheon at the Hotel Cecil under the presidency of Mrs. Wilfrid Ashley (President), Sir John Snell and Lt.-Col. K. Edgcumbe, being amongst the speakers. The luncheon will be followed by a visit to the works of Belling and Co.

Mr. Bernard C. Holding, Editor of THE ELECTRICIAN lectured on "Electricity in the Home: the Labour Saver and Comfort Bringer" to members of the Rugby Branch of the Electrical Association for Women, at a meeting at the Percival Guildhouse, Rugby, on January 9th.

INSTITUTION OF ELECTRICAL ENGINEERS.

The following candidates passed the Associate Membership Examination of the Institution of Electrical Engineers held in November, 1928.—Whole Examination: Messrs. C. Anderson, J. F. Bagnall, P. C. Bahree, R. Baldwin, R. W. C. Byrne, K. Chand, S. N. Chowla, G. A. Cladingbowl, J. A. Croucher, T. J. Crews, J. F. Dunn, F. Edmondson, I. Elkins, W. Fegan, L. G. Folipes, E. M. B. Ghosh, F. Ingham, E. H. Jordan, P. N. Kanwar, J. B. Kilshaw, W. L. King, A. A. Komarow, S. M. Lejeune, F. W. M. Lewis, J. D. T. McEwan, B. S. Mahal, A. D. Matthews, O. J. Mayo, R. G. Millard, A. R. Page, H. Roberts, B. L. Sabherwal, H. S. Saville, P. Shearer, Iqbal Singh, G. C. Smith, J. R. P. Smith, C. Tetley, F. G. Ticehurst, E. H. Van Meeteren, A. H. Venables, H. W. G. Westlake, S. C. Whaite, A. T. Witts. (This list includes candidates who are exempt from, or who have previously passed, a part of the examination, and have now passed in the remaining subjects.) The following passed Part I only: Messrs. E. D. R. Bell, O. P. Bhasin, J. S. Boyce, A. E. Clifford, A. C. Gosain, D. S. N. Khosla, M. Matchett, W. L. Muir, M. P. Nicholson, H. C. Sahgal, Chattar Singh, B. S. Sood, and J. K. Summerfield. Passed Part II only: Messrs. W. Kidd and B. A. Munford. Success in this examination does not of itself constitute the candidate an Associate Member of the Institution. Further results relating to candidates who sat for the examination abroad will be published later.

OVERSEAS TRADE.

Exports of Electrical Goods during 1928 Exceed Imports by £11 898 866.

ELECTRICAL machinery, apparatus and materials exported from this country in December, 1928, were valued at £1 435 438, and the figure for December, 1927, was £1 471 799, so that last month showed a decrease of £36 361. For the whole of 1928 the value of exports of the same classes of goods produced in the United Kingdom was £18 333 623, compared with £18 589 092 for 1927, decrease £255 469.

Imports of electrical goods in December, 1928, were valued at £617 865, an increase of £25 740 over December, 1927, and for the whole of 1928 imports of similar goods also show an increase over the year 1927, amounting in this case to £579 574. The exports in December, 1928, exceeded the imports by £817 573, and for the whole of 1928 the excess of exports over imports was £11 898 866. Of the increase in imports during 1928, submarine telegraph or telephone cables accounted for £5 877, and telegraph and telephone instruments and apparatus for £239 388, while carbons increased by £34 302, and unenumerated electrical goods and apparatus by £178 531. Exports of motors and generators, other than railway and tramway, for 1928, increased by £91 330, submarine telegraph and telephone cables by £82 303, and unenumerated electrical goods and apparatus by £194 167. Details for December, 1928, and for the whole year are given below :—

	Month of December,		Twelve Months.	
	1927.	1928.	1927.	1928.
IMPORTS.	£	£	£	£
Electrical Machinery	146 900	150 373	1 598 350	1 723 422
Electric Wires and Cables, Insulated—				
Rubber insulated (not being Telegraph or Telephone Wires or Cables)	13 325	22 654	131 925	195 428
Insulation other than Rubber (not being Telegraph or Telephone Wires or Cables)	55 046	52 011	608 296	600 357
Telegraph and Telephone Wires and Cables (not being Submarine Cables)	11 708	6 698	108 679	71 917
Submarine Telegraph and Telephone Cables	—	5 950	73	5 950
Telegraph and Telephone Instruments and Apparatus (except wireless valves)	59 975	104 321	487 468	726 856
Carbons, Electric	9 433	9 863	94 037	128 339
Electric Lamps and parts thereof—				
Electric Glow Lamps	57 886	22 695	435 370	424 968
Arc Lamps and Electric Searchlights	337	398	8 255	6 493
Parts thereof (except Carbon Rods)	4 023	2 120	29 216	30 741
Batteries and Accumulators (including parts)	79 937	80 248	746 620	742 687
Electrical Instruments (other than telegraphic and telephonic): Commercial (including ammeters, voltmeters, etc.), House Service Meters, and Scientific	29 136	24 232	288 182	279 866
Switchboards, other than Telegraph and Telephone	72	154	1 252	1 742
Electrical Goods and Apparatus, all other Sorts	124 347	139 148	1 317 460	1 495 991
Total of Electrical Goods and Apparatus	592 125	617 865	5 855 183	6 434 757
EXPORTS.	£	£	£	£
Electrical Machinery—				
Railway and Tramway Motors	8 100	16 986	495 159	475 191
Other Motors and Generators	197 038	186 377	2 353 626	2 114 956
All other Sorts	283 110	309 411	3 862 032	3 784 337
Electric Wires and Cables, Insulated—				
Rubber Insulated (not being Telegraph or Telephone Wires or Cables)	123 965	117 126	1 448 459	1 403 186
Insulation other than Rubber (not being Telegraph or Telephone Wires or Cables)	114 031	104 323	1 581 698	1 464 828
Telegraph and Telephone Wires and Cables (not being Submarine Cables)	69 770	56 591	954 772	855 418
Submarine Telegraph and Telephone Cables	17 977	51 137	547 998	630 301
Telegraph and Telephone Instruments and Apparatus (except wireless valves)	274 733	213 073	2 677 712	2 623 620
Carbons, Electric	617	411	24 482	13 720
Electric Lamps and Parts—				
Electric Glow Lamps	54 019	47 382	593 274	532 586
Arc Lamps and Electric Searchlights	1 058	1 475	13 466	13 396
Parts thereof (except Carbon Rods)	142	658	5 998	7 645
Batteries and Accumulators (including parts)	89 599	85 904	1 233 668	1 091 015
Electrical Instruments (other than Telegraphic and Telephonic): Commercial (including Ammeters, Voltmeters, etc.), House Service Meters and Scientific	33 488	22 100	374 181	378 351
Switchboards, other than Telegraph and Telephone	7 854	5 717	74 524	72 857
Electrical Goods and Apparatus, all other Sorts	196 268	216 767	2 348 013	2 512 210
Total of Electrical Goods and Apparatus	1 471 799	1 435 138	18 589 092	18 333 623

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BUSINESS ITEMS.

THE business which bears the name of the late Mr. C. O. CLARK will be continued by the same staff, with Mr. M. F. Clark as principal.

OXFORD RADIO SUPPLIES, LTD., 29, Queen Street, Oxford, are giving daily demonstrations of the Fultograph.

HARWELL, LTD., announce that they have changed their address to the Sessions House, Clerkenwell Green, London, E.C.1.

Mr. W. R. AMOS, electrical and radio engineer, of Stratford-on-Avon, has removed his business to 37, Wood Street, as from December 7th.

A fire occurred at the establishment of FLEETWOOD ACCUMULATOR SERVICE (owned by Mr. J. Leadbetter) on January 9th. Fortunately the damage was not considerable.

At a meeting of the wireless and electrical engineers at Ramsgate on January 8th, it was decided to form a local branch of the WIRELESS RETAILERS' ASSOCIATION OF GREAT BRITAIN.

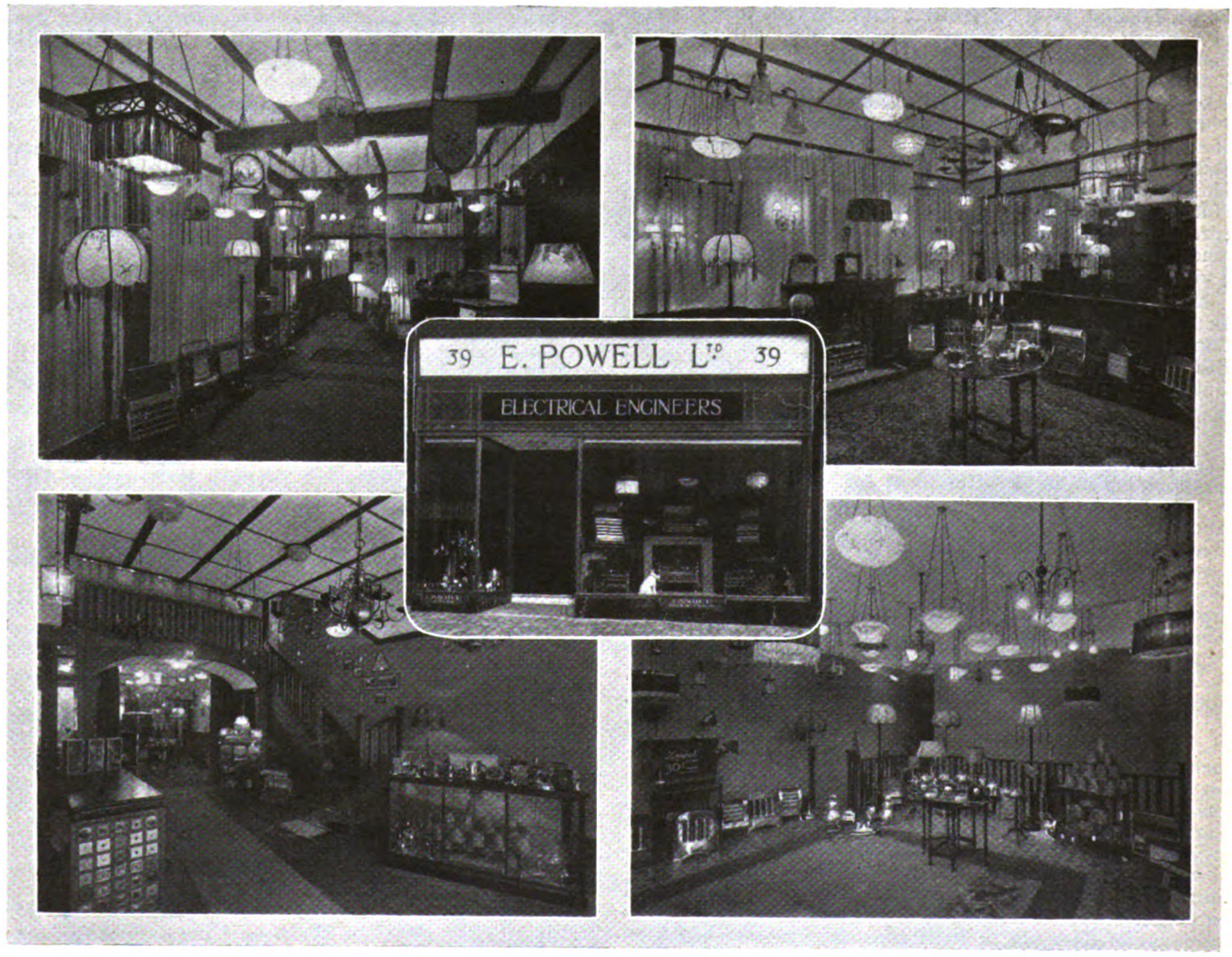
The issue of "Town and Country News," dated December 7th, contains a descriptive account of PORTER patent safety seals (7 and 9, Belfast Road, Stoke Newington, N.16) for use on electric light meters, etc.

A memorandum on the market for electrical apparatus and accessories in the Aleppo district has been received by the Department of Overseas Trade. Manufacturers desirous of receiving a copy should apply to the Department, quoting B.X. 4 962.

MR. RONALD B. BEATTIE, 1A, St. James's Street, and Hall Street, Burnley, is extending his electrical and radio business to include a department dealing with radio and other gramophone and musical instruments, having special reference to those employing electricity in any form. He invites communications from manufacturers desiring representation in Lancashire.

COMBUSTION STEAM GENERATOR, LTD., announces that the associated company, Combustion Engineering Corporation of America, has secured an order for two combustion steam generators, through Mr. W. E. S. Dyer, consulting engineer for the Philip Carey Magnesia Co. To operate at 1 800 per sq. in., these boilers, we are informed, will be the highest pressure units in regular practice in the world. The furnace volume will be 8 400 sq. ft. and each boiler will have an actual evaporation of 150 000 lb. of steam per hour with a final steam temperature of 815° F. The steam is to be used in back pressure reciprocating engines, the exhaust from which will be used for process purposes.

THE POOLEY HALL COLLIERY CO., LTD., Polesworth, near Tamworth, arranged at the Assembly Hall, Tamworth, recently, an exhibition and competition designed to stimulate interest in cooking by electricity. The company provides electricity to something like a dozen villages in the district, and there are on its books approximately 5 000 consumers, amongst whom are about 600 housewives who do their cooking by electricity. While there were on view a large number of domestic electric appliances other than cookers, the latter occupied the most prominent position. Many prizes were awarded. The most coveted of them, a silver challenge trophy presented by CREDENDA CONDUITS, LTD., Oldbury, whose Creda cookers are used throughout the Pooley Hall Colliery Co.'s area of supply, was won by Mrs. Ford, of Cope's Drive, Tamworth, who won the highest number of points. A special prize was awarded to Mrs. Wright, also of Tamworth, who in one day cooked 4 sponge sandwiches, 8 sponge rolls, 66 jam tarts, 84 lemon cheese cakes, 108 mince pies, and 160 small cakes, at an estimated cost for cooking of one shilling and ninepence. A vacuum cleaner for the cleanest electric cooker in the district was awarded to Mrs. Grant, of Dosthill; Mrs. Cowie, Tamworth, who was second, received an electric fan, and Mrs. Ford, Tamworth, who was third, was given an electric fire.



Some views of the extensive and well-equipped electrical showrooms which have been opened by Messrs. E. Powell, Ltd., electrical installation contractors, of Tunbridge Wells. Messrs. Powell have for many years maintained an electrical showroom, but it was felt that present possibilities for expansion on the domestic side demanded better display and demonstration facilities.

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The WELSBACH LIGHT CO., LTD., ask us to inform any of our readers who may have seen the announcements in the Press regarding the sale of the freehold of their premises in Gray's Inn Road, that no move in the immediate future is contemplated. In due course customers will be advised individually, and also collectively through our columns, of any alteration in address which takes place.

Mr. WILLIAM BLOGG, a manufacturers' representative with offices in York Street, Sydney, and agencies in other States, desires to get into touch with British manufacturers of electrical and radio apparatus of all kinds, also with manufacturers of small refrigerating plants. He would be happy to make appointments with the principals of firms interested in extending their business in Australia in these lines. Mr. Blogg may be addressed, c/o Messrs. Barclays Bank, Tottenham Court Road, London, W.

E. POWELL, LTD., electrical installation contractors, of 39, High Street, Tunbridge Wells, have opened extensive electricity showrooms for the purpose of displaying in suitable surroundings electric light fittings of all types, together with all domestic appliances from table ware to electric fires, heaters, cleaners and floor polishers. The firm was established in 1872, and although they have had a showroom devoted exclusively to electric light fittings and appliances for some thirty years, it was felt that something on a larger scale was necessary to meet present-day demands. Some views of the entrance and of the ground floor and first floor showrooms are reproduced on page 72. It is interesting to recall that as long ago as 1884—some eleven years before the Tunbridge Wells Corporation put down the first municipal plant—Messrs. Powell had their own generating plant, as well as a portable installation which was used for local exhibitions. Electric lighting was then unknown in Tunbridge Wells, except for the private installation of the late Sir David Salomons. When Mr. W. B. Hughes addressed the Tunbridge Wells Tradesmen's Association in 1888 on the future possibilities of electric lighting, Messrs. Powell lighted the Clarendon Restaurant electrically for the lecture.

TRADE PROTECTION.

Formation of New Electrical Trade Association—Members of Committee.

A REPRESENTATIVE gathering of electrical manufacturers and factors was held recently in London, for the purpose of forming a trade protection association on similar lines to that of the Scottish Electrical Manufacturers' and Factors' Association. Mr. H. C. McMillan, secretary of the latter organisation, was present and explained the scheme in detail, and was interrogated at some length on various points in connection therewith. The meeting unanimously agreed to appoint a committee of Major Hogan, Mr. F. Hicks and Mr. C. Orgel, representatives of Messrs. Hogan and Wardrop, the Welsbach Light Co., Ltd., and Superlamps, Ltd., to prepare the draft constitution of the Association and fix the subscription. At a further meeting, the Committee's recommendations were submitted, and were adopted as follows :—

1. That an Association be formed to be called the British Electrical Trade Protection Association.
2. That the subscription be £5 5s. per annum, together with an entrance fee of £5 5s.
3. That the first 100 Members be called Founder Members, these to be admitted without payment of entrance fee.

A number of recommendations regarding the internal workings of the Association were made and adopted.

The preliminary committee, with the addition of Mr. F. W. Evans, of National Electrical Supplies Co., Ltd., was given powers to carry on the work of the Association until January 15th, when the first regular monthly meeting was held and the office bearers for the ensuing year elected.

It is understood that the response of the trade has been encouraging and a large number of applications for membership have been received.

The registered offices of the Association meantime are at 5, High Holborn, London, W.C.1, with a Scottish Branch at 13, Dundas Street, Glasgow, C.1.

At a meeting of the Association on Tuesday, the following office bearers were appointed :—*Chairman :* Major Hogan, of Messrs. Hogan and Wardrop ; *Vice-Chairman :* Mr. C. Orgell, of Super Lamps, Ltd. ; *Executive Committee :* Messrs. T. Beadle (Messrs. Beadle and Co.) A. Hunstone (Electrical Conduits), P. L. Dwyer (Dwyer and Co.), F. W. Evans (National Electrical Supplies Co.), J Godden (Godden and Co.).

LEGAL INTELLIGENCE.

Litigation Between Electrical Firms over Publication of Photographs.

IN the Chancery Division on Tuesday, Mr. Kenneth Swan moved before Mr. Justice Eve for judgment in the action of the English Electric Co., Ltd., against Crompton Parkinson, Ltd.

Mr. Trevor Watson said after what the defendants offered, the action ought not to have been brought. He opposed the plaintiffs getting costs.

Mr. Swan said the action was for infringement of copyright in three photographs of electrical machinery of plaintiffs' construction and design. Blocks or negatives of these photographs came into defendants' possession, and they used them for advertising their own goods in a large number of electrical journals. Plaintiffs considered they were entitled to an order, and they went to court, and a motion for an interlocutory injunction was moved. They intimated that they were willing to treat the motion as the trial of the action, but Mr. Watson refused to make an end of the matter; an undertaking was given in terms of the notice of motion, and the costs were reserved.

Mr. Watson said plaintiffs did not object to the offer on the footing that they wanted it taken in court. Their objection to the offer was that they wanted an apology as well, and to give it the same publicity as the defendants' advertisement. To that the plaintiffs were not entitled. Neither ought defendants to be mulcted in the costs incurred after the motion.

Mr. Justice Eve thought plaintiffs were entitled to costs of the action, including the reserved costs of the motion.

TRADE PUBLICATIONS.

Pamphlet T.A. 175, dealing with transformers, has been published by FERRANTI, LTD., Hollinwood, Lancs.

The BRITISH THOMSON HOUSTON CO., LTD., Crown House, Aldwych, W.C.2, has published leaflet L.454 relative to projector lamps.

We have received from FERRANTI, LTD., Hollinwood, Lancs., lists No. M/F 30/1 and 30 dealing with a.c. watt-hour meter type FCc.

We have received from BRITISH INSULATED CABLES, LTD., Prescot, Lancs, a circular letter relative to pre-twisted shaped conductor cables.

The BRUSH ELECTRICAL ENGINEERING CO., LTD., Falcon Works, Loughborough, has published a special leaflet dealing with liquid starters.

THE ELECTRIC HEATING CO., George Street, Croydon, has issued a new catalogue of domestic electric appliances, under the reference of No. 508.

The Vol. 8 No. 15 of "Houghton's Radio News" gives further details of the "Fultograph." Another M.P.A. sales scheme is also announced.

A catalogue of wireless receivers and components has been published by the SUN ELECTRICAL CO., LTD., 118/120, Charing Cross Road, London, W.C.2.

The WHOLESALE FITTINGS CO., LTD., 23/37, Commercial Street, London, E.1, has published list No. 233, dealing with this season's "Alto" model electric fires.

The new Mazda daylight blue headlight bulb is the subject of leaflet L.458 published by the BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, W.C.2.

Aluminium foundry practice is dealt with in a new publication of the BRITISH ALUMINIUM CO., LTD., Adelaide House, King William Street, London, E.C.4. The reference is No. 313, and the issue supplements publication No. 190.

Floodlights and floodlighting are dealt with in a new issue of the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2. The publication is illustrated throughout with striking examples of floodlighting, and gives details of the projectors. The reference is F. 4 822.

The current issue of the "Osram G.E.C. Bulletin" gives a detailed description of the lighting at the Piccadilly Hotel, London. Details are also given in the same issue of the 10-metre transmitting plant of Mr. E. J. Simmonds (G.20D.), together with a photograph of the station.

A description of the laying of the all-welded pipe line at the Sabie River hydro-electric power station has been published by ALLOY WELDING PROCESSES, LTD., 14/16, Church Street, Islington, N.1, in the company's bulletin No. 53. A German opinion of "A.W.P." electrodes is given in bulletin No. 56.

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BUSINESS OPENINGS.

Latest Particulars of Electrical Engineering and Wiring Installation Contracts for which Tenders are being Invited at Home and Abroad.

WE give below the latest particulars of contracts for which tenders are invited. The closing date is given, when available.

CHERTSEY GUARDIANS.—Electric light installation at the institution. Particulars from the clerk, Mr. F. J. Wareham.

STAINES GUARDIANS.—Addition of 168 lighting points in the Institution, with transformer, cables and wiring, and provision of power for laundry. Also provision of 43 lights in the Girls' Home.

EDINBURGH DISTRICT BOARD OF CONTROL, January 18th.—Electric power and lighting installation at Gogarburn, Edinburgh. Specifications from Mr. Stewart Kaye, 14, Hill Street, Edinburgh.

ISLINGTON (LONDON) BOROUGH COUNCIL, January 18th.—Manufacture and supply of one 5 000 kVA Scott-connected transformer, for three-phase system, 6 600 V and 2 000/2 300 V per phase, with voltage regulator; and 375 kVA and/or 770 kVA Scott-connected transformers, for three-phase system, 6 600 V and 2 000/2 300 V per phase. Specification from the Borough Electrical Engineer, 60, Eden Grove, Holloway, N.7.

ISLINGTON (LONDON) BOROUGH COUNCIL, January 18th.—Supply of cables; electricity meters; terminal, service, network and fuse boxes; oil circuit breaker switches; electrical sundries; wires; lamps; transformers, etc., for one year. Specification from the Town Clerk.

HALIFAX CORPORATION, January 19th.—Electrical work in connection with erection of six shops. Particulars from the Borough Engineer; deposit £1 1s.

WEST RIDING EDUCATION COMMITTEE, January 19th.—Electric light installations in Norton New School and in Glass Houghton Ashton Road Council School and caretaker's house. Specification, until January 14th, from Education Department, County Hall, Wakefield.

CENTRAL ELECTRICITY BOARD, January 21st.—Supply and erection of 66 000 V switchgear in the London area, in connection with the South East England Electricity Scheme. Specification (S.E.E.-L.S.1) from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

ESSEX COUNTY AND COLCHESTER HOSPITALS COMMITTEE, January 21st.—Internal electric wiring of Brentwood Mental Hospital, with fuseboards, motors, etc. Specifications, etc., from Mr. H. H. Gepp, 66, Duke Street, Chelmsford; deposit, £5 5s. Only registered contractors are invited to tender.

NEWBURY CORPORATION, January 21st.—Direct-coupled electric motor and centrifugal pump, etc. Specification, etc., from Messrs. H. Humphries and Sons, 28, Victoria Street, Westminster, S.W.1; deposit, £1 1s.

CLITHEROE CORPORATION, January 22nd.—Electric light wiring of 12 houses in course of erection behind Chatburn Road, Clitheroe. Specifications can be seen at the office of the Borough Engineer.

GLASGOW CORPORATION, January 22nd.—Work in connection with electric lighting installations at (1) Haghill No. 1, and (2) Saracen Street, No. 1 rehousing schemes. Specifications, etc., from General Manager, Electricity Department 75, Waterloo Street, Glasgow.

MANCHESTER CORPORATION, January 22nd.—Supply of copper bands for tramway rails. Specifications from Secretary Tramways Department, 55, Piccadilly, Manchester.

Annual Contracts for Stores.

CHEADLE AND GATLEY URBAN DISTRICT COUNCIL, January 25th.—Electric lamps, meters, cable protection boards, service cables, meter boards, and ironclad cut-outs, for 12 months. Specification, etc., from the Engineer and Manager, Electricity Department, 37, High Street, Cheadle.

NEWRY URBAN DISTRICT COUNCIL, January 25th.—Supply of single and three-phase electricity meters. Specification, etc., from Mr. W. M. Cronin, town clerk, Town Hall, Newry.

GLASGOW CORPORATION, January 28th.—Electrical installation and heating installation, in connection with conversion of Family Home, St. Andrew's Street, Glasgow, for use as additional police headquarters. Specifications, etc., from the Office of Works, 64, Cochrane Street, Glasgow; deposit £3 3s.

CHICHESTER CORPORATION, January 28th.—Supply and erection of 40 kW motor-generator, with starting panel, shunt regulator, etc., for Apuldram outfall works. Further particulars from the City Engineer.

BELFAST CORPORATION, January 29th.—Installation of automatic telephones in the Infectious Diseases Hospital, Purdysburn. Specification, etc., from Mr. R. Meyer, town clerk; deposit £2 2s.

DUMFRIES AND GALLOWAY JOINT SANATORIUM BOARD, January 29th.—Electric wiring work in connection with erection of two houses for employees at Lochmaben Sanatorium. Specifications from the Clerk, County Buildings, Dumfries.

CHELTENHAM CORPORATION, January 30th.—One year's supply of electric light fittings. Tender forms from the Borough Engineer.

LIVERPOOL CORPORATION, January 31st.—Twelve months' supply of various materials, including (E.S.1) cables, compound and tapes; (E.S.2) insulated cables; (E.S.3) electricity meters; (E.S.4) cartage; (E.S.5) incandescent lamps; (E.S.6) brass and copper castings; (E.S.7) a.c. motors and starting gear; (E.S.8) stoneware troughing, etc.; (E.S.9) oils. Tender forms from City Electrical Engineer, 24, Hatton Garden, Liverpool. State number of form desired.

Overhead Transmission Line.

RIPON CORPORATION, February 1st.—Overhead 11 000 V transmission line and small quantity of e.h.t. underground cable (contract No. 2). Persons desiring to tender were to communicate their intention to Mr. W. C. C. Hawtayne, 9, Queen Street Place, London, E.C.4, before January 11th. Specifications, etc., will be issued, on or about January 18th, to persons who, after receiving notice from Mr. Hawtayne, send to the Town Clerk a deposit of £2.

HAMMERSMITH (LONDON) BOROUGH COUNCIL, February 6th.—Twelve months' supply of electric lighting sundries, insulated wires, joint boxes, meters, h.t. and l.t. paper insulated cables, etc. Forms of tender, etc., from the Borough Electrical Engineer. Stamped addressed envelope to be sent.

SHEFFIELD CORPORATION, February 14th.—Equipment for new generating station at Blackburn Meadows, Sheffield, including turbo-alternator, with condensing, evaporating and steam preheating plant (specification B.M. 67); water-tube boilers, with chimneys, superheaters, stokers (or pulverised fuel firing equipment), economisers, valves, etc. (B.M. 68); wagon tippers, conveyors and elevators (B.M. 70); cooling towers (B.M. 72); and overhead electrically and hand-operated cranes (B.M. 73). Specifications from Mr. S. E. Fedden, general manager and engineer, Electric Supply Department, Commercial Street, Sheffield; deposit £3 3s. for each.

CENTRAL ELECTRICITY BOARD, February 15th.—Supply and laying of 66 000 V cables in London area, in connection with South East England Electricity Scheme. Specification (S.E.E.-L.C.1) and form of tender from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

CENTRAL ELECTRICITY BOARD, February 18th.—Supply and erection of 132 000 V overhead transmission lines, in connection with the North-West England and North Wales Electricity Scheme. Specification (No. N.W.E.-P.L. 1) and form of tender from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit, £2 2s.

CENTRAL ELECTRICITY BOARD, February 18th.—Supply and erection of 132 000 V overhead transmission lines, in connection with the Central England Electricity Scheme. Specification (No. C.E.-P.L. 1) and form of tender from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit, £2 2s.

CENTRAL ELECTRICITY BOARD, March 4th.—Supply and erection of 132 kV outdoor switchgear, for transforming stations, in the area covered by the North West England and North Wales Electricity Scheme. Specification (N.W.E.-P.S.1) from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

CENTRAL ELECTRICITY BOARD, March 4th.—Supply and erection of 132 000 V transformers, in connection with the

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North West England and North Wales Electricity Scheme. Specification (N.W.E.-P.T.1) from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

Overseas.

UNLESS otherwise stated, particulars of overseas contracts are to be had from the Department of Overseas Trade (Room 52), 35, Old Queen Street, Westminster, London, S.W.1. *Note.—An asterisk denotes that local representation is, in practice, essential.*

BULAWAYO MUNICIPALITY, January 18th.—Supply of street lighting material, transformers, h.t. and l.t. cable, h.t. kiosks and pillars, and busbar material. (Reference B.X. 4 965.)

NEW SOUTH WALES PUBLIC WORKS DEPARTMENT, January 21st.—Supply of static power transformers, for Young-Wyangala section of Burrinjuck hydro-electric development transmission lines (contract No. 235/28). (Reference B.X. 4 995.)

GRAHAMSTOWN (SOUTH AFRICA) MUNICIPALITY, January 22nd.—Supply and erection of centrifugal pumps, motors and cable (Contract B. of 1928). (Reference A.X. 7 187.)

GRAHAMSTOWN MUNICIPALITY, January 22nd.—Supply of cable, transmission lines and transformers (contract C. 1928). (Reference B.X. 4 913.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, January 22nd.—Supply of two concrete mixers, with electric motors (contract No. D.W. 67/107). (Reference A.X. 7 315.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, January 22nd —Supply of telephonists' telephones (Reference B.X. 4 888.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, January 22nd.—Telephone transmitters and associated parts (schedule C. 386). (Reference B.X. 4 889.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, January 22nd.—Telephone receivers and associated parts (schedule C. 387). (Reference B.X. 4 890.)

ST. GILLES, BRUSSELS, MUNICIPALITY, January 22nd.—Supply of 400 3 A, 220 V, and 1 600 5 A, 222 V, Ah meters. Details (charge 5 fr.) from Service d'Electricité, Hotel Communal, St. Gilles, Brussels.

BOMBAY, BARODA AND CENTRAL INDIA RAILWAY CO., January 23rd.—Supply of 400 kW heavy oil engine-driven generating set. Specification, etc. (20s.) from Mr. S. G. S. Young, secretary, White Mansion, Petty France, Westminster, S.W.1.

CAPE TOWN MUNICIPALITY, January 23rd.—Supply of electric cable (specification 446/1928). (Reference B.X. 4 978.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, January 23rd.—Supply of armoured, multiple twin telephone cable. (P. and T. 151/1 240). (Reference B.X. 5 016.)

EGYPTIAN MINISTRY OF THE INTERIOR, January 24th.—Supply and installation of electric system for Beba. (Reference B.X. 4 916.)

JOHANNESBURG MUNICIPALITY, January 24th.—Supply of 4 500 porcelain insulators (contract No. 106). (Reference B.X. 4 972.)

JOHANNESBURG MUNICIPALITY, January 24th.—Supply of weatherproof copper wire, with fireproof coatings and outer braiding, for use on overhead electric lines. (Reference B.X. 4 976.)

JOHANNESBURG MUNICIPALITY, January 24th.—Supply of electric cable (contract No. 109). (Reference B.X. 4 977.)

JOHANNESBURG MUNICIPALITY, January 24th.—Supply of oil switches (contract No. 114). (Reference B.X. 4 994.)

JOHANNESBURG MUNICIPALITY, January 24th.—Supply of steel lighting and tramway poles (contract No. 107). (Reference A.X. 7 302.)

SOUTH AFRICAN DEPARTMENT OF POSTS AND TELEGRAPHS, January 24th.—Supply of telephone switchboards (tender No. 143). (Reference B.X. 4 912.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, January 24th.—Supply of two small d.c. generating sets, running on crude oil, for Maquassi. (Reference B.X. 4 943.)

EGYPTIAN MINISTRY OF THE INTERIOR, January 27th.—Transformer kiosks, cables and accessories, in connection with extension of electricity supply from Mit-Ghamr power station. (Reference B.X. 4 893.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, January 29th.—Accumulator batteries and counter E.M.F. cells (schedule C. 390). (Reference B.X. 4 906.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, January 29th.—Single core, paper insulated lead covered cable. (Reference B.X. 4 954.)

WAIRARAPA (N.Z.) ELECTRIC POWER BOARD, January 29th.—Supply of 15 sets of earth leakage protection equipment (contract No. 78). (Reference B.X. 4 950.)

CHILEAN MINISTRY OF MARINE, January 30th.—Two electric travelling cranes. (Reference A.X. 7 353.)

EGYPTIAN MINISTRY OF THE INTERIOR (SECTION DES MUNICIPALITES ET COMMISSIONS LOCALES), January 31st.—Diesel engine driven generator set, d.c. rotary balancer and accessories, for Kafrel Zayat electric station. (Reference B.X. 4 931.)

A MOTOR-CYCLE, featuring Osram lamps, snapped during a recent Empire week in British Guiana to boost the sale of British-made goods.

MANAWATU-OROUA (N.Z.) ELECTRIC POWER BOARD, January 31st.—Supply of automatic re-closing 11 000 V switchgear for pole platform mounting (contract No. 57). (Reference B.X. 4 988.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, January 31st.—Supply of electrically driven locomotive turntable (tender No. 1 386). (Reference A.X. 7 253.)

VICTORIAN ELECTRICITY COMMISSION, February 4th.—Supply of 11 000 V switchgear, in connection with the Yallourn power station extensions. (Specification No. 29/5.) (Reference B.X. 4 897.)

VICTORIAN ELECTRICITY COMMISSION, February 4th.—Supply of 22 000 V switchgear and accessories, for Richmond Terminal Station. (Reference B.X. 4 901.)

VICTORIAN ELECTRICITY COMMISSION, February 4th.—Supply of 11 000 V switchgear, for installation in the Richmond Terminal Station (specification No. 29/3). (Reference B.X. 4 898.)

VICTORIAN ELECTRICITY COMMISSION, February 4th.—Supply of pillar insulators, with metal parts for use on 132 000 V outdoor circuits. (Reference B.X. 4 921.)

INDIAN STORES DEPARTMENT, NEW DELHI, February 5th.—Supply of turbo-alternator, boiler, economiser, switchgear and cables. (Reference B.X. 4 944.)

EGYPTIAN STATE RAILWAYS, February 9th.—Electrification and equipment of Heluan line, including equipment of power station, overhead transmission lines, track bonding, motor and trailer coaches, etc. Tenders to General Manager, Cairo Station.

NEW SOUTH WALES PUBLIC WORKS DEPARTMENT, February 11th.—Supply, erection and maintenance of hydro-electric generating plant, in connection with Hume reservoir hydro-electric development. (Reference B.X. 4 989.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, February 12th.—Supply of 110 kV switchgear, and controlling equipment, for Waitaki power scheme, section 3. (Reference B.X. 4 848.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, February 12th.—Supply of dry cells, for telephone work. (P. and T. 151/1 205.) (Reference B.X. 4 991.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, February 12th.—Supply of v.i.r. wire (No. P. and T. 151/1184). (Reference B.X. 4 951.)

JOHANNESBURG MUNICIPALITY, February 14th.—Supply of two single-phase transformers, each of 1 080 kVA (contract 115). (Reference B.X. 5 005.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, February 14th.—Supply of 15-ton electrically-driven portal titan crane (tender No. 1 366). (Reference A.X. 7 272.)

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INDIA STORE DEPARTMENT, February 15th.—Supply of hydro-electric plant, comprising four 12 000 kW water-wheel driven alternator sets, auxiliaries and spares (schedule 4). Forms of tender (5s.) from the Director-General, Belvedere Road, London, S.E.1.

NEW SOUTH WALES DEPARTMENT OF PUBLIC WORKS. Extension of date.—February 18th.—Supply and erection of hydro-electric generating plant for Burrinjuck development. (Reference 4 938.)

NEW ZEALAND POSTS AND TELEGRAPHS, February 19th.—Supply of bronze wire and copper binding wire. (Reference A.X. 7 252.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, February 19th.—Supply of 120 000 galvanised steel spindles for insulators. (Reference B.X. 4 948.)

CAPE TOWN MUNICIPALITY, February 20th.—Pumping equipment for storm water, etc., for the electricity department (specification 445/28). (Reference A.X. 7 345.)

EGYPTIAN MINISTRY OF PUBLIC WORKS, February 28th.—Supply and erection at Sollum of aerial ropeway, with dynamos, telephone and other equipment. Specification (10s. 6d.) from Chief Inspecting Engineer, 41, Tothill Street, London, S.W.1.

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, February 28th.—Supply of six-conductor telephone cordage. (No. P. and T. 151/1 234). (Reference B.X. 4 990.)

WHANGAREI (N.Z.) HARBOUR BOARD, February 28th.—Supply of one 15-ton electrically-operated level luffing gantry crane (contract No. 35). (Reference A.X. 7 263.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, March 5th.—Supply of seven single-phase 5 500 kVA transformers, for Waitaki power scheme, section 4. (Reference B.X. 4 873.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, March 12th.—Supply of switchboard cords (P. and T. 151/1 247). (Reference B.X. 5 017.)

CAPE TOWN MUNICIPALITY, March 15th.—Supply of metal-clad switchgear (specification 449/28). (Reference B.X. 5 004.)

VICTORIAN ELECTRICITY COMMISSION, March 18th.—Supply of 1 300 strings of suspension insulators, 600 strings of tensioning insulators, 1 300 conductor suspension clamps, 350 conductor tensioning clamps, 50 semi-anchor clamps for "V" strings of insulators, 200 semi-anchor clamps for single strings of insulators, 475 earth wire suspension clamps and 125 earth wire tensioning clamps. (Reference B.X. 4 997.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, March 19th.—Supply of 110 000 V transformer, for Mangahao electric power scheme (section 204). (Reference B.X. 4 952.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, March 19th.—Supply of 11 000 V switchgear, for Mangahao power development (section 203). (Reference B.X. 4 953.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, April 9th.—Supply of induction voltage regulators, for Lake Coleridge scheme (section 215). (Reference B.X. 5 018.)

TANGANYIKA GOVERNMENT, June 1st.—Concession for utilisation of Pangani River Falls for the development of electric power. Copies of the draft concession may be obtained from the Crown Agents for the Colonies, 4, Millbank, London, S.W.1.

STATE ELECTRICITY WORKS, MONTEVIDEO, July 8th.—Construction and equipment of 50 000 kW power station.

Tenders Accepted.

DEWSBURY CORPORATION.—Power and Lighting Cables, Ltd., cable, £532.

LONDON COUNTY COUNCIL.—Edison Swan Electric Co., Ltd., feeder panel switches.

ERITH URBAN DISTRICT COUNCIL.—H. J. Creffield, wiring the baths for electric light, £48 10s.

CANNOCK URBAN DISTRICT COUNCIL.—English Electric Co., Ltd., switchgear, £431 7s. 9d.

ADMIRALTY.—Metro-Vick Supplies, Ltd., supply of Cosmos metal filament lamps (part contract).

PAIGNTON CORPORATION.—Paignton Electric Light and Power Co., Ltd., lighting streets by electricity.

ESSEX COUNTY COUNCIL.—Chelmsford Radio Co., wireless installation at Harold Court sanatorium, £107.

REIGATE CORPORATION.—T. S. Marriage and Co., wiring small houses under hire-purchase scheme (renewal for one year).

GREAT WESTERN RAILWAY CO.—Walter Parkins and Co., electric lighting installation in offices and stores at Stafford works.

FAIRFIELD SHIPBUILDING AND ENGINEERING CO., LTD.—Parsons Oil Engine Co., supply of two 60 kW generating sets, for new C.P. liner "Empress of Japan."

OLDHAM CORPORATION.—Whitworth, Whittaker and Co., Ltd., construction of screen, pump pit and pump house for circulating water pumps at new generating station.

BRADFORD CORPORATION.—British Insulated Cables, Ltd., supply of 41 tons of copper trolley wire, £3 951 4s.; Enfield Rolling Mills, Ltd., supply of five tons of copper trolley wire, £466 13s. 4d.

WALTON-ON-THAMES URBAN DISTRICT COUNCIL.—Hackbridge Electric Construction Co., Ltd., four transformers, for sub-stations, £647; Pirelli-General Cable Works, Ltd., short lengths of cable, for sub-stations, £59.

WIMBLEDON CORPORATION.—Foster Engineering Co., two 100 kVA transformers, £158; Hackbridge Electric Construction Co., two 200 kVA transformers, £237; Babcock and Wilcox, Ltd., installation of pipework at No. 5 boiler at electricity works, £374.

STEPNEY (LONDON) BOROUGH COUNCIL.—A. Reyrolle and Co., Ltd., supply of e.h.t. switchgear £10 421. (Recommended.) Also tendered: Ferguson, Pailin, Ltd., £10 798; British Thomson-Houston Co., Ltd., £11 226; English Electric Co., Ltd., £11 510; Metropolitan-Vickers Electrical Co., Ltd., £11 933.

CHESTERFIELD CORPORATION.—British Thomson-Houston Co., Ltd., supply of e.h.t. switchgear, £203 12s. 6d.; Hewittic Electric Co., Ltd., 150 kW mercury arc rectifier equipment and transformer, for extension of railless vehicle system to New Whittington, £960; Greenwich Cable Co., Ltd., supply of cables, £1 810.

STOKE-ON-TRENT CORPORATION.—Davenport Engineering Co., Ltd., erection of cooling tower, at power station, £8 267; Joseph Booth Bros., Ltd., supply of jib for electric coal-handling crane, at power station, £150; Barnett and Soans, erection of overhead wiring and services at 64 houses on Sutton estate, Trent Vale, £184 13s. 4d.

GLASGOW CORPORATION.—A. and P. Steven, Ltd., installation of passenger and goods lifts at a building at Glasgow Cross, £1 118 15s.; British Electrical and Manufacturing Co., supply of cable, £562 10s.; Kennedy, Stark and Co., electric lighting installation, bells, and fire-alarms, at Mearnskirk Sanatorium, £1 571 10s. 7d. (All recommended.)

GLASGOW CORPORATION.—British Insulated Cables, Ltd., insulated bolts, Drake and Gorham, Ltd., reflectors (for 'bus depot); Felten and Guilleaume, v.i.r. cable; Mavor and Coulson, Ltd., supply of switchboard (for 'bus depot); Revo Electric Co., Ltd., supply of 1 000 lanterns, 29s. 9d. each; H. T. Boothroyd, Ltd., electric lighting installation at, Knights wood Hospital, £350 15s. 6d. (All recommended.)

THE NATIONAL REGISTER.

Contractors' Applications Accepted at Meeting of Executive Committee.

AT a meeting of the Executive Committee of the National Register of Electrical Installation Contractors, held at the Institution of Electrical Engineers on January 11th, twelve applications from electrical installation contractors for enrolment on the National Register were accepted. At the same meeting six applications were declined, for various reasons, and one was withdrawn.

The names and addresses of the newly registered contractors are:—Alderson, Harold, 92, Claypath, Durham City; Allenby and Stokell, 126, Vicar Lane, Leeds; Bysouth, Christopher, 31, Hitchin Street, Baldock, Herts; Cropper and Hancock, 4, Exeter Street, Woodhouse Lane, Leeds; East Sussex Wiring Co., Ltd., The Broadway, Crowborough; England, Sidney E. J., 5, Dorchester Street, Bath; Jones, E. W., and Co., Park Street, Wellington, Salop; Modern Electrical Supplies, 208A, North Street, Leeds; Taylor, Whiting and Taylor, Oakes Yard, St. Peter's Street, Derby; West Wales Electric, Ltd., 3, High Street, Criccieth, N. Wales; Wilkinson, John, and Sons (Greengates), Ltd., Parkside Works, Apperley Bridge, Bradford; Woodward, Herbert, 254, High Road, Wood Green, London, N.22.

We understand that there has already been a large demand for copies of the pamphlet, "Hidden Risks," which has been produced for sale to registered contractors at cost, for distribution to members of the public. Supplies may be obtained from the Secretary, at 1, Lincoln's Inn Fields, London, W.C.2, at £1 3s. per 1 000, or 13s. 6d. per 500 copies.

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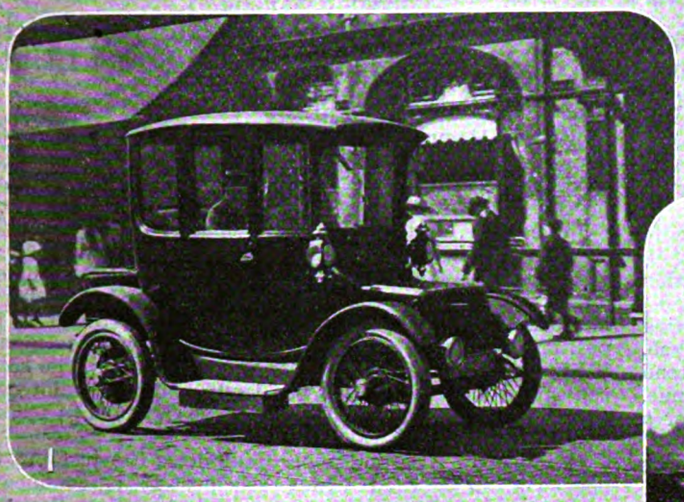
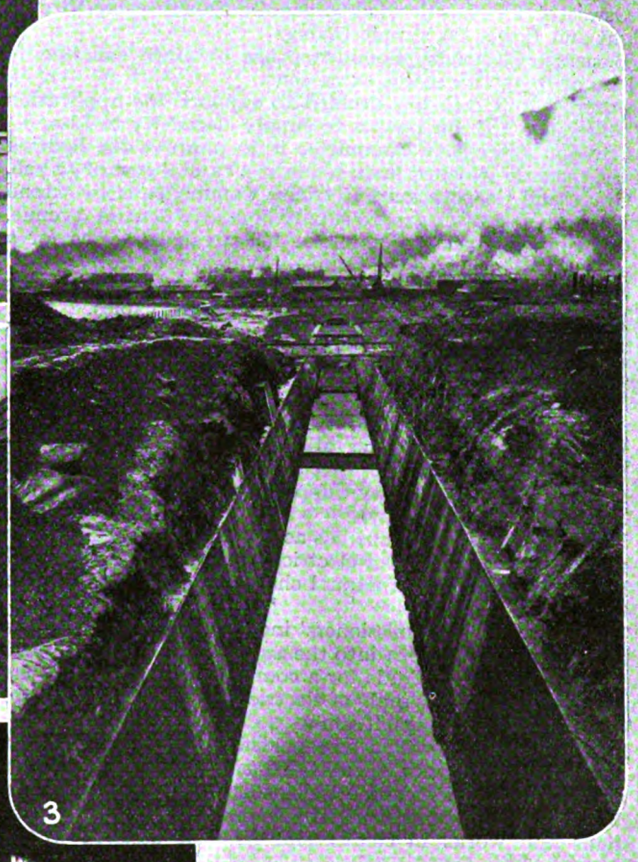
ELECTRICAL NEWS PICTURES.





(1) Our references to early electric passenger vehicles continue to arouse interest. Here is another reader's picture of an electric vehicle built during the petrol rationing period in the early days of the war ; **(2)** Some of the 813 oldest employees of British Insulated Cables, Ltd., who were presented with long service medals on the occasion of a recent entertainment given by the company. Those shown in the picture are Messrs. Arch. Lauder, superintendent of lead covering department ; Reg. P. Nash, resident electrical engineer ; J. L. Packer, manager of cables department ; and W. H. Birchell, mains engineer (left to right, seated), and Mr. A. J. Macphail, publicity manager (standing) ; **(3)** Works in connection with the making of a tunnel, 15 miles long, and 15 ft. in diameter, through Ben Nevis, through which water from Loch Treig will be carried to a power station near Fort William for the purpose of generating electrical energy for a large factory in course of erection for the British Aluminium Co. ; **(4)** Shell House, Aldwych, London, as seen one morning this week. The picture gives a good idea of the heavy day lighting load in London which is created during the dark winter days ; **(5)** A turbine house for the generation of electricity for two farms between Grassington and Kilnsey, Wharfedale, Yorkshire. It is hardly necessary to point out that it is *not* a selected station.

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ELECTRICITY SUPPLY.

The Mid-East England Electricity Scheme—Nottingham's Supply to Outer Districts—Proposed East Ham Installation Department—Extension of Hammersmith Street Lighting—Birmingham Supports Registered Contractors.

SHEFFIELD Electricity Committee has authorised mains extensions at a cost of £12 560.

Oswestry T.C. has decided to acquire the Oswestry Electric Light and Power Co.'s undertaking.

Barnsley Electricity Committee has obtained sanction to a loan of £7 356 for mains extensions.

Petersfield R.D.C. has decided to support the application of Aldershot T.C. for powers to supply electricity to Liss.

Croydon Electricity Committee is to improve the lighting of the recently widened main roads at a capital cost of £2 726.

Gravesend Corporation Electricity Committee is to extend mains, at a cost of £1 350, to supply houses in Central Avenue.

Grimsby Electricity Committee has arranged terms for a supply of electricity to the Grimsby Waterworks Co.

Southwark Electricity Committee seeks sanction for loans of £4 066 for mains and meters and £2 140 for cables.

Powers for electricity supply in Alresford rural district are sought by the Hampshire Electricity Co. and the Alton Electricity Co.

Commissioners' New Scheme.

We understand that the Mid-East England Electricity Scheme, prepared by the Electricity Commissioners under Section 4 of the Electricity Supply Act, 1926, will be published to-morrow (Saturday).

Fylde Board of Guardians has accepted the offer of Preston Corporation for a supply of electricity for the Institution and offices at Kirkham at an annual charge of £250, plus 1d. per kWh.

The Electricity Commissioners' inquiry, which was to have been held on January 8th into the application of the T.C. and the local Chamber of Trade for a compulsory reduction in the charges made for the supply of electricity in Pontefract by the Yorkshire (West Ridings) Tramways Co., has been postponed.

Nottingham Corporation has decided to apply for sanction to a loan of £150 000, to be expended as required on extension of mains, transformers, and switchgear in connection with the high tension supply for outside districts, erection of substations and works in connection with the assisted wiring scheme.

It is stated that about 20 000 applications have been received by the County of London Electric Supply Co. from consumers desiring to be charged under the company's new alternative two-part tariffs, under which the charge is 1d. per kWh for all purposes, plus a quarterly charge based on the dimensions of houses, and, in the case of business premises, on the wattage installed for lighting.

With regard to the supply of electricity for Wyvenhoe, Colchester T.C. has made a revised application for a loan of £8 536, made up of purchase price of the undertaking of the Wyvenhoe Electricity Co., £2 150; cost of application for Special Order by Wyvenhoe U.D.C., £275; estimated cost of transmission line from Hythe generating station to Wyvenhoe, £4 776; mains services, etc., £1 260; and contingencies, £75.

East Ham Electricity Committee has asked the Engineer to submit a report with regard to the supply of electricity to North Woolwich. The Electricity Committee has heard a deputation from the Electrical Trades' Union urging the Council to establish an installation department, and has deferred further consideration thereof until the next meeting. The electricity department is to extend cables at a cost of £2 222.

The Commissioners have informed Stratford-on-Avon R.D.C. that the Leamington and Warwick Electrical Co. has applied for consent to the erection of overhead wires in the rural area, and, as the Commissioners are satisfied with the technical proposals, they suggest that the Council should withdraw its objection. The Council has decided to continue to object, on the ground that in a very narrow road the cables should be laid underground.

The district engineer of the Central Electricity Board has informed Glasgow Corporation of the intention of the Board to erect two steel towers for the supply of three-phase, 50 cycle electrical energy, at a pressure of 132 000 V between phases, on the route within the city from Clyde's Mill (Cambuslang) power station to Dalmarnock power station, and 59 steel towers along the route through the city from Dalmarnock power station to Port-Dundas and Yoker power stations.

In 1924 Hammersmith (London) Council entered into an agreement with the Brentford Gas Co. (now the Gas Light and Coke Co.) regarding 587 gas lamps maintained by the company in the Southern portion of the borough. The agreement was for five years, and thereafter, terminable by notice. There was a proviso in the agreement that not more than 20 per cent. of such gas lamps should be converted to electric lighting during the period of the agreement, and, as that proportion has been converted, and the electricity department is in a position to convert a further 120 during the next 12 months, it has been decided to terminate the agreement. The cost of conversion will be £9 10s. per lamp, and the maintenance charge £4 per annum, compared with the charge of £4 19s. 11d. by the gas company.

Birmingham Electric Supply Committee has just put into operation an assisted wiring scheme. It is confined to premises of a residential character, and covers installations of not less than four and not more than 15 lighting and four power points, or their equivalent. To the cost of installations will be added interest and percentages to cover supervision and maintenance during the agreement period. The consumer is required to enter into an agreement, in the case of quarterly account consumers, for repayment by way of 12 equal quarterly instalments, and in the case of prepayment consumers, by way of an addition on prices charged for current. In the latter case the consumer will pay £1 on signing the agreement and the balance by an additional 2½d. per kWh for lighting and an additional ½d. for power. The wiring will be done, at the Corporation's cost, by registered contractors, to the Department's specifications.

Birmingham Corporation discussed on January 8th a report by the Electric Supply Committee dealing with the arrangements for the change-over of the electricity supply system, in accordance with the requirements of the Central Electricity Board, from 25 cycles to the standard 50 cycles. Three sites have been selected for transforming stations for dealing with supplies from the grid. These will be the Hams Hall and Nechells stations, and a further station at a spot between Selly Oak and Northfield. It will be several months before the two large frequency changers at Nechells can be installed as a temporary measure. The outer districts will first be dealt with, and the central and more highly developed industrial areas will be changed over as the demand grows. Coun. Lewis remarked that the Board was bearing the cost of all replacements, including that of altering or replacing plant belonging to manufacturers, and he asked if workpeople who temporarily lost time owing to substitution would be compensated. Coun. Beale replied that the manufacturer obtained no compensation for actual disturbance. When the Electricity Supply Bill was before Parliament, the Government resisted the efforts made to secure some such provision. The report was approved.

Douglas and Joint Authority.

Douglas (Isle of Man) Electricity Committee has reported that the Chairman, the Town Clerk and the Borough Electrical Engineer attended a meeting of the Electricity Commissioners, at which the subject of electricity supply to the Isle of Man was discussed. The Commission asked for the decision of the Committee as to (1) whether the Corporation desired to undertake the supply and distribution over the whole island; (2) whether the Corporation would be agreeable to the formation of Joint Electricity Authority, to which Douglas would sell its generating station and plant, and from which it would buy its electricity and continue distributing in its own area; (3) whether the Corporation would be prepared to undertake the supply and distribution over the whole island, if the alternative were the taking over of their station by a Joint Electricity Authority; and (4) whether the Corporation would be prepared to sell electricity in bulk to a company or Electricity Authority for the purpose of distribution outside the Douglas area, on the terms of the second schedule of the English Electricity Act, 1926. The Committee replied that it does not desire to undertake distribution outside the Douglas area, and it answered question (2) in the negative and expressed the opinion that question (3) cannot arise. The Committee also stated that it is prepared to supply on any terms which could be considered equitable.

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COMPANY NEWS.

Appreciation of Electrical Manufacturers' and Telegraph Shares—American Radio and Gramophone Amalgamation—Manx Electric Railway's Increased Receipts—Ever Ready Co.'s Bonus Share Issue—New Companies.

DURING the past week there have been considerable rises in the prices of electrical manufacturing companies' shares. Callender's 6½% preference have risen from 23s. 9d. to 25s., Crompton Parkinson 8% preference from 25s. to 25s. 7½d., English Electric ordinary from 7s. 6d. to 8s. 9d., General Electric ordinary from 55s. to 56s. 3d., Henley's ordinary from 116s. 3d. to 117s. 6d., Metropolitan-Vickers' ordinary from 30s. to 35s., and Siemens Bros. ordinary from 28s. 9d. to 30s. Telegraph securities also show improvement. There is little change in the supply and traction groups.

Last Annl. Divd.	Description.	This Week.	Last Week.	1928 to 1927. Highest.	Lowest.
%	**Electricity Supply.**				
(d)	Brompton & Kensington Ord. ..	27/-	27/-	45/-	23/9
4	Central Elec. Sup. 4% Deb. ..	93	93	100	67
(a)	Charing Cross Elec. Ord. (£1) ..	26/6	26/6	60/-	10/-
4½	" " " 4½% C.P. (£1)	17/6	17/6	19/6	10/-
(e)	Chelsea Elec. Sup. Ord.	27/-	27/-	39/6	10/-
10	City of Lond. Elec. L'ting Ord. ..	31/10½	31/10½	52/10½	20/3
6	" " " " " 6% C.P. ..	23/-	23/-	40/-	15/6
7½	County Lon. Elec. Sup. Ord. ..	49/-	50/-	68/6	14/6
6	" " " " 6% C.P. ..	23/-	23/-	24/9	15/3
(c)	Kensington & K'bridge Ord. (£1) ..	26/6	26/6	104/6	3/-
(b)	Lon. Elec. Sup. Ord. (£1)	26/-	26/-	38/3	5/-
9	Metro. Elec. Sup. Ord.	47/6	47/6	43/-	8/-
4½	" " " 4½% C.P. ..	17/6	17/6	18/6	9/6
7½	N'castle & Dis. Elec. Ltg. Ord. ..	30/-	30/-	22/6	7/9
6	N'castle-upon-Tyne Elec. Sup. Ord.	26/10½	26/3	26/-	11/6
6	N. Metro. Elec. 6% C.P.	23/-	23/-	23/9	10/1½
6	Notting Hill 6% C.P. (£10) ..	10½	10½	10½	6/13/9
(g)	St. James & P.M. Ord. (£1) ..	27/6	27/6	62/-	22/-
1/4½	Shrops. Worcs. & Staffs. Power B. Or.	35/-	34/4½	23/-	20/9
(f)	W'minster Elec. Sup. Ord. (£1) ..	27/-	27/-	52/-	18/-
4½	" " " 4½% C.P. (£1)	17/6	17/6	21/6	13/-
8	Yorks. Elec. Power Ord.	35/-	35/-	32/9	12/6
6	" " " 6% C.P. ..	24/-	24/-	25/-	14/3
	Railways and Tramways.				
8	Brit. Elec. Trac. Pfd. Ord. Stk. ..	124	124	152½	24
6	" " " 6% Pf. Stk...	127½	127½	129½	53
4	Cent. Lon. Ry. Ord. Stk. (assted.) ..	73	72½	89½	40½
4	" " " 4% Deb.	80*	82	103	56½
4	City & S. Lon. 4% Perp. Deb. ..	79½	79½	102½	50
4	Lon. Elec. Rly. Cons. Ord. Stk. ..	75½	75½	73½	10
4	" " " " 4% Pf. Stk.	73½	73½	84/2/6	43
4	" " " " 4% Deb.	81	81	98½	52
5	Lon. & Sub. Trac. A. Deb. ..	97½	97½	89	65
4	Lon. Un. Trams, 1st Deb.	61	61	82	30
4½	Met. Elec. Trams, 4½% Deb. ..	70	70	101½	49
5	" " " 5% Deb... ..	67½	67½	102/17/6	53
3	Met. Rly. Cons. Ord. Stk.	67½	67½	84½	19
3½	" " " 3½% Pf. Stk.	65	65	88½	40½
3½	" " " 3½% Deb. ..	72*	73	92½	51
4	Met. Dis. Rly. Ord. Stk.	80½	80½	66½	12½
4½	" " " 4½% 1st Pref. ..	82½	82½	91	45
6	" " " 6% Perp. Deb. ..	116½	115½	146/12/6	80
4	S. Met. Elec. Trams, 4% Deb. ..	70	77*	73½	48½
5	Underground Electric Rlys. Ord.	27/6	27/-	5/3	2/1½
—	Yorks. (W.R.) Trams, Ord. ..	5/-	5/-	27/-	1/-
4½	" " " 1st Deb. ..	59	59	87	52
	Electrical Manufacturing.				
7	Brit. Elec. Transformer 7% C.P. ..	15/-	15/-	22/1½	11/6
15	Brit. Insulated Cables Ord. ..	87/6	87/6	86/3	26/6
6	" " " 6% C.P. ..	22/6	22/6	25/6	14/6
7	British Thomson-Houston Pref. ..	23/-	22/9	24/6	19/7
7	" " " 7% Deb.	104½	104½	109½	92/-
10	Brush Electrical Ord.	28/9	28/9	29/9	10/-
15	Callender's Cable Ord.	86/3	85/3	86/-	22/-
6½	" " 6½% C.P. ..	25/-	23/9	26/7	3/-
7½	" " 7½% B. Pref. ..	27/6	27/6	27/6	16/6
8	Crompton-Parkinson 8% Cum. Pf.	25/7½	25/-	25/-	9/10
6	" " 6% Cum. 2nd Pf.	18/3	18/3	18/-	8/-
7½	Edison Swan Elec. Ord. (1st Pref. ..	25/7½	25/7½	26/-	5/-
5	" " " 1st Deb Stk...	86½	—	—	—
7½	Elec. Construction Ord.	26/10½	26/10½	25/9	6/7
7	" " 7% C.P. ..	22/6	22/6	25/3½	16/-
—	English Elec. Ord.	8/9	7/6	29/3	7/3
6	" " 6% C.P. ..	10/-	10/-	22/1½	10/6
7	Ericsson Telephones 7% Pref. ..	19/-	19/-	22/9½	12/7
35	Ever Ready (Gt. Britain) Ord. ..	31/-	33/6	93/9	18/6
6	Ferranti 6% Pref.	19/-	19/-	19/4½	16/9
7	" 7% 2nd Pref.	19/-	19/-	19/3	13/9
10	General Elec. Ord.	56/3	55/-	59/-	13/6
£25	W. T. Henley's Ord.	117/6	116/3	108/9	23/3
12½	Johnson & Phillips Ord.	36/3	36/3	67/11	14/6
7½	Lon. Elec. Wire & Smith's Pref. ..	23/9*	23/9	27/6	17/6
6	Metropolitan-Vickers Ord.	35/-	30/-	37/-	13/1
8	" 8% C.P. (£2)	55/-	55/-	67/10	5/-
7½	Siemens Bros. & Co. Ord.	30/-	28/9	36/6	12/3
10	Telegraph Const. Ord. (£12) ..	25	25	56/2/6	19
	Telegraph.				
3½	Anglo-Am. Tele. Ord. Stk... ..	64½	62½	68½	40
10	Eastern Ord. Stk.	265½*	270½	213½	113/2/6
3½	" 3½% Pref. Stk.	68½*	67½	84/17/6	49
4	" 4% Deb.	79½	79½	103½	60
10	Eastern Extension Ord. (£10) ..	26½*	27	21½	10/12/6
22	Gt. Northern Telegraph (£10) ..	34	32	42/12/6	19
10	Indo-European (£25)	49½	47½	47½	25
20	Marconi's Wireless T. Ord. ..	77/6	78/9	9/16/3	20/9
12½	" Int. Mar.	7(/-	72/6	5/11/3	14/11
10	Western Tel. Ord. (£1)	26½	26½	23	11/3/6

(a) 1s. 7½d. per share. (b) £8 8s. 6·66d. per cent. (c) 1s. 6·949d. per share.
(d) 1s. 8·706d. per share. (e) 1s. 9·3d. (f) 1s. 0.912d. (g) 1s. 7·223d.
‡ Including 1s. bonus. *Ex dividend.

* TRACTION AND GENERAL INVESTMENT TRUST.—Fin. div. 10% on ord. shs., makg. 10% for year, less tax, has been declared.

EASTERN EXTENSION, AUSTRALASIA AND CHINA TELEGRAPH CO., LTD.—Int. on 4% mtge. deb. stk. for half-year to Jan. 31 will be paid on Feb. 1.

ANGLO-AMERICAN TELEGRAPH CO., LTD.—Blce. div. £1 10s. % on ord. consol. stk., less tax, blce div. £1 10s. % on pfd. stk., less tax, and 1st and fin. div. £1 10s. % on defd. stk., less tax, all payable Feb. 1.

ADELAIDE ELECTRIC SUPPLY CO., LTD.—Rev. for year to Aug. 31, 1928, £801 514, increase £36 491. Pft. £411 946, decrease £670. To gen. res. £66 737; fin. div. on ord. shs. 6%, makg. 12%. Fwd. £31 902.

Mr. S. R. Mullard, who has joined the board of Everlite, Ltd.

AMERICAN RADIO-GRAMOPHONE COMBINE.—The directors of the Radio Corporation of America and the Victor Talking Machine Corporation approved on Tuesday the terms of the proposed merger.

MANX ELECTRIC RAILWAY CO., LTD.—Gross receipts for year ended Sept. 30, £42 007, agst. £30 508. Net workg. pft. £12 515, agst. £10 867, plus £878 brt. in. Deductg. deb. int., etc., £9 754, leaves £3 641, wh. is carried fwd.

CONSOLIDATED SIGNAL CO., LTD.—Net income for year ended Sept. 30, 1928, £31 677, agst. £25 363 for previous year. Div. on pref. shs., 6% p.a., less tax at 3s. 9½d. in £, and on ord. shs., 17½%, less tax at 3s. 9½d., agst. 12½%. Fwd. £673, agst. £803 brt. in.

INTERNATIONAL PAPER AND POWER CO. (NEW YORK).—Co. offered last week to common stkhldrs. 1 500 000 shs. of class C common stk. Each two shs. and common stk will carry right to subscribe at $10 p. sh. for one sh. of new issue of class C common stk.

TATA POWER CO.—Pft. for year ended June 30, 1928, Rs. 402 647. To depreciatn. Rs. 322 500; written off prelim. exes. Rs. 75 000. Blce. fwd. Rs. 5 078. During year full capacity of power house, with hydraulic adjuncts, was made available for service, and erectn. of remaing. three generators, with their twin turbines, was completed, makg. five in all.

BARBADOS ELECTRIC SUPPLY CORPORATION, LTD.—Tradg. pft. for year to June 30, 1928, £13 936, agst. £12 835. After provisn. for London gen. exes., deb. and loan int. and res. of £1 500 for taxation, total remaining is £12 212, includg. £2 194 brt. in. To depreciatn. and renewals res. £5 000, set aside for redemptn. of debs. £1 000; to gen. res. £1 374. Div. of 5%, less tax. Fwd. £2 007.

TATA HYDRO-ELECTRIC POWER SUPPLY CO., LTD.—Net pft. for year ended June 30, 1928, Rs. 2 144 592, agst. Rs. 2 543 598, plus Rs. 331 855 brt. in. Div. on ord. shs. at rate of 8% p.a., tax free, makg. 7%, agst. 8%. Fwd., Rs. 562 224. Industrial depression and the taking over by the Tata Power Co. of its own load reduced sales of energy from 131 000 000 kWh to about 114 000 000 kWh.

HASLAM AND NEWTON, LTD.—Statutory rpt. states that number of shs. allotted for cash is 250 000 7½% £1 cum. pref. shs. and 500 000 4s. ord. shs. Allotmt. of 500 000 4s. fully paid ord. shs. has been made, in accordance with prospectus. Total recd. in respect of shs., £335 778, and bank int. recd., £307. Paymts. to Dec. 31 include purchase moneys £265 000, investmts. £15 500, prelim. exes., £23 703, underwritg. commissns. and brokerage, £13 026, and gen. exes, £124. Cash at bank and in hand, £18 423.

EVER READY CO. (GREAT BRITAIN), LTD.—An extraordinary gen. mtg. will take place on Jan. 31 to consider a resolutn. to authorise capitalisatn. of £74 000 of undivided pfts. standing to credit of gen. res. so that it shall be used for paying up 296 000 ord. shs., which shall be distributed as fully paid amongst ord. shhldrs., in proportn. of one such fully paid sh. for every five ord. shs. held. Directors announce that co. has

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recently acquired substantial int. in a large mfg. business in part similar to that of the Ever Ready Co., but includg. mfre. and sale of numerous classes of goods which that co. does not at present mfre.

BRAZILIAN TRACTION, LIGHT AND POWER CO., LTD.—Directors have announced that in view of arrangemts. for purchase of ord. shs. of City Santos Improvements Co. which will involve an expenditure of approximately 14 000 000 dollars, and also in view of other essentl. cap. outlay required for expansn. of business, it has been decided to make an offer to ord. shhldrs. of additional ord. shs. of no par value on basis of one new sh. for each seven shs. held, at price of 40 dollars p.sh. This should produce approximately 31 000 000 dollars. Holders of pref. shs. may convert their hldgs. into ord. shs., in order to take advantage of right to subscribe. Qtrly. div. 50 cents p. sh. on ord. shs. is announced.

COMPANIES TO BE STRUCK OFF THE REGISTER.—The following companies will be struck off the register of joint stock companies unless cause to the contrary is shown before April 1st: Anode Wireless and Scientific Instruments, Associated Electric Traders, British Radio Sales Co., Electrolite, Holborn Radio Co., Mitchell's Electrical and Wireless, Modern Electrical Supply Co., Re-echo Electrical Mfg. Co., Swift Electrical Co., Tele-Dis Services (Founders Co.), Theatrephone Co., Uni-Directional Apparatus Co., Wireless Installations. The following will be struck off unless cause to the contrary is shown before April 4th: Coventry Wireless Supplies, Electric Lamp Regenerators, Holborn Electric Fire, Jenner Light and Power Co., Maywood Engineering and Electrical Mfg. Co., National Wire Mfg. Co., Prendergast Electrical Engineering Co., R.E.T. Construction Co., Stella Light Co., Sunbeam Light Co.

New Companies.

C. H. ROBERTS AND CO., LTD.—Cap., £2 000. To acquire business of electrical engineers, salesmen and contractors carried on by C. H. Roberts and T. R. Jackson, at 77, High Street, Broadstairs, Kent.

ALLANDS, LTD.—Cap., £2 100. Designers and manufacturers of and dealers in electrical fittings and lighting and wireless apparatus, etc. Reg. office: 7, Duke Street, Manchester Square, London, W.1.

OLIVER ELECTRICAL SUPPLIES CO., LTD.—Cap., £100. Electricians, manufacturers of and dealers in electrical apparatus and appliances, etc. Reg. office: 10, Bolt Court, Fleet Street, London, E.C.4.

LE VERRE ARTISTIQUE, LTD.—Cap., £1 000. Electrical engineers, manufacturer of and dealers in illuminated and coloured glass and electrical fittings, etc. Solicitor: W. H. Lane, 27, Chancery Lane, London, W.C.2.

BURGOYNE WIRELESS, LTD.—Cap., £6 000. To adopt agreement with E. H. Hine and to carry on business of manufacturers of and dealers in wireless sets, etc. Reg. office: 36a, York Road, King's Cross, London, N.

JERUSALEM ELECTRIC AND PUBLIC SERVICE CORPORATION, LTD.—Incorporated in Palestine. British address: 66, Queen Street, London, E.C.4, where T. K. Anderson, C.A., is authorised to accept service of process and notices on behalf of the company.

A. T. M. PENSION TRUST, LTD.—Cap., £100. To undertake and discharge office and duties of trustees of the existing pension fund for the benefit of the staff employees of Automatic Telephone Manufacturing Co., Ltd., and the International Automatic Telephone Co., Ltd. Solicitor: G. M. Magee, 10, Water Street, Liverpool.

TRE-COIL WORKS, LTD.—Cap., £300. To acquire business of electrical engineers now carried on at 5, Archer Street Works, Shaftesbury Avenue, W., by J. Dorn and R. Lurion, and the right to use the name of "Tre-Coil"; also to acquire all interest in certain inventions of said J. Dorn relating to manufacture and design of a three-coil cone speaker movement, etc.

PHOS DEVELOPMENT, LTD.—Cap., £4 050. To undertake improvement, development and exploitation of any inventions, patents and secret processes relating to television, to carry on business of importers and manufacturers of, agents for and licencees of television apparatus and electrical and wireless apparatus, etc. Reg. office: 68, Victoria Street, London, S.W.1.

W. M. SYNDICATE, LTD.—Cap., £2 500. To adopt agreement with Capt. M. Trouton for acquiring his interests relating to royalties under an agreement dated March 5th, 1928, and made between him and Wireless Music, Ltd., to carry on business of manufacturers of and dealers in wireless, and other apparatus, etc. Solicitors: Lawrence, Messer and Co., 14, Old Jewry Chambers, London, E.C.2.

A.R.L. SYNDICATE, LTD.—Cap., £3 000. To adopt agreement between A. D. de Castro and Central Trust Co., Ltd., to develop and turn to account patents for improvements to electric lamps, owned by the said A. D. de Castro, to carry on business of electricians, electrical and mechanical engineers, manufacturers, agents or vendors of electric and other lamps, electrical, radio and wireless apparatus, etc. Reg. office: 5, Broad Street Place, London, E.C,

ELECTRICAL TRADE MARKS.

The following information is prepared from the Illustrated Official Journal (Patents by permission of the Controller of H.M. Stationery Office. Printed copies of full Patent Specifications, when accepted, may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at 1s. each.

493 888.—Class 11. Gas and electric lighting units specially made for therapeutic purposes. Tylors (J.B.4), Ltd., 134, King Street, Hammersmith, London, W.6; manufacturers. August 8th, 1928.

CONOGRAPH.—493 969. Class 8. Sound reproducing instruments. John Denis Thompson Tsalta, Mount Row, Guernsey, Channel Islands; manufacturer. August 10th, 1928.

HERCULITE.—495 206. Class 8. Direction indicators for vehicles, and electrically illuminated advertising and display signs. R. D. Hughes and Son, 46, Sidney Street, Chorlton-on-Medlock, Manchester; sign manufacturers. September 21st, 1928.

Opposition to the Registration of the following Trade Marks can be lodged up to January 26th, 1929.

VERTIGRAPH.—494 474. Class 8. Philosophical instruments, scientific instruments, and apparatus for useful purposes; instruments and apparatus for teaching. Hinz Fabrik Gesellschaft mit beschrankter Haftung (a joint stock company organised under the laws of Germany), Lankwitzerstrasse 16 to 18, Berlin-Mariendorf, Germany; manufacturers. August 27th, 1928. (To be Associated. Sect. 24.)

494 655. Class 8. Philosophical instruments, scientific instruments and apparatus for useful purposes; instruments and apparatus for teaching. Schering-Kahlbaum Aktien-Gesellschaft (a joint stock company organised under the laws of Germany), 170 and 171, Mullerstrasse, Berlin, N.39, Germany; manufacturers. August 31st, 1928. (To be Associated. Sect. 24.)

FULTOGRAPH.—495 269. Class 8. Philosophical instruments, scientific instruments, and apparatus for useful purposes; instruments and apparatus for teaching. Wireless Pictures (1928), Ltd., 11, Bishopsgate, London, E.C.2; manufacturers. September 24th, 1928.

Opposition to the Registration of the following Trade Marks can be lodged up to February 2nd, 1929.

496 887. Class 8. Philosophical instruments, scientific instruments, and apparatus for useful purposes; instruments and apparatus for teaching. Sophus Berendsen (London), Ltd., 10, Philpot Lane, London, E.C.3; metal and general merchants. November 9th, 1928.

NEOLUX.—495 659. Class 13. Chandeliers, lamp shade frames, lamp shade supports, lamp shades, lamp holders, lamp standards, reflectors, and electric lighting fittings, all being goods made of ordinary metal and not included in other classes. Louis Dernier and Hamlyn Ltd., 23, Newman Street, Oxford Street, London, W.1; manufacturers. October 4th, 1928. (By consent.)

Registration of this Trade Mark shall give no right to the exclusive use of the device of an electric lamp.

480 059. Class 13. Electric lamps (ordinary). Martin Fraenkel, Siegmundshof, 5, Berlin, Germany; merchant. May 14th, 1927.

Opposition to the Registration of the following Trade Marks can be lodged up to February 9th, 1929.

COLUMBIA.—User claimed from October 31st, 1914, in respect of arc light carbons; from March 31st, 1915, in respect of projector carbons; from September 30th, 1914, in respect of photographic carbons; from February 28th, 1915, in respect of searchlight carbons; and from November 30th, 1919, in respect of forced carbons.

DULCETTO.—494 353. Class 8. Wireless telephonic apparatus, gramophones, sound reproducing apparatus, and parts and accessories of wireless telephonic apparatus, gramophones, and sound reproducing apparatus. Dulcetto-Polyphon, Ltd., 2 and 3, Newman Street, Oxford Street, London, W.1; manufacturers. August 22nd, 1928. (To be Associated. Sect. 24.)

METAL AND CHEMICAL PRICES.

TUESDAY, January 15th.

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£76 15 0	£0 5 0	—
Electro Wirebars	,,	£78 15 0	—	—
H.C. Wires, basis	per lb.	11d.	—	—
Sheet	,,	10 11/16d.	—	—
Phosphor Bronze—				
Wire (Telephone) basis	per lb.	1s. 2d.	—	—
Brass 60/40—				
Rod, basis	per lb.	8 1/4d.	—	—
Sheet ,,	,,	10 1/2d.	—	—
Wire ,,	,,	10 1/2d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£3 8 6	—	—
Galvanised Steel Wire, basis 8 S.W.G.	,,	£14 15 0	—	—
Lead Pig—				
English	per ton	£23 5 0	—	5 0
Foreign or Colonial	,,	£21 17 6	—	5 0
Tin—				
Ingot	per ton	£222 12 6	—	12 6
Wire, basis	per lb.	2 11	—	—
Aluminium Ingots	per ton	£95 0 0	—	—
Spelter	,,	£26 5 0	£0 2 6	—
Mercury	per bottle	£22 8 6	—	—

Sulphur—Flowers, Ton £12 0 0 *Copper Sulphate*—Ton £25 to £25 10 0
,, Roll, ,, £10 15 0 *Boric Acid* (Crystals) ,, £30
Sulphuric Acid (Pyrites, 168°) Ton £6 15 0 *Sodium Chlorate*—Per lb. 2 1/2d.
Sodium Bichromate—Per lb. 3 1/2d.

Rubber—Para fine, 11d.; plantation, 1st latex, 10d.

*** The metal prices are supplied by British Insulated Cables, Ltd., and the rubber prices by W. T. Henley's Telegraph Works Co., Ltd.

LEAD MARKET REPORT.

According to James Forster and Co. a dull and uninteresting lead market has been witnessed this week, prices fluctuating within narrow limits. Highest prices paid were on Monday at £22 3s. 9d. for January and £22 12s. 6d. for April, since when the tone has been slightly easier. New York price remains unchanged at 6.65 cents. Demand from consumers has been extremely quiet this week, a contrast from the activity seen the previous week, and similar conditions appear to prevail on the Continent. Supplies on the other hand, though not excessive, are quite sufficient for current needs.

Closing prices on January 11th were £22 1s. 3d. for January, £22 3s. 9d. for February, £22 6s. 3d. for March, and £22 8s. 9d. for April.

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COMMERCIAL INFORMATION

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debt. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

ELLIS, Mr. F. L., Wood Lane Electrical Works, Chapel Allerton, Leeds, electrician. £13 10s. 1d. November 15th.

GOTTLIEB, J. L. AND CO., LTD., 15, Cromer Street, Gray's Inn Road, W.C.1, wireless manufacturers. £11 16s. 6d. November 30th.

LEICESTER AND HOLT, 60, Blackburn Road, Haslingden, electrical engineers. £20 0s. 2d. December 5th.

MADDOX, Mr. G. E., 70, Rowson Street, New Brighton, radio engineer. £13 3s. 5d. November 22nd.

PEARCE, Mr. S., J., 91, High Street, Edgware, wireless agent. £13 8s. 7d. October 29th.

RAPINET, Hamilton P. Lotosca, 43, Hebdon Road, Tooting, wireless expert. £20 13s. July 6th.

RICHARDS BROS., Vale Street, Rhyl, electrical engineers. £16 11s. 5d. December 5th, and £15 12s. 1d. December 4th.

ROSE, Mr. W., 8, Sion Street, Radcliffe, wireless dealer. £19 8s. November 28th.

TROWER, Mr. J., 266, Charnwood Street, Leicester, electrical contractor. £11 2s. 4d. November 22nd.

WILLIAMS, Mr. J. S., 60, Bebington Road, New Ferry, wireless dealer. £18 1s. 10d. July 10th.

Receiverships.

ASHLAND ENGINEERS, LTD. A. R. Welchman, C.A., of 9, Old Jewry Chambers, E.C.2, was appointed Receiver and Manager on December 19th, 1928, under powers contained in debentures dated June 30th, 1927.

ATTAIX, LTD.—H. C. Merrett, of 32, Finsbury Square, E.C.2, was appointed Receiver and Manager on December 14th, under powers contained in debenture dated May 16th, 1928.

London Gazette, etc.

Bankruptcy Information.

GOVETT, Charles Kenneth, 179, Albany Road, Cardiff, trading as KENNETH GOVETT AND COMPANY, electrical contractor. Receiving order, January 5th. Debtor's petition.

Notices of Dividends.

HOLMES, Walter Godfrey, 42, Walcot Street, Bath, wireless and electrical engineer. First and final dividend 2s. 11½d. per £, payable, January 21st, Official Receiver's Office, 26, Baldwin Street, Bristol.

WOOD, Norman Hurst, 32, Highway Avenue, Thornton Heath, Surrey, lately 38, St. Charles Square, North Kensington, W.10, electrical engineer. First and final dividend, 1s. 10d. per £, payable, January 25th, Official Receiver's Office, 29, Russell Square, London, W.C.1.

Notice of Intended Dividend.

KELLY, Stanley Sherzell, 59, North Road, Durham, electrical contractor. Last day for receiving proofs, January 26th. Trustee, H. J. Armstrong, 2, Saville Place, Newcastle-upon-Tyne.

Partnerships Dissolved.

KEENE AND HARWOOD (James Alfred KEENE and George William Keene HARWOOD), electrical engineers, 68, Church Road, Barnes, S.W.13. By mutual consent as from December 31st, 1928. Debts received and paid by G. W. K. Harwood, who will continue the business under the style of G. W. K. Harwood.

MAGNUM ELECTRICAL APPLIANCES (Lawrence Arthur GOMMERSALL and Thomas Josiah LATTIMER and Frank Daniel SOARES), electrical engineers and manufacturers, and dealers in electric heating and cooking apparatus, 16, Limes Road, Croydon. By mutual consent as from December 31st, 1927, so far as concerns F. D. Soares, who retires from the firm.

Bankruptcy Proceedings.

WILLS, Thomas Treneman, 17, Britannia Place, Prince Rock, formerly 16, Turret Grove, both Plymouth, Devonshire, wireless apparatus vendor. The public examination in this matter was held recently at the Western Law Courts, Guildhall, Plymouth, when the debtor lodged a statement of affairs showing liabilities of £170, against estimated assets amounting to £21, leaving a deficiency of £149. The debtor stated that he had never had a shop of his own, but had generally worked as a journeyman painter. He commenced trading in 1927, with little money, securing work by personal recommendation. In order to secure work the debtor had had to cut prices, in one case from £34 to £23. He had kept no books of account, and stated that he had insufficient money with which to file his petition until he received a legacy of £20, £13 of which he used to commence proceedings, handing the balance to his mother, he having borrowed money from her. A formal adjournment was agreed to, subject to a balance of £1 being paid in the meantime.

PATENT RECORD.

The following information is prepared from the Illustrated Official Journal (Patents) by permission of the Controller of H.M. Stationery Office. Printed copies of full Patent Specifications, when accepted, may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at 1s. each.

Specifications Accepted.

302 497 A. V. KELLER and B. F. ANCOCK. Low-voltage continuous-current motors. (14/12/27.)
302 502 D. R. DAVIES and METROPOLITAN-VICKERS ELECTRICAL CO., LTD. Electrical switchgear. (22/12/27.)
302 503 M-O VALVE CO., LTD. and J. W. RYDE. Manufacture of cathodes for electric discharge tubes. (23/12/27.)
302 507 J. E. POLLAK. (HERMSDORF-SCHOMBURG-ISOLATOREN GES.). Electrical insulators or the like. (9/1/28.)
283 502 SOC. C. SCHNEIDER ET CIE. Fuses, fuse boxes, or the like. (11/1/27.)
283 931 H. F. PORTER. Magnetic alloys. (20/1/27.)
284 716 W. LEYHAUSEN. Automatic multipolar toggle-lever electric switch. (4/2/27.)
285 020 BRITISH THOMSON-HOUSTON CO., LTD. Shielding systems for electric discharge devices. (8/2/27.)
302 522 SIEMENS BROS. AND CO., LTD. and A. E. FOSTER. Insulated electric conductors. (17/2/28.)
302 523 E. D. FELDMAN. Electric motors. (22/2/28.)
286 268 J. T. WELSH. Electrical switches. (2/3/27.)
286 650 ALLGEMEINE ELEKTRICITATS-GES. Process for the manufacture of cathodes for discharge devices. (7/3/27.)
287 458 ELEKTRO-HEIZ U. WARME GES. Manufacture of electric heating-resistances. (19/3/27.)
302 529 E. F. NORTHRUP. Apparatus for heating rods, tubes and the like by electricity. (21/3/28.)
289 475 BRITISH THOMSON-HOUSTON CO., LTD. Automatic switching systems. (28/4/27.)
302 538 I. INABA. Electric switches. (4/5/28.)
290 665 A. POUCHAIN. Zinc-lead electric accumulators. (19/5/27.)
291 011 AKT.-GES. BROWN, BOVERI ET CIE. Pressure-applying devices for two or more concentric transformer windings. (23/5/27.)
302 550 C. G. NOBBS and W. W. NOBBS. Electric heating-apparatus. (7/6/28.)
302 551 W. J. UNDERWOOD. Arrangement for the electric control of railway points or other traffic-regulating devices which are required to remain in one position until each passing train completely clears them. (11/6/28.)
294 255 INTERNATIONAL GENERAL ELECTRIC CO., INC. Elastic-fluid turbines. (21/7/27.)
294 546 BRITISH THOMSON-HOUSTON CO., LTD. Transmission of pictures. (25/7/27.)
297 113 SIEMENS-SCHUCKERTWERKE AKT.-GES. Vacuum cleaner with two impellers. (16/9/27.)
299 016 TELEFUNKEN GES. FUR DRAHTLOSE TELEGRAPHIE. Direction-finding aerials, for use on aircraft. (19/10/27.)
302 217 ASSOCIATED TELEPHONE AND TELEGRAPH CO. and J. WICKS. Automatic or semi-automatic telephone systems. (9/8/27.)
301 084 SIEMENS-SCHUCKERTWERKE AKT.-GES. Electric current-collecting brushes. (25/11/27.)
272 928 COMPAGNIE INTERNATIONALE DES FREINS AUTOMATIQUES SOC. ANON. Hydro-electric motor. (17/6/26.)
274 514 DR. S. LOEWE. Multiple thermionic valves. (19/7/26.)
302 706 CREED AND CO., LTD., and E. O. SYMONDS. Thermionic amplification of line or cable signal potentials or potentials subject to a slow rate of change. (21/7/27.)
302 622 AUTOMATIC TELEPHONE MANUFACTURING CO., LTD., and P. J. ROBINSON. Electrically-operated traffic warning signal lamps for use at road-traffic control points. (16/8/27.)
302 623 BROOKHIRST SWITCHGEAR, LTD., and J. O. KNOWLES. Electric fuses. (19/8/27.)
302 634 STANDARD TELEPHONES AND CABLES, LTD. (WESTERN ELECTRIC CO., INC.). Radio signalling systems. (19/9/27.)
277 698 W. D. FLETCHER. Generation of electric power. (17/9/26.)
302 638 P. B. HEALEY and TELEPHONE MANUFACTURING CO., LTD. Telephone circuits. (19/9/27.)
302 715 COLLISON'S PRECISION SCREW CO., LTD., and F. E. COLLISON. Electric circuits employing thermionic valves. (21/9/27.)
302 716 AUTOMATIC TELEPHONE MANUFACTURING CO., LTD., and W. O. PASSMORE. Automatic or semi-automatic telephone systems. (21/9/27.)
278 710 SIEMENS-SCHUCKERTWERKE AKT.-GES. Electric gas-purifying plant. (5/10/26.)
302,751 F. C. RUSSELL [trading as RUSSELL, NEWBERY AND CO.], and J. H. BRADBURY. Adjustable and flexible magneto and like shaft couplings. (7/10/27.)
302 754 BROOKHIRST SWITCHGEAR, LTD., and J. O. KNOWLES. Electric switches, fuses, and the like. (14/10/27.)
302 764 T. HOUGH. Electrical gramophone-pickups. (25/10/27.)
302 768 SWITCHGEAR AND COWANS, LTD., and G. H. NEEP. Electric switches and switchgear. (28/10/27.)
302 769 F. S. BLAKEY and A. WILLIAMSON. Electrical terminal plates for electric motors and the like. (28/10/27.)
302 777 B. DUNGLINSON and ELECTROFLO METERS CO., LTD. Recording-instruments. (4/11/27.)
302 784 C. M. E. TROTTER [legal representative of G. H. TROTTER (deceased)]. Electric accumulators. (16/11/27.)
302 793 A. D. RICCIA. Reflector for short Hertzian waves. (1/12/27.)
302 799 BROOKHIRST SWITCHGEAR, LTD., and G. RATTENBURY. Relays, particularly applicable to automatic regulating-apparatus for alternating-currents. (15/12/27.)
302 800 W. H. COX. Devices for discharging static electricity from machinery. (15/12/27.)
302 823 BRITISH MANNESMANN TUBE CO., LTD., and E. S. SMITH. Electric-light standards. (18/1/28.)
284 990 N.V. PHILIPS' GLOEILAMPENFABRIEKEN. Manufacture of bodies from metals having a high melting-point. (7/2/27.)
302 824 BRITISH THOMSON-HOUSTON CO., LTD., C. J. MORTON and T. H. WOODFIELD. Shock-absorbing devices. (26/1/28.)
302 838 H. ANDREWES and DUBILIER CONDENSER CO. (1925), LTD. Pick-up and amplifying devices for use with gramophones and the like. (24/2/28.)
302 840 IGRANIC ELECTRIC CO., LTD. (CUTLER-HAMMER MANUFACTURING CO.). Thermally-actuated electric cut-outs and other thermally-responsive electric elements. (29/2/28.)
286 649 F. HOLWECK. Thermionic valves. (7/3/27.)
291 003 AKT.-GES. BROWN, BOVERI ET CIE. Method of preventing back ignitions in metal-vapour rectifiers having insulated anode sheaths. (13/5/27.)
291 085 SIEMENS-SCHUCKERTWERKE AKT.-GES. Explosion-proof housing for electrical apparatus. (27/5/27.)
302 855 W. J. SCOTT. Electric stop-motion for drawing-boxes for wool, worsted, and like fibres. (4/5/28.)
290 644 ASSOCIATED TELEPHONE AND TELEGRAPH CO. Remote control of electric power substations. (11/10/26.)
291 731 BRITISH THOMSON-HOUSTON CO., LTD. Means for indicating synchronism between alternating electric voltages. (6/6/27.)
292 101 BRITISH THOMSON-HOUSTON CO., LTD. Indicating-instruments. (23/6/27.)
294 885 ASSOCIATED TELEPHONE AND TELEGRAPH CO. Telephone systems. (18/10/26.)
298 205 DR. S. LOEWE. Multiple thermionic valve. (19/7/27.)
273 320 AKT.-GES. BROWN, BOVERI ET CIE. Electric annealing-furnaces of the resistance type. (23/6/26.)

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303 075 DUNLOP RUBBER CO., LTD., H. WILLSHAW, W. A. DAVIS, and H. SMITH. Electrical time-switch mechanism applicable particularly to moulding and vulcanising apparatus. (22/8/27.)
30 0337 W. S. SMITH and N. W. MCLACHLAN. Thermionic valves. (26/8/27.)
303 039 SPENCER, A. E., WALLER, P. H., AND GENERAL ENGINEERING DEVELOPMENT TRUST, LTD. Electric incandescent lamp holders. (27/8/27.)
303 190 J. R. QUAIN. Illuminated signs. (31/8/27.)
303 078 C. R. BURCH, F. E. BANCROFT, and METROPOLITAN-VICKERS ELECTRICAL CO., LTD. Vacuum distillation. (21/9/27.)
302 960 J. GROSSART. Electric cut-outs. (22/9/27.)
277 988 ASSOCIATED TELEPHONE AND TELEGRAPH CO. Telephone systems. (22/9/26.)
277 990 C. E. BENNETT. Electric current interrupters. (23/9/26.)
302 973 BRITISH THOMSON-HOUSTON CO., LTD., P. H. HARDING, and J. M. GOODALL. Protection of dynamo-electric machines. (23/9/27.)
293 681 RAINBOW LIGHT, INC. Starting and operating luminous electric discharge tubes (9/7/27.)
293 682 RAINBOW LIGHT, INC. Luminous electric discharge tubes of high candle-power. (9/7/27.)

APPLICATIONS FOR PATENTS

December 10th.

36 354 METROPOLITAN-VICKERS ELECTRICAL CO., LTD. Voltage regulators. (9/12/27, U.S.)
36 367 D. G. PETRIE and YOUNG, OSMOND AND YOUNG, LTD. Electric heating units, etc.
36 454 D. G. PETRIE and YOUNG, OSMOND AND YOUNG, LTD. Resistance units and electric heating apparatus.
36 462 O. PRESSLER. Photoelectric cells. (9/12/27, Germany.)
36 470 W. ROW. Electric dimmer switches.
36 374 D. R. SHARMAN. Automatically lighting vehicle lamps, etc.
36 467 SIEMENS AND HALSKE A.G. Telephone installations. (23/6/28, Germany.)
36 424 SUDDEUTSCHE TELEFON-APPARATE KABEL UND DRAHTWERKE A.G. Manufacture of alternating rectifiers. (10/12/27, Germany.)
36 351 C. C. G. TAYLOR. Trolley head for electric vehicles. (14/9/28.)
36 388 A. A. THORNTON (PAILLARD ET CIE). Electrical amplifiers for sound reproducing apparatus.
36 320 C. B. WALKER. Electric power systems.
36 391 WESTINGHOUSE LAMP CO. Manufacture of incandescent lamps. (9/12/27, U.S.)

December 11th.

36 605 J. P. ANNACKER. Electrical fuse bridges.
36 565 BRITISH ELECTRICAL AND ALLIED INDUSTRIES RESEARCH ASSOCIATION, P. D. MORGAN, E. B. WEDMORE and S. WHITEHEAD. Electric cables.
36 601 R. E. H. CARPENTER. Electron discharge amplifying apparatus.
36 599 E. W. CHALLANS, L. H. PETER and WESTINGHOUSE BRAKE AND SAXBY SIGNAL CO., LTD. Apparatus for electric transmission of indications.
36 524 E. S. CLUDERAY. Electric relays.
36 483 F. DUFFY. Tramcars, etc.
36 568 W. H. EGGINTON and J. LUCAS, LTD. Electrically heated cigar lighters, etc.
36 563 ELECTRAD, INC. Electrical resistors. (17/12/27, U.S.)
36 542, 36 543, 36 544 ELECTRICAL RESEARCH PRODUCTS, INC. Television systems. (6/4/27, U.S.)
36 531 GENERAL ELECTRIC CO., LTD., and E. WEINTRAUB. Mercury vapour rectifiers. (21/7/28, France.)
36 574 G. GROENEVELD. Protective switching device.
36 564 HAZELTINE CORPORATION. Wheatstone bridge filter. (20/1/28, U.S.)
36 572 L. A. LEVY and D. W. WEST. Electrical production of visible images.
36 482 L. N. LLOYD. Variable speed electrical transmission gear.
36 557 C. LORENZ AKT.-GES. Electrical transmission of pictures. (28/12/27, Germany.)
36 500 A. H. RICHARDSON. Tuning devices for wireless receiving apparatus.
36 537 F. G. L. SCOTT and A. W. SHARMAN. Apparatus for producing electrical radiation.
36 554 SIEMENS-SCHUCKERTWERKE A.G. Withdrawable oil switch for multiple busbar systems. (1/2/28, Germany.)
36 545 SIEMENS-SCHUCKERTWERKE A.G. Means for regulating flow. (12/12/27 Germany.)
36 475 H. M. SPENCER. Detector unit for wireless receiving set.
36 595 A. E. TELFORD. Transmitting and remote recording systems.
36 562 A. E. WHITE (BASTIAN MORLEY CO.). Electric heating apparatus. (10/10/27.)

December 12th.

36 725 AUTOMATIC TELEPHONE MANUFACTURING CO., LTD., R. TAYLOR and W. SAVILLE. Telephone systems.
36 726 F. A. CAIN. Transformers, etc.
36 728 E. C. DAVIES and GENERAL ELECTRIC CO., LTD. Arrangements for controlling electric motors.
36 615 H. F. DOWLER. Electrodes of batteries.
36 690 EDISON SWAN ELECTRIC CO., LTD., and L. H. SOUNDY. Thermionic valves and circuit arrangements therefor.
36 613 R. R. HOLMES. Electric light fittings.
36 688 INTERNATIONAL GENERAL ELECTRIC CO., INC. Speed controlling means for a.c. motors. (12/12/27 Germany.)
36 680 METROPOLE DEVELOPMENTS LTD., and A. SCHMIDT. Manufacture of light emitting elements for electric lamps.
36 724 METROPOLITAN-VICKERS ELECTRICAL CO., LTD. Electrical control devices. (13/12/27, U.S.)
36 738 J. NEALE. Electrostatic relay.
36 662 J. and J. V. WALKER. Electrical make and break contact.

December 13th.

36 829 C. G. M. BENNETT. Electric lamp holders.
36 752 G. B. BRAITHWAITE and J. W. RIGBY. Miners' electric lamps.
36 865 BRITISH THOMSON-HOUSTON CO., LTD. Electron discharge devices. (14/12/27, U.S.)
36 866 BRITISH THOMSON-HOUSTON CO., LTD. Photoelectric cells. (4/1/28, U.S.)
36 816 W. H. BULL and J. E. SCHEEL. Apparatus for producing high-frequency alternating currents.
36 819 ECONOMIC ELECTRIC, LTD., and C. HOLT. System of winding inductances.
36 820 ECONOMIC ELECTRIC, LTD., and C. HOLT. Connecting radio receivers.
36 821 ECONOMIC ELECTRIC, LTD., and C. HOLT. Constant amplitude oscillator.
36 856 ELEKTRIZITATS A. G. VORM, W. LAHMEYER AND CO. and RHEINISCH WESTFALISCHE SPRENGSTAFF AKT. GES. High tension insulators. (12/1/28, Germany.)
36 829 C. A. ELY. Electric lamp holders.
36 841 J. FELDMAN. Transformers, choking coils, etc.
36 793 GENERAL ELECTRIC CO., LTD., and J. W. RYDE. Electric rectifying apparatus.
36 778 D. JONES. Apparatus for galvanising metallic sheets.
36 750 W. J. LINE. Electric plugs.
36 867 LONDON ELECTRIC WIRE CO., and SMITHS, LTD., and E. L. WILDY. Transformers.
36 883 MASCHINENFABRIK OERLIKON. Electric rectifiers. (16/12/27, Switzerland.)
36 881 J. E. POLLAK (ASSOCIATED TELEPHONE AND TELEGRAPH CO.). Telephone systems.
36 870 H. J. ROUND. Means for recording sound, etc.
36 805 SIEMENS-SCHUCKERTWERKE A. G. Electric switches. (2/2/28, Germany.)
36 871 S. B. SMITH. Signal limiting, amplifying, etc., devices.
36 765 H. M. SPENCER. Low-frequency unit for wireless sets.
36 862 SPRAGUE SPECIALITIES CO. Electrical condensers. (13/12/27, U.S.)
36 861 A. E. WHITE (SPRAGUE SPECIALITIES CO.). Electrical condensers.

December 14th.

36 974, 36 975 AKT. GES. BROWN, BOVERI ET CIE. Insulators. (9/5/28, Germany.)
36 976 AKT. GES. BROWN, BOVERI ET CIE. Insulators. (20/4/28, Germany.)
37 017 AKT. GES. BROWN, BOVERI ET CIE. Strainers for overhead lines of electric railways. (31/12/27, Germany.)
36 888 BRITISH THOMSON-HOUSTON CO., LTD. Temperature responsive inductances. (13/12/27, U.S.)
36 966 BRITISH THOMSON-HOUSTON CO., LTD. Toasters. (14/12/27, U.S.)
36 970 BRITISH THOMSON-HOUSTON CO., LTD. Amplifying apparatus. (24/12/27, U.S.)
36 954 D. A. CHRISTIAN, and SIEMENS BROS AND CO., LTD. Selecting switches for automatic telephone systems.
36 905 J. A. CORRY and H. WOOLDRIDGE. Electric signs.
37 042, 37 043 S. G. S. DICKER (N. V. PHILIPS' GLOEILAMPENFABRIEKEN). Electric pick-ups.
37 053 D. R. FLETCHER. Devices for connection of electric wires, etc., to apparatus.
36 951, 36 953 E. A. FORCEVILLE, E. A. PETITHORY, and SIEMENS BROS. AND CO., LTD. Selecting switches for automatic telephone systems.
36 952 E. A. FORCEVILLE, E. A. PETITHORY, and SIEMENS BROS. AND CO., LTD. Automatic telephone selector banks and selectors.
37 054 R. K. HEARN. Electric oven heater for soldering irons.
37 052 H. M. JONES. Tubular joints and bearings for electric lamps, etc.
36 977 T. KENDALL. Sound reproducing apparatus for wireless receiving apparatus.
37 010 KERSONS MANUFACTURING CO., LTD., and C. W. PARSONS. Electric fuses.
36 895 J. F. J. MALONE. Transformers.
37 050 R. S. MILLER, and OLDHAM AND SONS, LTD. Apparatus for charging galvanic batteries, etc.
37 034 TELEFUNKEN GES. FÜR DRAHTLOSE TELEGRAPHIE. Piezo-electric devices. (17/12/27, Germany.)
37 035 TELEFUNKEN GES. FÜR DRAHTLOSE TELEGRAPHIE. Manufacture of dielectrics. (21/12/27, Germany.)
37 005 F. E. WOOLNOUGH. Radiant heat baths.

December 15th.

37 147 BRITISH THOMSON-HOUSTON CO., LTD. Radio signalling apparatus. (22/12/27 U.S.)
37 151 W. P. DIGBY and R. B. FAIRTHORNE. Cooling transformers.
37 117 O. FULTON, G. PRIECHENFRIED, and WIRELESS PICTURES (1928), LTD. Apparatus for electrical reception of pictures.
37 118 INSTITUT FÜR PHYSIKALISCHE GRUNDLAGEN DER MEDIZIN. Charging and discharging electric condensers. (17/12/27, Germany.)
37 149 A. JOFFÉ. Manufacture of electric insulations, etc. (20/12/27, Germany.)
37 132 L. N. MILLS. Electrical sheathings or casings.
37 079 V. C. J. SAMPSON. Sound amplifier for telephones, etc.
37 137 M. SORO (NÉE LAVATELLI). Electric switches.
37 128 H. A. SUTTON. Microphonic devices for wireless transmission, etc.
37 150 TELEFONAKTIEBOLAGET, L. M. ERICSSON. Generation of harmonic oscillations. (17/12/27, Germany.)

December 17th.

37 261 ALLGEMEINE ELEKTRICITATS GES. Compressed gas switch. (15/12/27 Germany.)
37 241 A. E. ANGOLD, GENERAL ELECTRIC CO., LTD. Arc lamps.
37 309 P. G. ARGUELLES. Safety device for lamp bulbs.
37 187 R. BOSCH AKT.-GES. Electric switches (17/12/27, Germany.)
37 246 BRITISH THOMSON-HOUSTON CO., LTD. Electric condensers. (21/12/27, U.S.)
37 247 BRITISH THOMSON-HOUSTON CO., LTD. Electron discharge devices. (22/12/27, U.S.)

COMING EVENTS.

Friday, January 18th.

ELECTRICAL DEVELOPMENT ASSOCIATION.—Royal Society of Arts, John Street, Adelphi, London. Conference on "Electric Heating and Cooking Developments." Speaker, Mr. C. H. Rayner. 7.30 *p.m.*

Saturday, January 19th.

ASSOCIATION OF MINING ELECTRICAL ENGINEERS (SOUTH WALES BRANCH).—South Wales Institute of Engineers, Park Place, Cardiff. Paper by Mr. F. E. Pring on "Coal Cutting Machines in Low Seams." 6 *p.m.*

Monday, January 21st.

INSTITUTION OF ELECTRICAL ENGINEERS (LONDON STUDENTS' SECTION.)—Institution of Mechanical Engineers, Storey's Gate, Westminster. Paper by Mr. H. R. Sketch on "Engineering Insurance." 7 *p.m.*

INSTITUTION OF ELECTRICAL ENGINEERS (SOUTH MIDLAND CENTRE).—University Edmund Street, Birmingham. Lecture on "Wireless," by Capt. P. P. Eckersley. 7 *p.m.*

CROYDON WIRELESS AND PHYSICAL SOCIETY.—5, Altyre Road, East Croydon. Demonstration and description of the "Construction of Moving-coil Loud Speakers." 8 *p.m.*

Tuesday, January 22nd.

ELECTRICAL CONTRACTORS' ASSOCIATION (CHESTERFIELD SUB-BRANCH).—Falcon Café. Ordinary meeting.

ELECTRICAL CONTRACTORS' ASSOCIATION.—Savoy Hotel, Strand, London. Annual Dinner. 6.30 for 7 *p.m.*

INSTITUTION OF ELECTRICAL ENGINEERS (NORTH-WESTERN CENTRE).—Engineers' Club, 17, Albert Square, Manchester. General discussion on "The Anticipation of Demand, and the Economic Selection, Provision and Layout of Plant," with introductory papers by Capt. J. M. Donaldson (Power Systems), and Mr. J. G. Hines (Telephone Systems). 7 *p.m.*

ILLUMINATING ENGINEERING SOCIETY.—Lecture Theatre of the Home Office Industrial Museum, Horseferry Road, Westminster. Paper by Dr. L. C. Martin on "Colour and its Applications." 7 *p.m.*

Wednesday, January 23rd.

ELECTRICAL ASSOCIATION FOR WOMEN.—Visit to the newly equipped showrooms of Messrs. Troughton and Young, Ltd., 143, Knightsbridge, S.W. Short lecture by Mr. A. B. Read on "Modern Decorative Lighting of Interiors."

INSTITUTION OF ELECTRICAL ENGINEERS (NORTH-WESTERN CENTRE).—Midland Hotel, Manchester. Annual Dinner. 6.45 for 7.15 *p.m.*

Thursday, January 24th.

INSTITUTION OF ELECTRICAL ENGINEERS.—Institution, Savoy Place, Victoria Embankment, London. Paper by Messrs. Johnstone Wright and C. W. Marshall on "The Construction of the Grid Transmission System in Great Britain." 6 *p.m.*

Friday, January 25th.

ENGINEERING AND SCIENTIFIC CLUB (WOLVERHAMPTON).—Debate on "Trams *versus* 'Buses." Opened by Mr. A. C. Baker and Mr. C. Owen Silvers.

INSTITUTION OF ELECTRICAL ENGINEERS (IRISH CENTRE).—Gaiety Theatre, Dublin. Faraday Lecture by Mr. Ll. B. Atkinson on "How Electricity Does Things." 4 *p.m.*

PHYSICAL SOCIETY.—Imperial College of Science, Imperial Institute Road, South Kensington. Papers by Prof. G. Vernon Boys on a "Fused Quartz Pendulum Rod for Clocks"; Mr. G. W. Sutton on "A Method for the Determination of the Equivalent Resistance of Air-Condensers at High Frequencies"; and Mr. L. Hartshorn on "The Measurement of the Anode Circuit Impedances and Mutual Conductances of Thermionic Valves." 5 *p.m.*

BIRMINGHAM ELECTRIC CLUB.—Grand Hotel, Colmore Row, Birmingham. Presidential Address. 7 *p.m.*

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THE ELECTRICIAN

Established 1861. The Oldest Weekly Illustrated Journal of

Electrical Engineering, Industry, Science and Finance.

Bouverie House, Fleet Street, London, E.C.4. Telegrams: "Benbrotric, Fleet, London." Telephone: City 0244 (Ten lines).

No. 2643. [No. 4; Vol. CII.] **Friday, January 25, 1929.** Annual Subscription, 25s. Overseas, 30s.

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Current Topics.

Overhead Lines and Rural Electricity.

OUR experiment a year ago in producing a special issue mainly devoted to overhead line transmission and distribution met with such wide and immediate approval that a considerably augmented edition was sold out within a few hours of publication. The present issue, planned on somewhat similar but even wider lines, describes and illustrates the developments made since that time, and supplies a good deal of information which should prove useful in future construction work. In addition to overhead lines this issue deals with various aspects of rural electrification which are the natural corollary of the extensive transmission and distribution schemes that are now in progress. Although it is manifestly impossible to cover every aspect of overhead line work in a single issue, every effort has been made to provide the maximum of information in the space available. The whole subject is one of such topical interest and importance that instead of forgetting all about it until the publication of our next Overhead Lines Number in January, 1930, arrangements have been made to devote space to it throughout the year, normally in the fourth issue of each month.

The Mid-East England Scheme.

STILL another electricity scheme has been submitted to the Central Board by the Commissioners, the area covered representing something like 7 545 square miles, including e East and West Ridings of Yorkshire, parts of the North Riding, Lincolnshire, Rutland and parts of Derbyshire and Nottinghamshire. The area embraces such industries as coal, iron and steel, engineering and textile, as well as large tracts of agricultural territory. The area is now served in part by 3 authorised undertakers, operating some 40 generating stations, and it is suggested that 18 of these stations be "selected" units, while 3 others be classed as "temporary" stations. The Commissioners estimate that with the scheme in operation, the maximum load of 1927–28 will be more than doubled by 1940–41, and, as shown by the details published elsewhere in this issue, the system will well link up with the S.E. England, and N.E. and N.W. England schemes, so as to form one comprehensive system. It is contemplated that the growing load will be dealt with by allocating as far as possible the base load output to the Ferrybridge, Kirkstall, Thornhill, Blackburn Meadows, and Prince of Wales stations, while stations not carrying such loads will meet the peak demands. It is interesting to note that the scheme does not make provision for any new stations, it being the opinion of the Commissioners that the present plant, installed or sanctioned, together with the contemplated extensions, is sufficient to meet the needs of the area up to the year 1940–41. Another interesting point is that, so far as the stations of authorised undertakers are concerned, there is practically no plant of non-standard frequency in the area, and in those cases where distribution is made at frequencies other than 50 cycles, such as bulk supplies from collieries, etc., alteration of such systems is not regarded by the Commissioners as essential to the scheme. In addition to the transmission lines shown on the map on page 111, there are many existing secondary lines which have been or are being constructed by the Yorkshire Electric Power Co., by the Derby and Notts Electric Power Co., and by a number of municipal undertakings, and where these do not give sufficient service it is contemplated that the Board will run further secondary lines as required.

The Financial Position.

OWING to the standard plant and high efficiency of the stations in the area served by the Mid-East England scheme, the capital expenditure is estimated as lower than that associated with the already adopted schemes. The expenditure is put down by the Commissioners as £4 616 750 up to the end of 1935–36, this sum representing £2 907 156 to be spent by the Board on transmission lines and transformer stations, and £1 709 594 by owners of selected stations on extensions. On the basis of individual development by the various undertakers, in the absence of the scheme, it is estimated that in order to make provision by 1935–36 for extensions of plant in existing stations to meet the load in that year and to allow for further growth, owners would be required to make an expenditure of £5 406 584, including the sum arranged for under the present scheme. By that year a proportion of the existing plant in many of the generating stations will, if the scheme is adopted, be available for revenue earning purposes, such plant, amounting in all to something like 80 000 kW, and representing an expenditure of about £1 360 000. Thus, allowing for the non-release of spare plant in the absence of the scheme, it appears that whereas the system of interconnection for the area under discussion could be affected by a capital expenditure up to 1935–36 of £2 907 156 under the scheme, an investment of £5 056 990 would be required under the existing system; the latter sum being made up of the preceding items of £5 406 584 for extensions under individual development, less the £1 709 594 spent under the scheme, plus £1 360 000 for spare plant released for revenue earning purposes. The publication of this

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scheme and, we hope, its early adoption by the Board, is a good start for the New Year, representing as it does further contracts to be competed for, and further orders to be completed. As an indication of the magnitude of the scheme it may be understood that the main transmission system alone comprises 324 route miles of line, involving 11 transformer stations.

Salesmanship.

IT was well that Col. VIGNOLES found occasion, at last Friday's E.D.A. Conference in London, to remind an unusually large audience that the series of discussions which the E.D.A. organises during the winter season was originally established in order to encourage development of the art of salesmanship in the industry. On many recent occasions interesting subjects have been introduced under excellent sponsors, and have been discussed, at times with considerable enthusiasm, from various points of view. We have been able to listen with the requisite degrees of sympathy or admiration to the relation of the troubles or the triumphs of numerous worthy members of the industry in their own particular jobs. We have listened, stirred by memories of the past, or with half-credulous amusement, according to our age, to reminiscences of the early days of the industry and of the apparatus which it then produced. We have discussed electricity tariffs with an enthusiasm worthy of an I.M.E.A. Convention, and many other very interesting and important matters, each with requisite zest. But so far have we strayed from the original idea of "Salesmanship Conferences" that when somebody does stand up and say something about salesmanship his remarks seem somehow out of place. If we were past masters of the art this attitude would be understandable. Actually, it must regretfully be acknowledged that our sales methods in most branches of the industry are very little less haphazard than they were when the exploitation of electricity really was "in its infancy." It is pleasant, in reminiscent vein in the club, to talk of the old "sausage" radiators, reciprocating sets and such like, but as subjects for a salesmanship course of an Electrical *Development* Association they are rather lacking in inspirational point. In the past electricity and certain types of electrical apparatus have practically sold themselves. While we are fortunately far from saturation point, stronger sales resistance must be expected as time goes on and the more obvious outlets for energy and appliances are utilised. We should therefore be ready with plans to cope with the changing conditions. The sooner we get seriously to grips with the specialised business of selling the sooner will the work of our designers and manufacturers come to full maturity.

The Inferiority Complex.

ONE good feature of the last E.D.A. Conference was the bold assault made by one of the speakers upon the inferiority complex which seems to have taken hold of so many electrical people. As he rightly pointed out, the purveyors of a rival commodity can find so little to criticise in electric cookers that they can only tell people that the electrical method is so much slower than theirs. So assiduously has this point been developed that there must be many in our own industry who do not think it necessary to question the truth of this contention. What was true of the electric cooker hotplate of ten, five, or even two years ago is out of date to-day, and though finality in cooker design is hardly within measurable distance, we can at least give to those desiring it the facility of rapid cooking and water heating, in addition to all the other exclusive advantages of the electrical method. Again, too many of us accept too readily the implication that the odorous competitor is almost invariably cheaper than electricity. In scores of cases only the simplest knowledge of mathematics suffices to show that the much-vaunted advantage is either very slight or even non-existent. Years ago we may have had some excuse for deprecating comparisons of this kind, but now we have no occasion to fear the results of such tests. On the two points of speed and price we have undoubtedly lost much valuable business. We shall lose still more if we let this widespread misapprehension go unchallenged.

Contractors and Shoddy Wiring.

ANY attempt to raise the standard of electrical installation work must command the support of all who have at heart the best interests of the electrical industry and of the public. To that extent we heartily sympathise with the remarks of various speakers, including the President, at the E.C.A. annual dinner on Tuesday. We fail to appreciate, however, why, in all these speeches, no solitary reference was made to the work in this very direction which has been, and is being, done by an independent organisation which is surely well known to almost every member of the E.C.A. We refer, of course, to the National Register of Electrical Installation Contractors, which, we feel, has done more to improve electrical installation work in its short life of five years than the E.C.A. has done in twenty years. In saying this it is not our intention or desire to blame the E.C.A. for devoting most of its attention to the trade interests of its members. That, we feel, is its legitimate and main function, and the attention which the Association is now paying to the nefarious activities of the unqualified contractor is to be welcomed. It should be obvious that such interest should be complementary to, and in active co-operation with, the efforts of the National Register, which, by reason of its independence alone, is the most appropriate body to deal with such matters. By working in harmony with this organisation the E.C.A. will stand a much better chance of seeing its ideals put into practical operation. We cannot think that the absence of any reference to the excellent work of this voluntary and public-spirited body was intentional, but it is possible that some people might put that construction upon it.

Fire Designers Wanted.

THE new architectural, furnishing and other art forms which are being evolved in continental Europe, are slowly but surely being transplanted into English soil, and it is fairly safe to predict that within the next decade, so far as architecture and furnishing are concerned, some of these ideas will be incorporated in many houses in this country. On the lighting fittings side, as readers will know, vigorous steps are being taken to develop the new art which, for want of a better name, has been called architectural lighting, in a manner suited to native tastes. So far, however, we have not heard of any corresponding effort in regard to electric heating apparatus. Electric fires to-day are for the most part designed to stand in a fireplace before a chimney which is no longer necessary, and generally made to look as much as possible like the anachronistic heating devices which they replace. But in the new kind of home there will be no yawning chasm to be filled up by imitation fire grates. The heating apparatus will have to be put into housings designed to form, with the lighting, an integral part of the architectural and furnishing scheme. In a restaurant well known to most electrical men are to be seen examples of an attempt to get away from conventional electric heating forms, but there is endless scope for designers to evolve types of fire suited to take their place in the wholly modern all-electric home of the near future.

A Well-deserved Compliment.

To many who saw a complete stranger to the electrical industry take the most important position it had to offer, Sir ANDREW DUNCAN, in the two years during which he has been chairman of the Central Electricity Board, has been a figure of unusual interest. Sufficient time has passed to show quite unmistakably the wisdom of his appointment, and each further step towards the completion of the interconnected national supply network gives rise to renewed wonderment at the smooth and diplomatic way in which its myriad difficulties are overcome. Although Sir ANDREW had distinguished himself long before his alliance with th electrical community it may be presumed that the recommendation of his name for election to the Counc l of Directors of the Bank of England is, in part at least, a compliment to his work during the past two years.

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OVERHEAD LINE PROGRESS.

Modifications in Regulations Assist Development—Importance of Low Capital Costs—Growing Popularity of 11 000 V for Distribution—Farm Electrification Possibilities—A Lesson from One of the Dominions.

By THEODORE RICH, M.I.E.E.

IN considering the events of the past year from the point of view of rural electrification, the modifications made in the regulations last April, although they did not go so far as some people would have liked, were in a way a recognition of the fact that the real problem of supply in agricultural districts is that of distribution costs and not power costs as such; that is to say, getting the power from the wholesale supply point, be it local power station or sub-station to the village green, and to the farmer's door. When a line is constructed to transmit thousands of kilowatts with a large prospective annual "traffic," the revenue will be ample to cover capital charges and maintenance. But where a line is constructed for rural supplies, revenue is not so ample, and capital costs must be kept down as low as possible, consistent with safety and durability.

* * *

The reduction in ice loading enables longer spans to be used, which means lower pole costs per mile, and lower annual wayleave charges. To the same end there has been quite a material increase in the use of galvanised stranded steel conductors for h.t. sub-circuit work, and in the use of compound conductors of aluminium and steel. Up to recently, spans of 200 to 300 ft. were very usual, but now 400 to 500 ft. is being adopted under favourable conditions. The use of long spans means stouter posts, and to comply with the regulations, chocks will often be necessary in bad ground. Negotiations regarding wayleaves would be facilitated if the advantages of an electricity supply could be impressed on farmers.

* * *

There is to be noted a distinct upward tendency regarding distribution at high tensions, and it is significant that a large proportion of the new work on hand is being arranged for 11 000 V. It is realised that there is but little to gain and much to lose by the adoption of 2 000 or 3 000 V, unless the average transformer unit is very small indeed, to supply scattered farms or hamlets. If, for example, a transformer of 80 to 120 kVA is installed on a 2 000 V line, money has simply to be thrown away on excessively heavy overhead conductors, whereas at 11 000 V a No. 8 copper will comfortably carry several hundred kVA. The heating load is growing rapidly in towns, and the night storage hot water heating system is also developing. In due course it may spread to the farms; the possibility provides a further reason for keeping the voltage up.

The difference in cost between a line at 3 000 V and one at 11 000 V is small, the spacing is limited by wind sway rather than by voltage, the difference in insulator costs is a small item per mile, and experience abroad shows that once a sufficient demand has sprung up, the difference in cost for fuses, aerial switches and transformers is negligible compared with the much greater capacity thereby attained.

With a higher voltage in rural areas it is possible to make a lot of extensions without bothering about line capacity at all. As the new regulations specially favour low tension lines, there is a temptation to lengthen these to outlying points, rather than to extend the h.t. line; this practice will result in l.t. voltage drop troubles should heating loads develop, although it tends to diminished transformer light load losses.

It is, of course, hardly logical to assume that a h.t. line will have a different ice loading from that of a l.t. line, and a materially different road clearance; if it were not for this a new system now being tried out in Central France would have some attraction. Under this system transformer stations are being put up with double wound transformers with an intermediate step between the h.t. feeding pressure and the 115/200 V l.t. supply. Extension line feeders are insulated for the h.t., and small transformers on 500 or 1 000 V placed in farms or outlying villages. As soon as the load is built up transformers at the normal h.t. voltage replace those at the intermediate voltage.

* * *

During the last few years remarkable progress has been made in New Zealand with regard to electricity supply to farms. This country—as large as Great Britain, but with a population of only one and a half millions—is showing what can be done in spite of apparently severe obstacles in the way of high labour costs and sparse population. Many of the New Zealand farmers enjoy the advantages of a supply of electricity, and altogether they use approximately 8 000 electrically-driven milking machines. Yet it must not be assumed that this progress has been mainly due to the existence of water power, for there, as here, the cost of the power at the terminals of the generator switchboard is only a fraction of the total costs. If such supplies can be given in New Zealand, it ought to be possible to give them here.

OVERHEAD LINES SECTION.

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PROPOSED FORMULÆ FOR CONDUCTOR SPACINGS.

Important Governing Considerations—Vertical Offset *v.* Horizontal Arrangement—Choice of Conductor Material—Wind Conditions Favour Small Conductor—New Constant Values and an Example.

By WILLIAM T. TAYLOR, M.Inst.C.E., M.I.E.E., Fel.A.I.E.E.

THE most important consideration which governs the spacing of overhead electric power conductors is the necessity for preventing them from making contact or flash-over. The lightweight conductors, more particularly in the longer spans, have a relatively greater tendency for equivalent sag and sagging to swing out of the synchronism than the heavier weight conductors of equal diameter.

It is doubtful whether the vertical offset arrangement of conductors has any advantage in minimum spacing over the horizontal arrangement, due to possible uplift and slack or deformation of the catenary shape of the span from upward gusts of wind or from ice-jumps, and from swing-in of the slack to adjacent spans relatively longer.

Safest Spacing.

The safest absolute minimum horizontal spacing of conductors that can occur is where the conductors are supported from rigid insulators; where sags of conductors in the span are equal; where conductors have the least diameter for the greatest weight; where the spans are uniform and level, and are of moderate length; where spans are located so that upward gusts of winds cannot occur; and where lines are operated so that hazardous ice accumulations cannot occur.

On the other hand, the most dangerous minimum horizontal spacing of conductors is in that line located where the heaviest upward gusts of wind are prevailing; where conductors are arranged in vertical offset at the commonly understood distances apart; where conductors have the least weight for a given diameter, and are supported from suspension insulators; where the spans are long and short and not level; where conductor sags are unequal and relatively greater for the long spans; and, where heavy ice formation is allowed on conductors.

As a general rule, we need only consider the electrical factor as, say, a maximum additional length of 0.5 in. for every 1 000 V between lines, for lines operating at voltages above 22 000. Looking at the subject in a practical way, knowing that a 1 in. spacing is good enough for 10 000 V, very often this constant is ranged as we consider best for the particular formulæ employed. As the regulations fix the loading conditions for all spans, we need only consider: (*a*) choice of conductor material; (*b*) safest location and best uniformity of spans; (*c*) choice of span lengths; (*d*) choice of conductor-insulator supports—rigid or flexible; (*e*) method of dealing with heavy ice accumulation on conductors; (*f*) arrangement of conductors. The factors (*b*), (*c*) and (*d*) are, in one form or another, inter-related with (*a*). All these factors should be considered in the choice of line voltage—hence the reason for adding a flashover factor slightly greater than 1 in. per 10 000 V for the higher voltages and for lines using suspension insulators.

For a given conductivity the conductor material will have much to do with the size required for a given regulation on lines operating at voltages up to any value, but for this purpose let us say up to 66 000 V, because the copper conductor has the smallest diameter and allows of the highest annealing temperature of the conductor from arcs. Metal vapour during an air-spark shows up most intensely for aluminium, and vaporisation occurs in much less time than the most rapidly operating switch can open. Greater separation of conductors is required for the lighter weight conductor, also for the longer span with equivalent tension on conductor, and copper is the most favourable, because, among other advantages, it permits of less torsional stresses on supports and less voltage drop on the higher voltage lines for equal kW transmitted. The use of copper conductor and medium span construction and stringing tension conforming to regulations offer the best and safest line construction. Aluminium and steel-reinforced aluminium conductors are lighter in weight and larger in diameter for equivalent conductivity, and will blow about more than copper, hence are relatively more dangerous; the most dangerous movement is the upward, because of slack and the sudden vibrations and oscillations set up, and unequal stresses on supports, etc.

With a strong steady wind blowing in a transverse horizontal direction across the line, say at the regulation velocity of 50 miles per hour actual (or an equivalent velocity of 83 ft. per second) the time that elapses before the same air impulse acts on the adjacent horizontal conductor is of no practical importance because there is little or no change in the velocity or direction of the air on the conductors in such a short air space that separates them: what there is favours the copper line.

Some Irregularities.

In the horizontal and vertical spacing of conductors we have to cope with irregular and somewhat unknown upward and downward and transverse components; irregular, opposing, and unequal velocities, eddies and gusts of wind; irregular falling off of ice. The horizontal spacing of conductors involves complicated factors such as: for equal conductor weight an increase in sag requires a greater separation; for

EARTH BORING APPARATUS.

EQUIPMENT for the boring of holes for the erection of poles is shown above. To the left is seen the "Highway" earth boring machine mounted on a truck, with winch and pole derrick installed. This equipment finds extensive use in the U.S.A. The other picture illustrates a boring machine in conjunction with a tractor, with a cut-away hole showing the auger in position.

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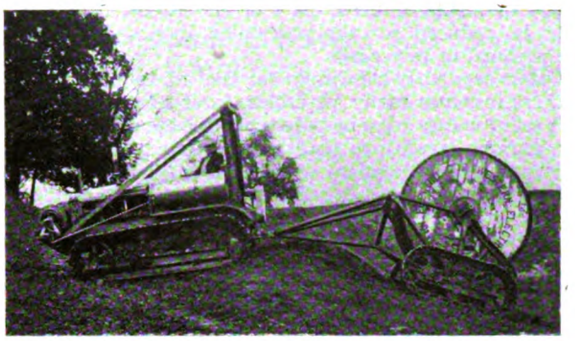

CABLE TRANSPORTING EQUIPMENT.

THE transport of cables for use in overhead line construction is sometimes no easy matter. To the left is seen a trailer for hauling cable drums, which is extensively used in America for road transport jobs. A new device to facilitate cross-country work is shown in the other picture, in which a "Holt" caterpillar draws a cable drum mounted on crawlers. We are indebted to the Highway Trailer Co. for permission to reproduce these photos and also those on page 86.

equal conductor weight an increase in sag requires a greater separation for the same or for an increase in span; for a larger diameter of conductor (not weight) the spacing should be greater for equal sag, span and loading per unit length; for less weight of conductor (same or perhaps less diameter) the spacing should be greater for equal sag and span. Apart from the variable factors covering the design, such as wind, weight, diameter, span, sag, we have to deal with irregular upward components of wind, heavier or lighter momentary weights, changing sags, unknown location conditions, uncertain pull-in to other spans. Nevertheless, the copper line is the most favoured.

Best conditions favour the relatively heavier conductor for equal diameter or the relatively more weighted span for equal sag, as well as the relatively better configuration of the ground from upward components of wind *en route*—all of which may be said to favour the copper line.

Any force or condition tending to reduce weight or tension (reducing the tension can be effected by a reduction in weight) for a given span, will require a greater minimum horizontal spacing of conductors. Any line location causing an upward turn of the wind, such as a rising hillside or hollow ground formation, which are the more common in long-span construction, will require a greater minimum spacing of conductors; the wind will have an upward component in the one case, and in the other case there is the possibility of ice falling from one-half (the sloping part) of the span, while remaining on the other half (the bottom and relatively level part) of a hillside span.

Where suspension insulators are used, the conductor slack and deformation of the catenary shape of the span may be partly drawn into the adjacent spans, thus aggravating the danger of flashover between conductors. With long spans which are often located over foothills and across hills, over gulleys and across surface depressions, the lifting of one part and/or the weighting of another part of the same span from the effects of strong winds (relatively more prevailing in such locations) require greater separation of conductors than for medium-span construction, assuming relative sags and equal conductor diameters. As relatively lower tension of conductors is often employed in such locations, still wider separation of conductors becomes necessary—the advantages again favouring copper.

Copper Favoured.

Wind conditions favour the smaller conductor, provided it is relatively heavier, such as copper. The character of the ground and height of supports, etc., favour the medium span, and tend to keep the line low and make the best use of the relatively more favourable ground surface, for which a copper line is well suited. For the higher voltage lines (132 kV) the jumping distance of line voltage is less for a line designed for maximum economy, and again favours the copper line for equal kW transmitted.

The weight of conductor is practically fixed by the choice of material and loading regulations; the diameter is fixed by the electrical requirements and choice of material; and the span length is fixed by the conditions of location, mechanical and economic factors, and the choice of conductor material. Hence, the value of sag must first be calculated when designing, and is therefore known at the start. For any given span, the safe horizontal spacing of conductors depends more on the sag than on any other single group of factors.

Extending the Formula.

Some time ago the writer proposed in his book* a formula for the spacing of conductors based on sag, swing and flash-over voltage. The sag (or tension) involves the span length, the weight and the diameter of conductor. In the main we have to deal with sag, excessive wind gusts and ground surface formations and/or obstacles causing deformation of the catenary shape along the route, flashover distance for worst weather conditions and for the highest operating (perhaps surge) voltage, and a factor for possible pull-in to adjacent span or spans when the weight and tension are thrown off. For horizontal spacing of conductors the swing is directly dependent on the weight, the sag and its difference from uniformity, span length, amount and direction of wind gusts or eddies, and ground configuration. Instead of writing minimum *horizontal* spacing of conductors as given,* we may develop it to show more detail; thus, for bare conductors:

$$S_h = y + g + k \text{ inch or feet } \textit{units}.$$

For ice-coated conductors:

$$S_h = y + d + k \text{ inch or feet } \textit{units}.$$

where:

y = For minimum swing of conductors out of synchronism.
Varying with the weight, diameter and kind of conductor material; span length; location of lines; degree of unequal sagging; flexibility of conductor supports; direction, velocity, irregularity, and length of wind gusts for one or more spans or part of a span length.

d = For deformation of the catenary shape of span or spans, due to the irregular and excessive upward wind gusts.
Varying with the height and arrangement of conductors; length of span; deviation from the regulations loading; size and kind and make-up of conductor material; excessive upward gusts of wind; ground formation *en route*, which includes hollows, hillsides and longitudinal obstacles.

g = For deformation of the catenary shape of span due to irregular ice jump (irregular falling-off of ice) from conductors.
Varying with the length and type of spans (level to steep side hills); size and kind of conductor material; arrangement of conductors; ground surface formation; prevailing excessive air gusts and their direction at certain points of span.

k = For maximum flashover (jumping distance) of voltage.
Varying with the design and kind of conductor material used. The relative equivalent kW load and loss and voltage regulation in the case of higher voltage lines, such that variations occur with the maximum operating line-voltage, the altitude, the climatic and economic conditions, and arrangement of conductors.

As the maximum possible pull-in of conductors into adjacent span or spans can rarely add to d or g, a constant for this value can be (and is) omitted.

From the above formulæ it is evident that the factor y may show a difference at the same time a deformation of the catenary shape occurs, either for ice-jump at one time, or for maximum uplift due to a vertical upward wind gust initiating the release. And, as the upward slack and deformation of the catenary shape occur, part of the conductor may be drawn

* See "Distribution of Electricity by Overhead Lines," p. 61, (Chas. Griffin and Son, London, 1928).

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into adjacent spans at the same time. For any arrangement and type of insulator used, part of the values d and g can scarcely be reduced for the particular span and conditions, except perhaps in rare cases.

It is thus seen that a formula for the minimum spacing of conductors involves many variables, inter-related and uncertain. A set of values may be prepared for each constant, based on the various conditions mentioned herein. The values y, d and g are largely dependent on respective sag and sagging for the different span lengths, weights and diameters of conductors used.

The minimum *vertical* spacing of conductors also depends on the factors d and g and k. The difference between d and/or g (if any), and that between the vertical sag for maximum ice on the one, and bare conductor conditions on the other, or for bare conductors only, must be accounted for, and the maximum value chosen for design and safety.

For minimum vertical spacing of conductors we may write:

For bare conductors:

$$S_v = S + (S \pm d) + k \text{ inches or feet.}$$

For ice-coated conductors:

$$S_v = S + (S \pm g') + k \text{ inches or feet.}$$

where:

S = For difference between *vertical* sag of bare conductors and *vertical* sag of conductors covered with ice, or for bare conductors only, whichever offers the worst condition.

$d'g'$ = For maximum deformation of catenary shape of span.
Varying with conditions mentioned under d and g respectively, in formulæ S_k.

k = For maximum flashover voltage.
Varying according to the conditions mentioned under k in formulæ S_k.

It will be noted that, for minimum horizontal spacing of conductors, the writer first proposed (in his book) $S_k = y + k$; where $y = y' + g$ (for wind), and $y' + d$ (for ice-jump).

For equal span length and regulation loading, the sag for steel-cored aluminium cable is less than that of copper for the same overall diameter. But this is a poor comparison, because of the relative advantages of copper for maximum kW carrying capacity, etc. However, it is a simple and short way of showing the minimum conductor spacing, because one formula will serve for both conductor materials. As copper is heavier and has other advantages, it is safe to base both copper and steel-cored aluminium on the same spacing for the same overall diameter and regulation loading conditions.

The length of a suspension string of insulators increases with the line voltage. But so do span lengths as well as large-sized conductors. Whether long or short strings are used, the effect can be accounted for by the greater swing and pull-in of conductors as compared with pin insulators. Taken as a general rule, for the lower voltage lines the spans will be shorter, voltage surges lower and pin insulators used, so that constant values for y, d, g, and k can be decreased somewhat for the lower voltage lines.

Constants.	Values for Constants based on sag percentage of span values given in feet.	
	Pin insulators.	Suspension Insulators.
y	1·0 to 4·0	1·0 to 6·0
d	0·5 to 5·0	0·5 to 8·0
g	0·5 to 6·0	0·5 to 10·0

	Voltage.	Maximum Line-Voltage Constant values for k, in feet.
Suspension Insulators	220 000	11·0
	154 000	7·7
	132 000	6·6
	110 000	5·5
	88 000	4·4
	66 000	3·3
Pin Insulators	66 000	2·5
	33 000	1·0
	11 000	0·4

Example.—Lines traversing both level and rugged country, and the span lengths vary so that the range of sags is between 2·0 and 3·5% in the respective normal spans; medium and medium-large sized conductors are used and arranged in vertical offset with two circuits per line support.

Minimum horizontal spacing of conductors from $S_k = y + d + k$
$= y + g + k$

For a 132 kV line =	2·3 + 2·8 + 6·6 = 11·7 feet	Suspension Insulators
	2·3 + 3·5 + 6·6 = 12·5 feet	
For a 110 kV line =	2·2 + 2·8 + 5·5 = 10·5 feet	
	2·2 + 3·4 + 5·5 = 11·1	
For a 66 kV line =	2·0 + 2·7 + 3·3 = 8·0 feet	
	2·0 + 3·3 + 3·3 = 8·6 feet	
For a 66 kV line =	1·8 + 2·3 + 2·5 = 6·3 feet	Pin type Insulators
	1·8 + 2·7 + 2·5 = 7·0 feet	
For a 33 kV line =	1·6 + 2·0 + 1·0 = 4·6 feet	
	1·6 + 2·4 + 1·0 = 5·0 feet	
For a 11 kV Line =	1·0 + 1·6 + 0·4 = 3·0 feet	
	1·0 + 2·0 + 0·4 = 3·4 feet	

BRICK SUB-STATIONS.

A NUMBER of sub-stations of brickwork construction are to be seen in different parts of Great Britain, but their employment is by no means general. As a rule they are connected to the line by end bells and cable.

On the Continent, despite the extra cost, sub-stations of brick or masonry are still popular. The apparatus is under cover, it is accessible in all weathers, and part of the structure can be used as a linesman's store.

It is a usual practice to arrange section links, choking coils, and any fuses in the upper part of the building, with screened connections to the transformer below. In stations of appreciable size oil circuit-breakers are usually installed.

The attractively designed sub-station which we illustrate here is a type of station used for the final step down for a village. The high-tension leads arrive over the door, and the low tension leads can be seen on the right. The low tension lines can be controlled through the hatchway if required. Thanks are due to the Royal Swedish Water Power Board for permission to reproduce this illustration.

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RURAL LINES IN NEW ZEALAND.

How the Power Boards Solved a Difficult Problem—Economical Design and Construction in Sparsely Populated Areas—Methods and Materials Employed—Costs of Different Types of Line.

By W. P. GAUVAIN, M.I.E.E., M.I.Mech.E., A.M.I.C.E.

RURAL electrification in New Zealand started on a large scale as the result of the passing of the "Electric Power Boards Act" in 1918. It is true that, prior to that date, a certain amount of country electrification had been carried out, but no definite schemes had been devised for supplying outlying areas, nor did it appear likely that public or private companies would embark on such undertakings.

It is not proposed to deal with the various clauses of this Act; it is only necessary to say that the Act enabled districts to form themselves into Power Board areas with the right to generate their own power or purchase it in bulk from the Government, and to carry out the distribution work. Power was first supplied to consumers, under this Act, in March, 1921, and the progress of the work since that date has been rapid. Distribution lines have been erected in all parts of the country and a supply given to outlying areas where, but a few years ago, it would have been considered impossible, from an economic point of view, to confer the benefits of electricity on the settlers.

The present population of New Zealand is under 1 500 000, whilst the area of the country approximates that of Great Britain. It will be realised, therefore, that the problem which confronted the Power Boards, in their endeavour to give a supply to the settlers in the back-blocks, was no small one. The security for loans raised for this distribution work is a rate, which is struck but not collected, over the areas, and in consequence every owner of property feels that he is entitled to a supply, no matter how far his land may be situated from the main distribution lines. Only by strict economy in design and construction has it been possible to supply light and power at rates which compare favourably with those in other countries, where the population per square mile is greatly in excess of that in New Zealand.

The questions of safety to the general public and to the operating staffs, and continuity of supply, have been the first consideration, and the Public Works Department has altered and added to the Regulations only after full consultation with the authorities concerned, so that every advantage is taken of the experience of engineers operating schemes in all parts of the country under varied climatic conditions.

Bulk Supplies.

In the majority of cases, power is purchased in bulk from the Government stations, at a pressure of 11 000 V, and the sizes of the areas are such that this voltage is usually sufficiently high for the main distribution work. There are certain districts, however, where distribution could not be economically carried out at this voltage from one point only, and in such cases it is customary to receive a supply from two or more points, the Government making a charge of £400 per annum over and above its standard rates, for each extra point of supply.

Fig. 1.—A pole in a village carrying two 11 000 V and one low tension circuits.

VOLTAGES.—The standard voltages for distribution work are 11 000, 6 600, 3 300, and 415/240, the frequency being 50 cycles. The tendency, as the result of experience, is to carry out the main distribution at 11 000 V, and whilst 6 600 is used in some cases—more especially where the main distribution voltage is higher than 11 000—the adoption of 3 300 V is not favoured to any great extent. The Regulations permit of the 415/240 V lines being run on the same poles as the higher voltage lines. Wherever possible this form of construction is adopted, thereby effecting large savings in capital cost.

POLES.—The majority of poles used in the construction of rural lines are of ironbark, or other Australian hardwoods. Steel and reinforced concrete poles are in use to a small extent, but the comparatively high cost of these materials militates against their general adoption for distribution work. The factor of safety allowed is two in the case of iron, steel and reinforced concrete, and four in the case of wood, calculated on the crippling load of the structure. In computing the strength of wooden poles the working stresses allowed, based on heart wood measurement, are as follows for Australian woods:—

Fig. 2.—A single circuit 11 000 V line in New Zealand in course of construction. The pole also carries a low tension circuit.

Ironbark	3 500 lb. per sq. in.
Other approved Australian hardwoods	3 000 lb. per sq. in.

The wind pressure is taken as 30 lb. per sq. ft. of plane surface, and 18 lb. per sq. ft. of diametral plane of a cylindrical surface.

In lines operating at 11 000 V, the minimum clearance between any portion of the line and ground is 20 ft. and consequently, in the majority of cases, poles having a length of 35 ft. have been adopted. This height is sufficient to allow of a double circuit 11 000 V line, with a low pressure line on a crossarm at a distance of 4 ft. below the lower 11 000 V arm. The poles are set 6 ft. in the ground. Fig. 1 shows such a pole erected in a village, and carrying two 11 000 V and one low tension circuits. On the low pressure arm are three phase wires, neutral, and street lighting wires. It will be observed that earthing guards are attached to the high tension crossarms. These consist of hardwood arms (bolted to the crossarms) attached to which are galvanised iron bars with which the lines would come in contact should they break away from the insulators. The ironwork is efficiently earthed at the base of the pole. The service crossarm will be noted at some distance below the low pressure arm.

Typical Pole Construction.

Fig. 3 is a drawing showing the pole construction. In this case it will be seen that on the low tension arm the street lighting wire has been omitted, and two high tension telephone wires take its place. This is the usual country line construction. Owing to shorter spans when passing through towns, it is customary, with the same length of low tension crossarm, to accommodate seven wires, namely, three phases, neutral, two high tension telephone wires, and street lighting wire. In country districts the pole spacing is generally 4 chains (88 yd.), but when passing through towns and villages this is reduced to 2½ chains (55 yd.).

Fig. 2 shows a single circuit 11 000 V country line in course of construction, also carrying a low tension circuit. The

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pole spacing is 88 yd. It will be seen that the three high tension insulators are on the same crossarm, which is attached to the top of the pole by a galvanised iron U bolt which

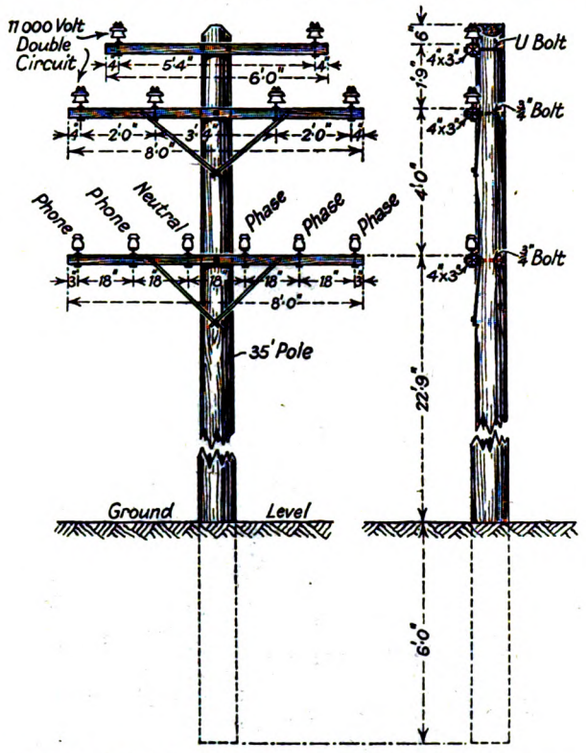

Fig. 3.—A typical New Zealand double circuit 11 000 V pole with low tension (415/240 V) and telephone circuits.

prevents any tendency for the pole top to split. The spacing of the high tension insulators is 2 ft. 8 in.; the crossarm being 6 ft. long and having a section of 4 in. by 3 in.

The sizes of the 35 ft. poles on these lines vary from 11 in. to 12 in. diam. at 6 ft. from the butt, tapering to from 6½ in.

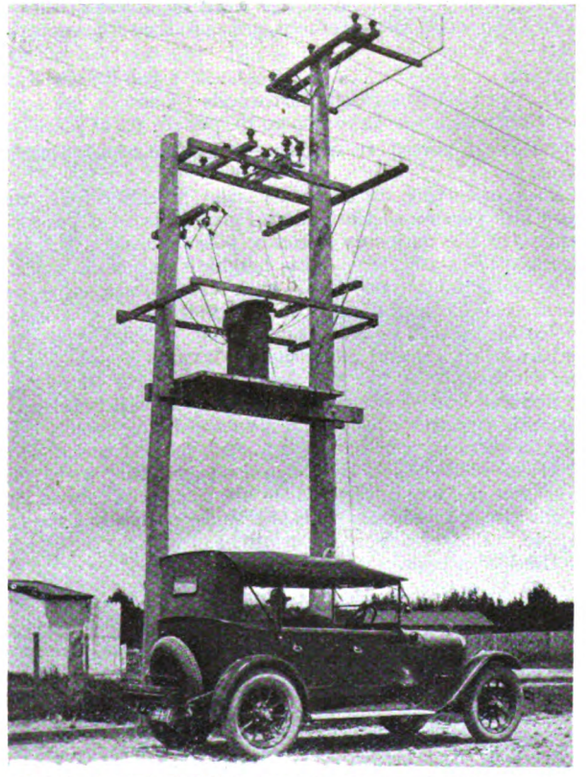

Fig. 4.—A rural sub-station. The pole arrangement provides for the subsequent installation of a larger transformer.

to 7 in. at the top. It is usual to specify the proportion of heart wood which each pole must have. Ironbark is a quick growing timber, and whilst it is very satisfactory for large poles, it is not so good for the smaller sized pole—such as are used for service lines—owing to the fact that small poles of this wood contain too great a percentage of sap. The prices of 35 ft. ironbark poles of the sizes indicated above vary from about 55s. to 60s. each. Preservatives are but rarely used on these poles as there is some doubt whether sufficient penetration can be obtained on these hardwoods, and whether the expense of such treatment is warranted.

For 6 600 and 3 300 V lines, 30 ft. poles tapering from about 10 in. diam. to 6 in. diam. are used, and cost from 42s. to 46s. landed. It is customary to use a similar type of pole for low tension distribution in town districts, but in country areas a 26 ft. pole is often adopted, whilst for service lines, poles having a height of 24 ft., and costing about 30s. each, are largely used. Crossarms are chiefly of Tasmanian tallow wood, and the standard section for main distribution is 4 in. by 3 in., the cost being about 5d. per running foot.

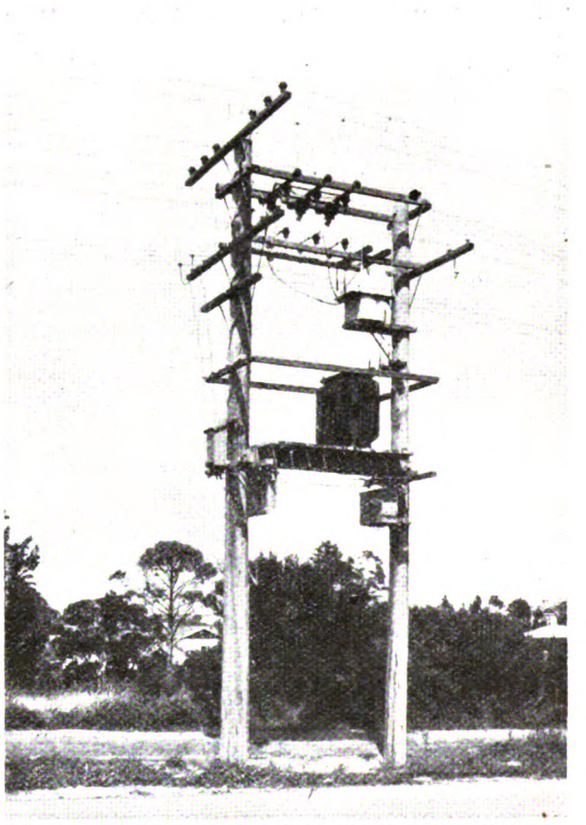

Fig. 5.—A 50 kVA village sub-station in New Zealand. Provision is made for the addition of a further 50 kVA transformer.

WIRES.—Stranded hard drawn copper is chiefly used. Galvanised iron wire and the various forms of copper-covered steel wire are in use to a small extent, usually in cases where the loading is small, and with but little chance of any increase in demand. On lines of 3 300 V and over, where copper is used, stranded wire only is allowed, and the minimum size is 7/·064. On service lines the minimum size allowed is No. 10 S.W.G., and for other low pressure lines, No. 8 S.W.G. The stress in a hard drawn copper conductor, at a minimum temperature of 20 deg. F. and a wind pressure of 18 lb. per sq. ft. of diametral plane in country areas (or 12 lb. per sq. ft. in town areas) must not exceed 25 000 lb. per sq. in. If there is a liability of the lines being subjected to ice loading they must be designed to stand a wind pressure of 8 lb. per sq. ft. of diametral plane with a radial thickness of ½ in. of ice.

All lines operating at 11 000 V and upwards must be bare. In country districts, all lines below this pressure may be bare, but when such lines pass through towns, the low pressure lines must be covered with triple braiding thoroughly impregnated with waterproof compound, whilst lines above low pressure, and up to and including 6 600 V, must be covered with vulcanised rubber of at least 600 megohm grade. It is specifically stated in the Regulations that these coverings must not be deemed to be an insulating covering for making the lines safe to handle when alive.

In perusing the Regulations it will be observed that they afford full protection to the Post and Telegraph, and Railway Departments, without harassing the Power Boards. One

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side of each road is reserved for the Power Boards and the other for the Post and Telegraph Department.

Fig. 4 is an illustration of a country sub-station. The transformer is 15 kVA 11 000/10 500/10 000 to 415/240 V. On the high tension side can be seen an air break switch (made locally) and high tension fuses, whilst low tension cut-outs are attached to one of the crossarms. The poles are arranged so that a larger transformer can be installed as the load grows.

Fig. 5 shows a 50 kVA sub-station in a village, through which a double circuit 11 000 V line passes. The equipment consists of a double-throw switch (made locally) and oil switch on the high tension side. On the low tension side are fuses and measuring apparatus. The station is arranged to receive a second 50 kVA transformer when the demand warrants its installation.

In the construction of these rural lines the main aim has been to provide reliable distribution at a reasonable cost. Almost the whole of the material necessary for construction has to be imported, and the cost of labour is considerably higher than that in European countries. Even with these handicaps, and taking into consideration the sparsely populated nature of the country, the majority of the Power Boards are in a good financial condition, and are supplying electricity to the country districts at rates which cannot be considered high for rural work. The lighting rate averages about 7d. to 8d. per kWh, although a number of undertakings are giving a supply at a price considerably below these figures. Domestic power rates generally start at 3d. per kWh and go down to 1½d. or 1d. per kWh, whilst water heating is in some cases as low as ¼d. per kWh. The country industries, such as dairy factories, flax mills, etc., receive a supply at varying rates according to their load and time of running, and a number are purchasing power at under 1d. per kWh.

And, now, as to the cost of these rural lines. An 11 000 V single circuit line with 7/·083 copper wire can be constructed for from £250 to £300 per mile, depending to a great extent on the locality. A three-phase four-wire low tension line having 7/·083 phase wires and 7/·064 neutral will cost slightly less. Three-phase four-wire service lines to the farms cost from £160 to £200 per mile. The cost of lines is, however, one item only in a rural electrification scheme, and, apart from the transformers and switchgear, there are also such items as the building and equipping of offices, service depots, and showrooms. For a country scheme to be successful it is essential that efficient service be provided, and money spent on service depots, although increasing the first cost of the scheme is a good investment.

As a matter of interest, figures have been taken out of capital costs of twenty-eight of the New Zealand Power Boards operating in rural areas, and either purchasing power in bulk from the Government, or generating their own power from water. These figures show that approximately £6 000 000 has been spent; the route miles of line erected amount to 9 000 miles or say £660 per mile. It will be realised that some of these are three circuit lines, whilst a very large number will have two circuits. The figure comprises everything in the way of capital expenditure, and includes such items as the expense of the flotation of loans, interest during construction, and administration. A number of these twenty-eight Boards have not yet completed their distribution work, and therefore it is reasonable to anticipate that the cost per route mile will show a reduction as years go on. These figures of costs per route mile, taken as a whole, may be somewhat misleading, unless the particular circumstances are investigated. For example, the costs of one of the Boards per route mile was at the low figure of £333, with a revenue per route mile of £62 or 18·6%. Another Board, with £366 per route mile had a revenue of £40 or 10·9%, whilst a third had a cost per route mile of £1 030 with a revenue of £170 or 16·5%. In the last case it is obvious that much heavier construction was necessary, but the extra revenue received shows that such construction was justified. In all three cases the main schemes have been completed, but a large number of extensions still remain to be carried out.

The latest figures as to the actual mileage of overhead distribution lines in use in New Zealand are not available, but the route mileage of these lines may be taken as approximately 18 000 miles.

INFLUENCE OF ATMOSPHERIC POLLUTION ON PERFORMANCE OF LINE INSULATORS.

A Special Investigation of Troubles Experienced in Britain—Performance of Fouled Insulators—Action of Coal Smoke—The Wind Factor—Points in Insulator Design.

By B. L. GOODLET and J. B. MITFORD.

In certain regions of the world during damp or foggy weather transmission engineers experience considerable annoyance due to the arcing over of insulators on their lines. The extent of the trouble is indicated by the increasing tendency for insulator specifications to contain a fog or mist test. The details of this test are, however, generally left to the imagination, the standard phraseology being that the test shall be made in an "approved manner."

The peculiar climate of our island renders the matter one of considerable importance to British engineers, and, in view of the general lack of information on the subject, even in technical circles, some results of an investigation by the Metropolitan-Vickers Electrical Co. may not be without interest.

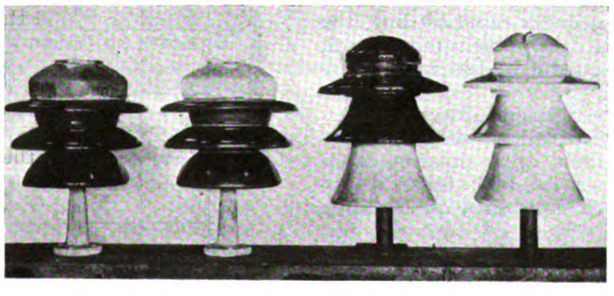

Fig. 1.—Four insulators of the same rated voltage, on which a coal smoke film was built up in a fume chamber.

Operating experience indicates unmistakably that trouble of this kind occurs only in districts where a considerable amount of solid matter in a finely divided state is in suspension in the atmosphere. This "impurity," which, according to circumstances may consist of smoke and soot particles, minute salt crystals, dust from roads and quarries or the product of various industries such as chemical works, blast furnaces or cement kilns, is gradually deposited on to the insulators, forming a film over their surface. In the majority of cases the impurity is of a hygroscopic nature; in every case the spongy and porous structure of the film facilitates the condensation of moisture during damp weather. The consequent increase in surface conductivity leads to a redistribution of stress which may in turn give rise to damaging surface discharges, and—finally, arc overs.

Although apparent only during damp weather, the "fog" trouble, therefore, is primarily due to the presence of a surface film of dirt; if no such film is present the damp alone will have little effect.

As surface films are completely ignored in the various National Insulator Specifications it is not to be expected that the standard tests will enable the performance of an insulator with regard to fouling to be predetermined. Indeed, it must be admitted that our present testing procedure is altogether a little illogical. In service the insulator is seldom clean, the most severe electrical stresses are the impulsive disturbances due to lightning, and the atmospheric conditions vary over a wide range. In the laboratory, insulators are tested after careful cleaning, seldom with impulsive voltages, and under atmospheric conditions which vary only very slightly. The realisation of these facts lead the Metropolitan-Vickers Co. to undertake an extensive investigation into the performance of fouled insulators under various electrical and atmospheric conditions. The results given in this article have been selected mainly to illustrate the phenomena in the case of the 33 and 44 kV systems most prevalent in Britain at the present date.

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In any attempt to reproduce service conditions in the laboratory, the first essential is to obtain very precise ideas of the phenomena, the effects of which it is desired to study. The investigation accordingly commenced with the examination of operating records and meteorological data. It was

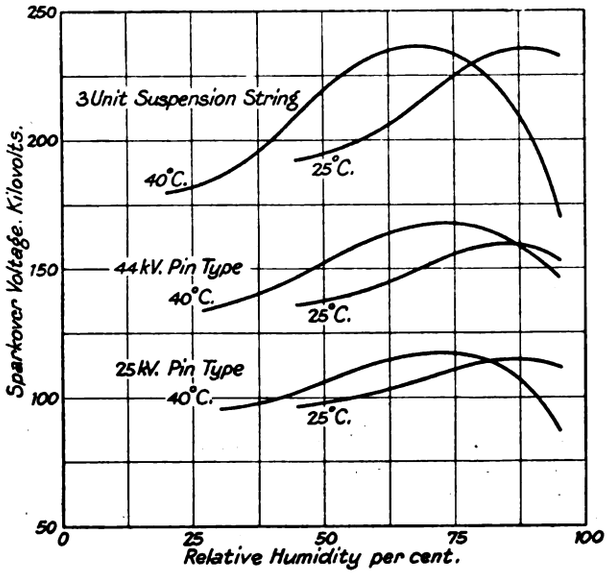

Fig. 2.—Variation of sparkover voltage with humidity and temperature —clean insulators.

found that the majority of insulator troubles of this nature occur on lines running fairly close to the sea shore, the deposit consisting of minute salt crystals formed from the evaporation of sea spray in a dry wind, and carried inland. Meteorological data indicates that such salt crystals are one of the main constituents of the permanent impurity of the atmosphere.

Trouble due to this cause has been experienced on lines as much as thirty miles from the sea coast, although the intensity of the deposit usually diminishes rapidly as the distance from the coast increases.

The second most prevalent source of trouble seems to be fouling by coal smoke. While the reduction in discharge and sparking voltages due to this impurity is admittedly less than in the case of salt, yet the number of lines (at any rate in England) working at some point in a smoke polluted atmosphere, must be very great. As an example of the magnitude of the reduction experienced, we may quote the case of an insulator installed in an industrial district of Manchester, but not in a particularly foul situation. In six months the accumulated desposit was sufficient to reduce its "dry sparkover voltage" (at 70% humidity) from 166 kV to 97 kV, i.e., to 58% of its value when first installed.

In addition to salt and coal smoke, troubles have also been experienced due to ashes from metallurgical works, cement dust, fumes from chemical works, etc., but, owing to the larger size of the particles and consequent rapid settling, the distribution of such impurities is very much more local, and they are, therefore, of correspondingly less importance to the industry as a whole.

The experimental side of the investigation falls very naturally into two distinct parts. First of all we have to study methods of building up surface films approximating sufficiently closely to those formed in service, and also to devise some method of characterising such films in a quantitative manner.

Secondly, we have to investigate the performance of insulators so prepared, under various atmospheric and electrical conditions.

Formation of the Surface Deposits.

The formation of a satisfactory surface deposit is not at all the simple matter which first thoughts might lead one to expect. Such films can only be properly built up by placing the insulator in an atmosphere in which the required impurity is held in suspension, and allowing the deposit to form by precipitation.

In the formation process the size of the particles of the disperse phase, the concentration, the stability and other properties of the aerosol, all play an important part. In particular, the size of the particles requires consideration. A particle suspended in the atmosphere close to the insulator will be acted on by four sets of forces, viz. :—

1. The gravitational attraction varying as the density and cube of the diameter of the particle.
2. The frictional resistance offered by the air to the motion of the particle, varying as its diameter and velocity.*
3. The wind forces varying as the diameter.
4. Electrical forces due to (*a*) the action of the field on the particle, (*b*) ionic bombardment, the magnitude of which depend very little upon the size of the particle.

According to the size of the particles one or other of these sets of forces will predominate and govern the formation of the film. In particular, the electrical forces require most careful consideration.

It is here necessary clearly to distinguish between the phenomena occurring when the insulator is working respectively below and above its discharge voltage. In the first case the forces are merely electrostatic and of comparatively small magnitude; the tendency is for dirt to accumulate on surfaces over which the normal component of the intensity is high. In the second case the forces are much greater, and are due mainly to the electric wind. Electrostatic precipitation as a method of removing impurities from the air is, of course, well known. It is not, however, generally appreciated that this phenomenon occurs equally well wherever an electrical discharge is present.

Conditions During Film Formation.

In the case of insulators, the atmospheric dirt is precipitated on the dielectric surfaces adjacent to the discharge, and, in conjunction with the nitrous products of the latter, forms an extremely stable and adhesive deposit. The necessity for considering the electrical conditions during the formation of the film will be apparent from Fig. 1, which shows four insulators of the same rated voltage on which a coal smoke film was built up at the same time in the same fume chamber. Numbering from left to right, the only difference in the conditions was that insulators 1 and 3 had their rated voltage impressed on them during the formation of the film, while numbers 2 and 4 were left disconnected. It should be noted that insulators 1 and 2 have a brown and not a white glaze.

Another most important factor in the formation of the film is the presence or absence of a side wind. In the latter case the deposit will be distributed uniformly over the insulator and mainly on the upper surfaces of the rain sheds. In the former case, the deposit will be heavier on the side facing the air current, and a considerable amount of matter will be carried under the rain sheds, quite apart from any electrical effects tending to this end.

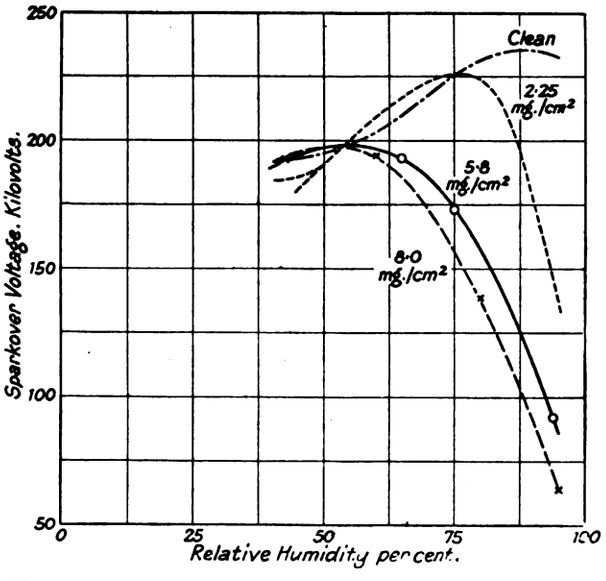

Fig. 3.—Sparkover voltage of 3-unit suspension chain as function of relative humidity and severity of salt deposit. (Temperature 25 deg. C. Barometer 755–767 m.m.)

As the majority of engineers will be interested rather in the results of the investigation than in the experimental methods adopted, the procedure employed in building up the various deposits will not be discussed in detail. It may be noted that the investigations were carried out in a large fume

* The particles in the majority of practical cases are too large to exhibit the Brownian movement; indeed, they are frequently much larger than the mean free spaces of the gas, and consequently follow Stokes law.

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chamber, the atmospheric conditions in the interior of which could be strictly controlled. In building up the deposit the insulators were mounted in this chamber, and the required suspensoid introduced into the atmosphere by a process appropriate to the impurities in question. Salt fog, for example, can be produced by spraying an aqueous solution of sodium chloride through a high velocity air stream; salt haze is best formed by a spray evaporation process similar to that employed in the preparation of dried milk.

Industrial smoke can be obtained by the combustion of the appropriate grade of fuel, with slight admixtures of other ingredients; the composition of the deposit from a given grade of fuel is, however, liable to vary considerably. This uncertainty may be due partly to variations in the quality of the coal itself, but is mainly dependent upon the degree to which combustion is carried out; with imperfect combustion the size of the particles will be much increased, the deposits will be correspondingly heavier, and the tar content greater. The reports of the Advisory Committee on Atmospheric Pollution were of great assistance in suggesting the composition of deposit to be aimed at.

Comparison of Deposits.

A point which necessitates particular consideration is the time in which the deposits are formed. In service, the building up of a surface film is usually a matter of months, and, sometimes, years. In the laboratory, such periods cannot be employed, and the process has to be accelerated by increasing the concentration of impurity in the atmosphere, so that the required deposit is built up in at most a few days. The question may well be asked if deposits formed in such a manner are comparable in behaviour with those formed by natural processes.

As far as can be seen at present, the distribution of a deposit over the insulator does not depend very greatly upon the concentration of the aerosol from which it was formed; the stability and adhesion of artificial deposits is, however, undoubtedly inferior.

It is, of course, most desirable to have some numerical index of the severity of the deposit which can be correlated with the electrical performance of the insulator. Unfortunately, it is by no means easy to devise a quantitative method of characterising the deposit that will satisfy even the most modest requirements. The electrical performance of the insulator depends upon the peculiarities of the distribution of the film over its surface; the mean thickness of the deposit is connected only remotely with some of the phenomena observed, and even the mean thickness of the film can only be determined with considerable difficulty.

Surface resistance measurements provide no solution of the difficulty, the results being hopelessly erratic, and the only feasible method seems to be the characterisation, not of the deposit itself, but of the aerosol from which it is built up.

The important physical properties of an aerosol are the number and size of the particles of the disperse phase, and its life or stability.

The particles of interest to us in the present connection are too large to exhibit the Brownian motion; their size may accordingly be calculated by Stokes equation from observation of their mean rate of settling in still air under the influence of gravity. Their number in a unit volume can be determined by means of the Aitken dust counter or similar apparatus. These methods of examination, however, find their main application in work connected with the standardisation of the aerosol itself; they are not sufficiently rapid to provide a continuous control on conditions in the fume chamber during the formation of a deposit. Once the spraying and combustion processes are standardised, conditions in the fume chamber can be controlled fairly well by observing the total obscuring power of the fog and the weight of deposit formed in a given time on small exploring plates inserted in the chamber. More refined methods of measurement are, however, being investigated.

* * *

The experimental procedure best calculated to exhibit the effect of surface deposits on the performance of an insulator is to observe the discharge and sparkover voltages as a function of the relative humidity of the air. Curves connecting these variables are first obtained for the clean insulator, and the procedure repeated with surface deposits of gradually increasing thickness until this factor ceases to have a noticeable influence on the results.

The dispersion of the observations in such tests is always quite considerable, and in order to obtain even moderate consistency, tests have to be made simultaneously on a number of identical insulators.

The procedure adopted by the writers was to place the insulators in the fume chamber, build up the deposit and carry out the electrical tests without any further handling whatsoever. With all the precautions taken, however, the magnitude of the dispersion was seldom less than ±5%, while at the higher humidities deviations of as much as ±15% were sometimes observed.

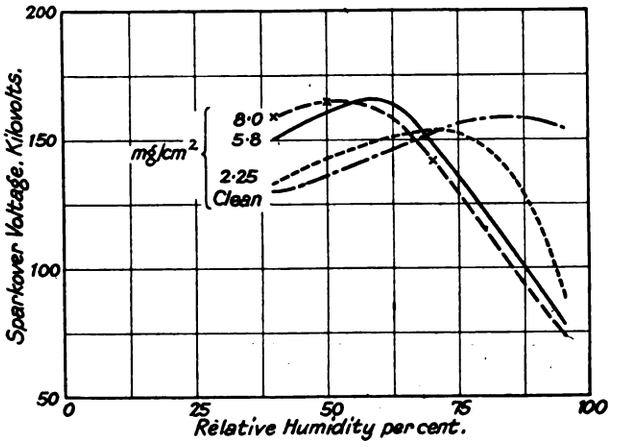

Fig. 4. Sparkover voltage of 44kV pin type insulator as function of relative humidity and severity of salt deposit. (Temp. 25 deg. C., Barometer 756 mm.)

A source of error requiring particular mention is the influence of the time of exposure of a fouled insulator to the humid atmosphere. The sparkover voltage usually continues to decrease for a considerable time after the atmospheric conditions have been stabilised, and due allowance for this fact has to be made.

The curves of Fig. 2 show the sparkover voltage of three different sizes of insulator in the clean condition as a function of the relative humidity and temperature of the air. It will be noticed that with increasing humidity the sparkover voltage first increases, then attains a maximum, and, finally, begins to fall. The reasons for this peculiar shape of the curve are not known with certainty. It may be noted, however, that the sparkover voltage increases with the humidity also in the needle gap, and, in fact, in any spark gap in which a bush discharge precedes sparkover.

Reason for Phenomena.

The reason for this phenomenon is probably associated with the decreased mobility of ions in moist air. The falling portion of the curve is possibly due to the formation of a surface film of moisture by adsorption.

If this suggestion is correct it might be expected that with a surface deposit the falling portion of the curve would start at a lower relative humidity than in the case of the clean insulator, in consequence of the rougher surface of the deposit and the decreased vapour pressure when the substance of the latter is hygroscopic. It will later be seen that this prediction is, in fact, realised. One conclusion which may be drawn from these curves is that the humidity has a much greater influence than the temperature on the sparkover voltage, and the usual assumption that the sparkover voltage varies inversely as the absolute temperature is liable to be misleading.

In Fig. 3 curves are given showing the influence of various intensities of salt deposit on the power frequency sparkover voltage of a three-unit chain of cap and pin type insulators. such as is frequently used on 33 kV lines. The relative intensity of the deposit is expressed by the weight (mg/cm²) of precipitate collected on the exploring plates mentioned above during the period the deposit was being formed. If we assume the nominal dry sparkover voltage of the insulator to be that measured at 25deg. C., and 70 % relative humidity, it will be seen that the combined action of a heavy salt film and damp atmosphere is capable of reducing the actual sparkover voltage to less than 30% of its nominal value.

In Fig. 4 similar curves are given for a pin type insulator of flow line design nominally rated at 44 kV. The general behaviour of this insulator is much the same as that of the suspension chain shown previously, but the absolute magnitude of the reduction is considerably less.

That the use of insulators with a long leakage path is not necessarily a cure for the trouble will be apparent from

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Fig. 5, which shows the results obtained on two pin type insulators of the same nominal rating, but different design. Curve A refers to an insulator having a leakage path of 32 in., while Curve B was obtained on an insulator with a leakage path of only 23 in. It will be seen that in this particular

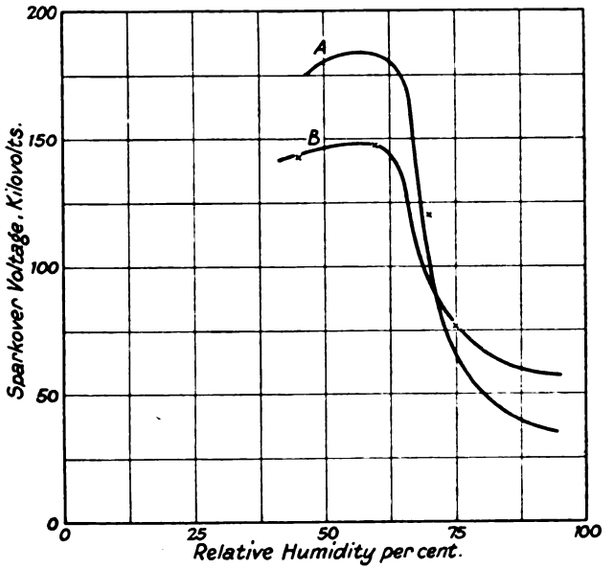


Fig. 5. Variation of sparkover voltage with humidity salt-coated insulators. (7mg/cm². Barometer 755mm.)

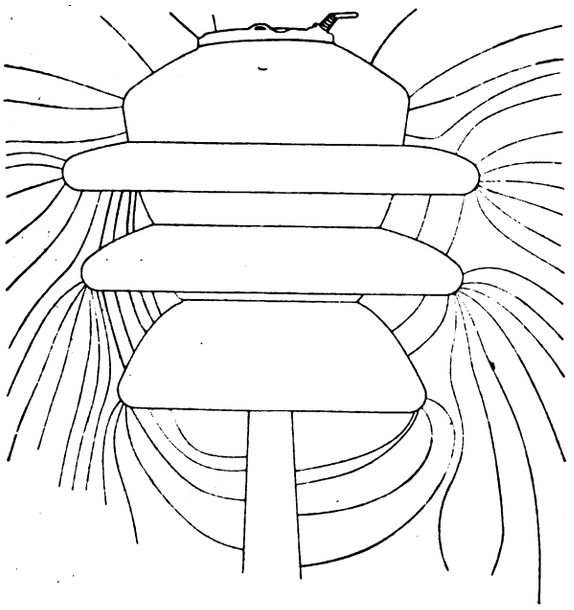
case the insulator with the longest leakage path gives much the poorest performance.

The magnitude of the reduction due to smoke deposits is in general less than that caused by salt, but is still quite sufficient to cause serious annoyance.

Fig. 7 shows some results obtained with the same insulators that furnished the data for Figs. 3 and 4.

The phenomena observed with substances, other than salt and soot, are qualitatively very similar, and need not be discussed in detail here. It may be noted, however, that of all impurities those of a metallic nature, such as fumes from metallurgical works, seem to have the most deleterious effect. Cement dust, however, is also extremely harmful, the sparkover voltage being frequently reduced to 10% or 15% of its nominal value.

It should be noted that the performance of an insulator in the fouled condition cannot be characterised solely on the basis of its sparkover voltage. Usually luminous discharges



CLEAN. **Fig. 6.** FOULED.

are present at very much lower voltages, and, with certain types of insulator, at the higher humidities these discharges assume the form of partial arcs between the sheds, developing considerable heat and noise, but without causing complete arc over. The action of such discharges, if prolonged, is very damaging to the surface and glaze of the insulator, and the useful life of the latter will be considerably reduced.

A point of considerable interest is the fact that the sparkover voltage of a fouled insulator is frequently lower in an atmosphere of 95% relative humidity than in actual rain. This somewhat unexpected effect is particularly noticeable where the surface film is easily soluble, and not of a particularly adhesive nature. In a humid atmosphere the surface film is moistened fairly uniformly. In rain, however, the wetting process is a gradual one ; the upper surfaces of the rain sheds will be streaming in a very few seconds, but a considerable time may elapse before the vertical and under surfaces attain a stable condition. The result is that a considerable portion of the deposit on exposed surfaces gets washed away before the protected surfaces are moistened to any great extent.

Whether such washing would occur to any degree with the more adhesive deposits obtained in actual service may be doubted ; the effect is not apparent, even in the laboratory, with deposits of a greasy and adhesive nature such as are formed from smoke.

It is now necessary to consider how the evil effects of damp and surface deposits can be minimised in service. Since one of the most apparent effects of a surface deposit is a greatly decreased leakage resistance, the solution most generally adopted is to instal insulators having an especially long leakage path, or, in the case of suspension insulators, to add additional units to the chain. This solution is simple, obvious, and has certainly cured the trouble in a good many cases.

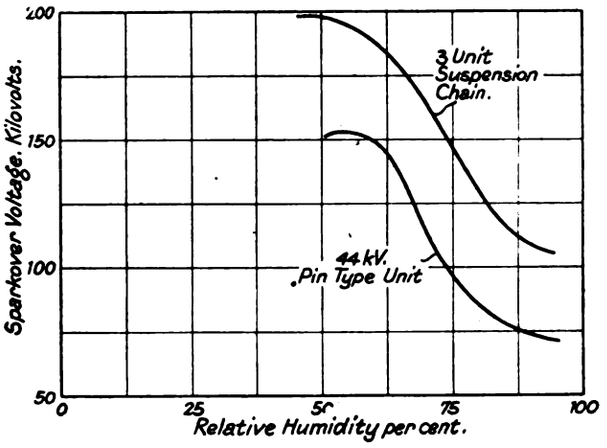


Fig. 7. Sparkover voltage of smoke-fouled insulators as function of relative humidity. (Temp. 25 deg. C., Barometer 769 mm. Average deposit 1·1 mg/cm².)

In the majority of systems, however, fouling troubles occur only in some one particular locality. Installing long leakage path insulators in this locality alone is rather liable to upset the general balance of the system insulation as a whole, since such insulators usually have also a considerably longer arcing path than the normal units. As the impulse and high frequency sparkover voltages are unaltered by rain or fouling, the result will be that the lightning strength of this part of the system will be considerably above the average. This result may be avoided by the use of arcing horns, which are very valuable means of controlling the arc over voltage in various parts of a system.

The sparking voltage of two properly designed arcing horns depends comparatively little upon the atmospheric conditions. Its variation with humidity is not negligible, but is no greater than that of the insulator protected ; a maximum value is usually attained at about 95% relative humidity, in other words, under fog conditions. Rain, however, has very little effect, the decrease being seldom greater than 5%. We may, in fact, regard a horn shunted insulator as a combination of two spark gaps in parallel, one of which is affected by the atmospheric condition, while the other is not. As we wish the arc to pass always between the horns we have to so dimension the insulator that its arc over voltage under the most adverse conditions still exceeds that of the protective horn gap.

The fouling trouble has given rise to a considerable amount of thought among insulator designers, and there are at present on the market several designs for which especially good performance in damp and polluted atmospheres is claimed. The majority of these designs depend for their effectiveness

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upon the presence of a long and protected leakage line obtained by the use of deep vertical surfaces. In the case of suspension units, the shape of the insulator is reminiscent of a bell; with pin types the leakage path is obtained by several deep vertical ridges on the under sides of the rain sheds. Many of these insulators are quite effective in service, although largely the result of empirical design. A rational criterion on which the probable performance of an insulator in the foul condition may be estimated is provided by the following consideration.

If a moist deposit is formed on the surface of a dielectric under stress, then the tangential component of intensity along that surface tends to vanish to an extent dependent upon the conductivity of the surface film, and in the limit an equi-potential surface is established.

The minimum disturbance of the original field form will, therefore, occur with an insulator where the deposits accumulate mainly on surfaces which are equi-potential surfaces, also in the clean condition.

Fig. 6 shows the field forms determined by experiment on the pin type insulator of Fig. 4, in the clean, and in the foul and damp condition. The vanishing of the tangential component of the intensity is here well illustrated, the majority of the lines of force cutting the fouled surfaces strictly at right angles.

While the above principle is undoubtedly correct, it by no means follows that the ideal so presented is attainable in practice. When the mobility of the particles in suspension is high, and prevailing winds not especially marked, a good deal can undoubtedly be done by designing the insulator so that the electrical forces will themselves tend to precipitate the suspensoid on to surfaces where it will do little harm. Whether any such principles are capable of extended application can, however, only be shown by practical experience.

ACCESSORIES FOR H.T. LINES.

Isolating Links—Aerial Switches—Combined Links and Fuses—Earthing and Earth Plates.

AMONG the accessories useful for overhead line work are isolation links, aerial switches, fuses and isolated aerial oil circuit breakers. At one time horn lightning and other h.t. dischargers were very largely used, but of recent years, in many cases, they have proved to be more bother than they are worth; the surges set up when they operate sometimes causing more disturbance than the shock due to atmospheric disturbance. Where a transformer is of small capacity it is quite practicable, after cutting off the load on the low tension side, to break the transformer current by means of simple isolating links. Fig. 2 shows a set of links on a concrete post line in France. Each link has a ring at the swinging end of the blade, which can be operated by means of a long insulated pole with a hook at the end.

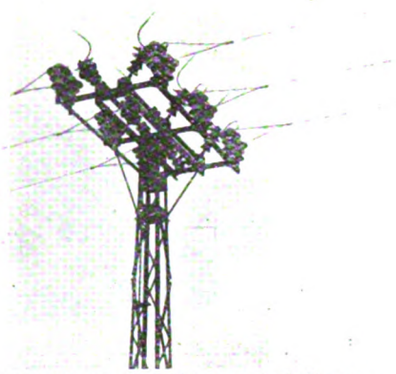

Fig. 1.—An aerial switch of a type which is popular in France.

It is well known that on a heavy short-circuit there is a tendency for a circuit to attempt to enlarge itself, and this may cause a link to open. Some makers therefore fix latch locks to the knife blades. The vertical pattern is in some favour as it can be arranged in the leads coming down to a transformer.

Owing to the difficulty of manipulating a very long insulated hook rod in the wind or rain, especially at night, and to the danger that one of the links might be left alive when repairs are being done, aerial switches have been popular among overhead line engineers. By means of crossbars and linkage, the three blades can be made to open simultaneously, and by means of a quadrant and padlock the switch can be locked in an open or shut position. With the aid of arcing horns quite an appreciable load can be broken.

A type of aerial switch introduced into French Alpine water power districts before the war by Messrs. Maljournal et Bourron of Lyons (now Messrs. Grammont of Paris), can be seen in Fig. 1. It has two sets of movable horns which separate, the movement being very rapid; the horns are faced with anti-arc metal, and the contact is made at the base of the horns. This type can be seen in many parts of France to-day, and many switches made nowadays with rocking contacts on insulators contain features traceable to this type of switch, which has stood the test of time.

Fig. 9 (p. 97) shows an aerial switch made by Ferguson Pailin; Fig. 8 an outdoor sub-station in North Wales at 33 000 V with switchgear made by the same firm. In this case flexible leads supported by hinged arms make connection to the knife blades; an interesting feature of this sub-station is the use of an ammeter directly in the h.t. circuit placed out of reach. It is strange that this simple arrangement is not more often used. Fig. 5 (p. 96) is an aerial switch combined with horn fuses made by Messrs. Johnson and Phillips. As will be seen the switch blades are fitted with horn arcing tips.

Fig. 7 is a switching point on an 8 000 V line at Shoreham. This is arranged with a cable end box and bells, inclined tubular fuses, a bracket guard to earth a conductor should it break, and aerial switches at the top. As will be seen, the terminal insulators are of the suspension type; this gear controls a transformer placed on the ground.

Fig. 6 is an aerial switch on an 11 000 V line in North Wales. This switch is placed one pole away from the fuses and transformer that it controls, an arrangement that is becoming increasingly popular at home and abroad. The usual procedure before approaching the h.t. fuses or transformer is to open the l.t. circuit, break the h.t. circuit at the aerial switch, and then the final span is quite dead and safe to work on. The installations shown in Figs. 6 and 7 were made by Crompton-Parkinson, Ltd.

The horn type aerial switch is usually used to break circuit at low loads. It is often used abroad for undertakings such as small brickworks which buy power at high tension; when such consumers shut down, the h.t. side of the transformer can be cut off and the light load losses on the transformers avoided.

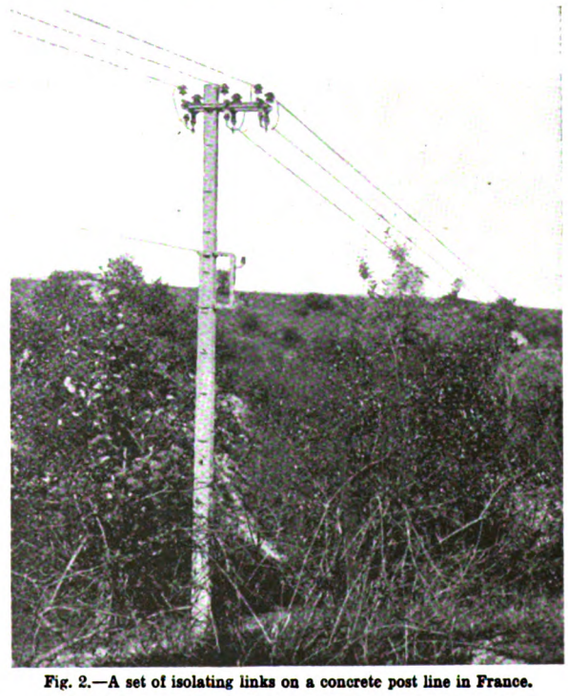

Fig. 2.—A set of isolating links on a concrete post line in France.

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In urban districts, with ample opportunities of revenue per mile of line, oil switches are, of course, mainly used, especially in connection with underground cables. Where, however, it is of importance to cut down the capital cost to a minimum consistent with safety and durability, as in the case of lines in many rural areas, fuses are indicated in many cases. They have been used for some time abroad, and are becoming more popular at home with the extension of rural electrification.

A favourite type of fuse for many years was a porcelain tube with a silver wire as fuse, the silver being used to diminish oxidation. Recently, to prevent difficulty from the porcelain tube bursting in the case of a very violent short circuit, the greater capacity of modern power stations behind a blow tending to make it more violent, even when toned down by intermediate transformers and reactive aerial lines, bakelite tubes have been used, in some cases with a cap at one end to direct the arc out at the other.

The horn type fuse has been established for a number of years, the blow out being not merely the result of the draught of air due to the heating, but also to the magnetic effect which tends to push the circuit outwards.

Fig. 3 is a type of combined link and fuse developed before the war by Messrs. Maljournal and Bourron, of Lyons, now handled by their successors, Messrs. Grammont, of Paris, and still a favourite appliance, often used for 15 000 V. The fuse is arranged between two terminals supported on insulators on a hinged base, held up into position between the main link contacts, which are also on insulators, by means of a latch with a looped handle. The fuse can either be connected directly between the terminals or wound round a strip of celluloid, with the idea that when the fuse blows the celluloid will ignite, and the fact that it has blown shown from below. As can be seen, arcing horns are fitted.

The advantage of this type is that it acts at the same time as a disconnecting link with safety latch, and is re-fused from below while the fuse contacts are dead. In one area in the North of France, where very sticky fogs are experienced, it is sometimes found that when a fuse breaks gently after a gradual warming up, the heat of the break has not been sufficient to blow the damp celluloid, and trials have been made with a gunpowder cartridge to give a similar result. Some linesmen say they can tell from the ground when a fuse has blown, even if the wire is small.

It is of importance in the case of links, link fuses and aerial switches to take side-strain off the contact terminals, and in most of our illustrations, showing the accessories in place, separate anchoring terminals have been provided.

Fig. 4 is a horn fuse developed by Messrs. Johnson and Phillips. The fuse is carried by a holder made in two halves connected by an insulator, the fuse contacts having bases in the form of conical bells; the horned fuse holder can be lifted off the fixed contacts by means of an insulated rod operated from the ground.

At home on high tension lines, either an earthing conductor or earth plates are used to minimise danger from a broken

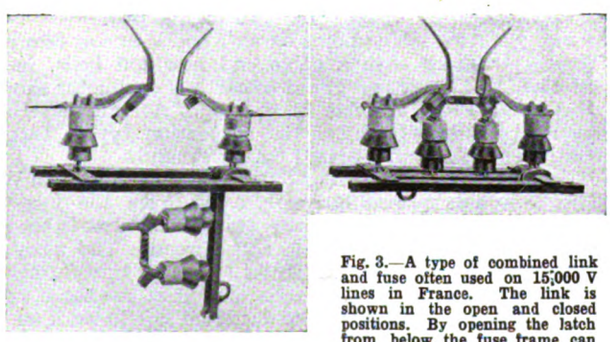

Fig. 3.—A type of combined link and fuse often used on 15,000 V lines in France. The link is shown in the open and closed positions. By opening the latch from below, the fuse frame can be dropped down clear of the h.t. contacts, and a fuse replaced from below in safety.

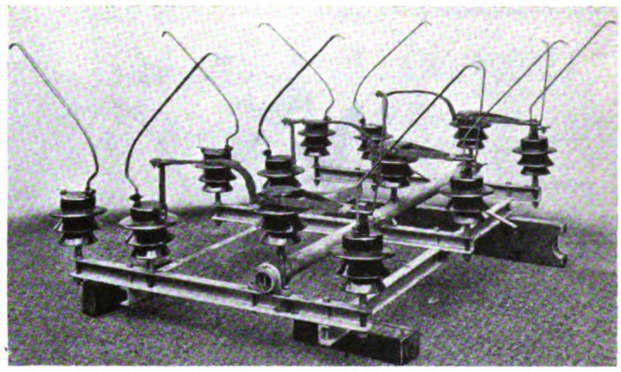

Fig. 5.—A "J. & P." aerial switch combined with horn fuses. The fuse wire is fastened to the base of the horns, and the inner insulators of the switch on the right open round the tubular hinge.

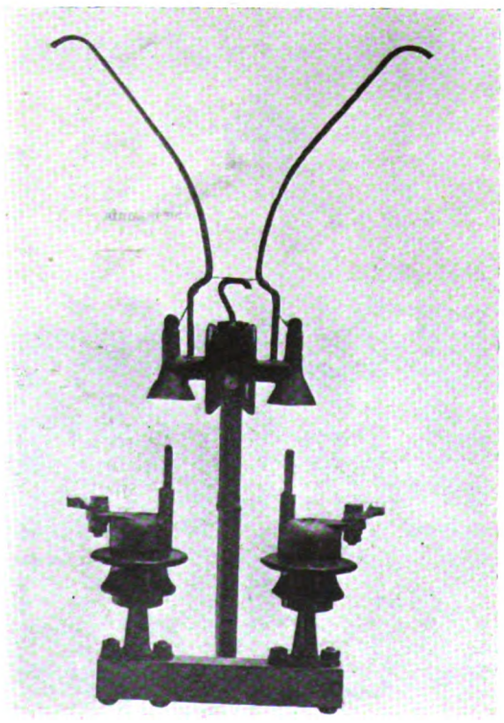

Fig. 4.—A type of horn fuse developed by Messrs. Johnson and Phillips.

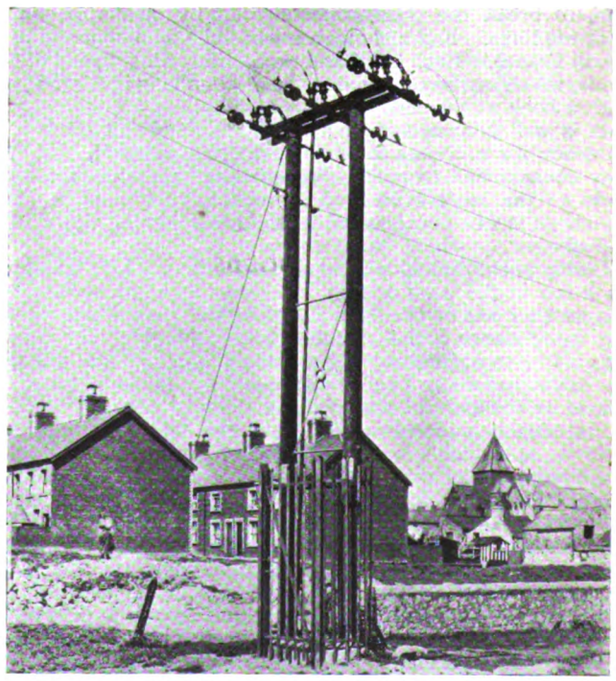

Fig. 6—An aerial switch employed on an 11 000 V line in North Wales.

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conductor or leakage. The Regulations dated April, 1928, recommend the placing of the earth wire below the others, so that if a conductor falls contact may be made and safety devices operated. There is one objection, and that is that from the point of view of lightning protection the earth wire is best above the main conductors.

For the support of earth wires the Electrical Transmission Company makes a hanging clip. The same undertaking makes a cast iron earthing plate 3 ft. by 2 ft., the earth lead being bound and sweated to a copper bond expanded at each end into holes in the plate. A box is formed by ribs in the top of the plate, and when the earth connection is sweated the box is filled with compound, and covered with a board. Some engineers use an earthing arrangement made with galvanised steel plate which can be placed round the butt of the pole and tightened up by means of flanges and bolts.

From the point of view of safety the more connections there are from an earth wire to earth the better, as the longer the run the greater the drop in voltage along the earth wire itself in the case of a leakage.

In countries where no earthing conductor is insisted on, some accidents have occurred at aerial switch points and other places where accessories are installed through the metal work becoming alive. Where no earth wires are used and good earths are difficult to arrange, insulated platforms are being adopted from which aerial switches can be operated.

Perforated copper tubes and perforated galvanised pipes are much used in the U.S.A. as earth plates. It should not be forgotten that when a bad leak to earth takes place there may be a rapid fall of potential on the ground itself round the leakage point, which may give rise to dangerous voltages at a foot pace interval, even if no conductors are touched at all.

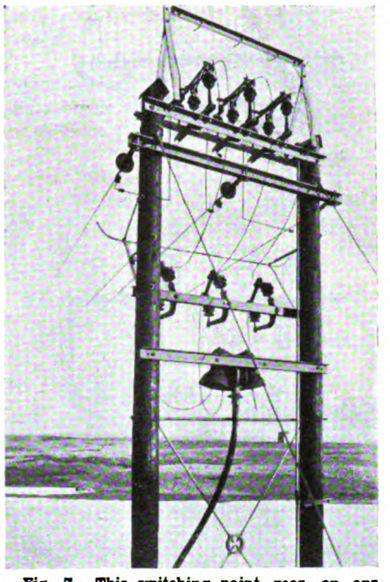

Fig. 7.—This switching point gear on anr 8 000 V line at Shoreham controls a transformer placed on the ground. By opening the horn switch at the top with the aid of gear below, the tubular fuses can be made dead for replacement purposes. The transformer is connected through a short length of cable.

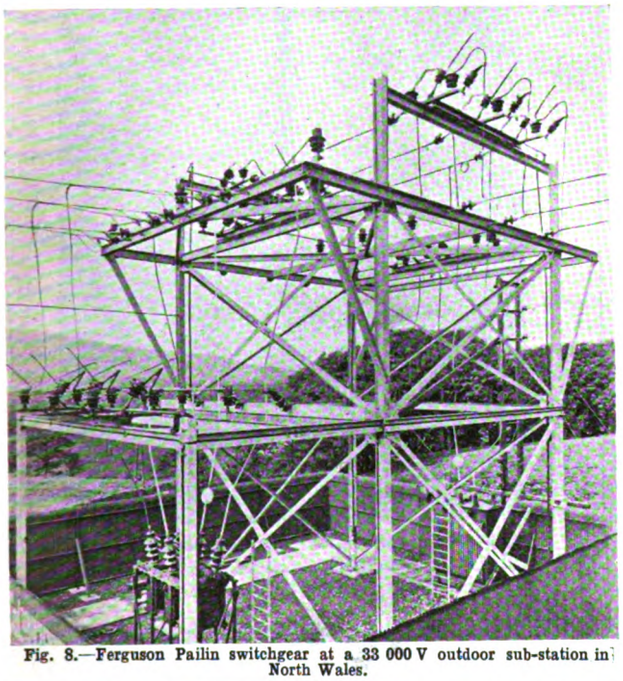

Fig. 8.—Ferguson Pailin switchgear at a 33 000 V outdoor sub-station in North Wales.

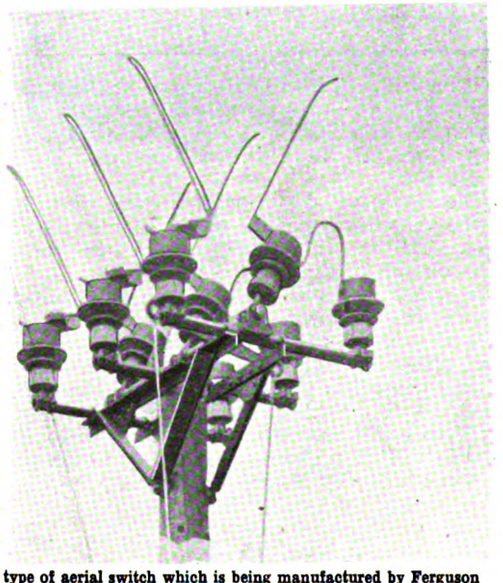

Fig. 9.—A type of aerial switch which is being manufactured by Ferguson Pailin, Ltd.

LOW TENSION LINES.

Some Necessary Precautions—Angle Poles and Strain Insulators—Types of House Brackets for L.T. Work.

OWING to the use of 220 to 250 V to neutral with three-phase currents, materially greater precautions must be taken at home than in countries where 110–125 V is customary. The 1928 regulations allow of a minimum height of 19 ft. across a roadway, 17 ft. in other places, and 15 ft. at points inaccessible to vehicles. This means a material reduction in pole heights, and the Electricity Commissioners are also prepared to consider arrangements for the support of low tension mains on the same posts as high tension; the latter are placed at the top with ample clearance so that the low tension can be got at without danger. The new regulations which enable an earthed neutral when placed below other conductors to act as a guard have led to a reduction of the "top hamper" of low tension lines, making them materially safer for linesmen to get at.

It is somewhat of a paradox that, per mile, low tension lines are so often dearer than high tension lines, the reason being that owing to the very much greater amperage per kilowatt the amount of copper in the former is usually high. Where a l.t. line runs along a roadway with houses every few yards, owing to the requirements for taking off services it does not usually pay to have spans as long as those which are possible for mechanical reasons.

The use of outdoor aerials for wireless reception has introduced a new source of danger. It would certainly be an advantage from the point of view of neatness if they could be forbidden in towns. At any rate, their presence makes it objectionable in some cases to put up bare conductors under the eaves of houses; where ownership of blocks of houses or arrangements permit, the supply of a row of houses by means of insulated genuinely weatherproof conductors, such as "Maconite," is desirable from the point of view of safety, and the reduction of the number of tapping points tends to make the overhead work neater.

Fig. 2 (p. 98) shows a l.t. line with three copper conductors, 0·05 sq. in section, with two 0·0145 sq. in. conductors as a

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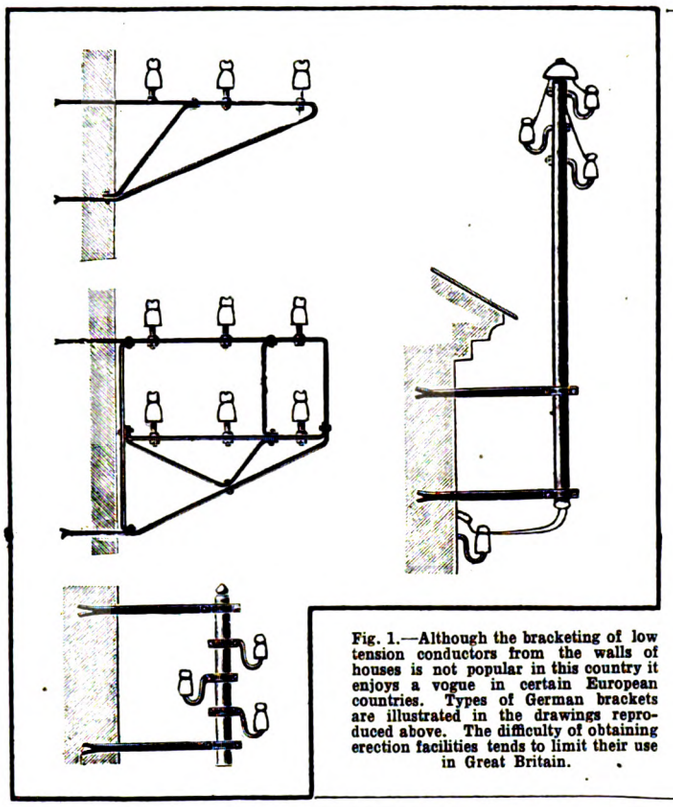

Fig. 1.—Although the bracketing of low tension conductors from the walls of houses is not popular in this country it enjoys a vogue in certain European countries. Types of German brackets are illustrated in the drawings reproduced above. The difficulty of obtaining erection facilities tends to limit their use in Great Britain.

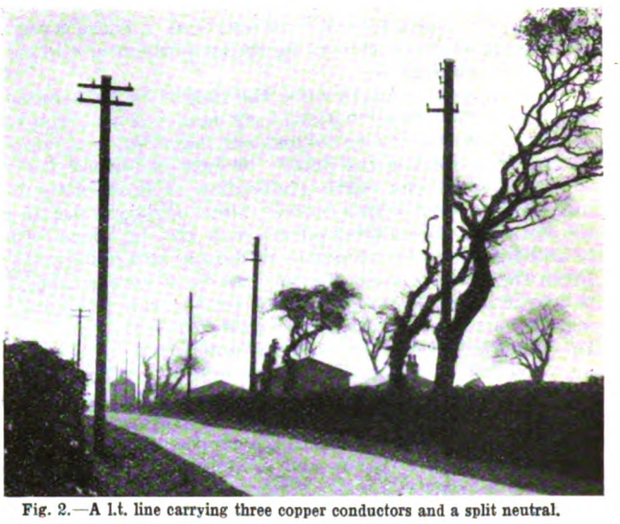

Fig. 2.—A l.t. line carrying three copper conductors and a split neutral.

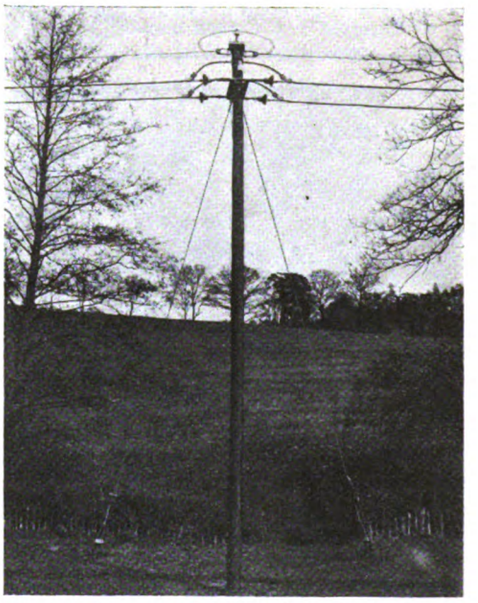

Fig. 3.—Angle pole on l.t. line fitted with strain insulators.

split neutral. A Post Office line is at the opposite side of the road. Fig. 3 is an angle pole on a low tension d.c. line, with 0·5 sq. in. conductors at 480 V for power, and a neutral of 0·05 sq. in. It will be noticed that strain insulators are fitted to this pole.

The spans are 165 ft. maximum and 150 ft. normal. Owing to the very heavy conductor a strong construction has to be used. The two above lines were constructed by Messrs. Johnson and Phillips.

In many towns and villages on the Continent it is very usual to bracket low tension conductors off the walls of houses. In some countries the law gives facilities for so doing, but in some places in England the cost of negotiating for any such arrangements has proved to be more than the facilities are worth to the electricity supply undertaking. The use of 115 V to earth naturally makes it safer to use such a construction. Fig. 1 shows various types of house brackets for l.t. work made by Messrs. Hannemann, of Duren, Germany.

RURAL ELECTRIFICATION IN WESTERN LORRAINE.

Some Interesting Statistics on Recent Developments of Village Supplies—Methods for Encouraging Fuller Utilisation.

MONS. R. PICAUD and Mons. R. Gilliard, inspector-general and chief engineer respectively of the French Department of Rural Engineers, have published some statistical notes on rural electrification in the departments of Meuse, Menthe-et-Mosell and Vosges, published by J. L. Paton, of Troyes.

The particulars relate to 24 rural associations of communes with 554 communes (villages) associated, each having an average of 8·65 sq. km. (3·3 sq. miles). The average density of population is 57 per sq. mile, and the average length of h.t. line per commune 3 005 yds. and l.t. 1 278 yds., so that the villages are fairly closely grouped.

There is an average of 1·1 transformer posts per village, the average capacity being 11·9 kVA per transformer; each station supplies 175 inhabitants. Each village averages 47 consumers, or nearly 1 in 4 of the population.

In the areas examined there were 25 830 consumers. The average capacity in motive power per motor is 2·08 kW; 8·7 motors per village; 31% of the capacity is lighting and 69% power. The capacity in lighting plus power installed per village is 27 kW.

In 1927 the consumption was 4 390 kWh per village and 94 kWh per consumer. The sale price varied between 1·40 and 2·05 frs. (2·8 and 4·1d.) for lighting, and 1·1 to 1·35 frs. (2·2 to 2·7d.) for power. For each 1 000 inhabitants there are 12·4 miles of combined h.t. and l.t. line and 5·75 transformer posts.

The average utilisation factor of the transformers installed is 320 hours per year; the best is 500 hours, and the worst 132 hours. Efforts are being made among agricultural consumers to encourage a successive time table utilisation of the farm motors to improve this factor.

It might be noted that if in the part of France concerned, 230 V had been used instead of 115 V, it would doubtless have been possible to reduce the number of transformers and increase the capacity, but not quite in inverse proportion to the numbers, owing to the improved diversity factor.

Owing to the developments which are taking place at home, the statistics given are distinctly interesting. For the carrying out of village electricity supplies the French Government puts up money on easy terms, the schemes being prepared or supervised by officers of the department of Rural Engineers, to which department thanks are due for the particulars given.

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RURAL ELECTRIFICATION AND ITS PRACTICAL POLITICS.

Development of the National "Grid" and the Sequel—Problem of Supplying Outlying Small Towns and Villages—Experience in Sweden and the Netherlands—The Lincolnshire Area Scheme.

By ALFRED EKSTROEM, D.Sc. M.I.E.E.

PUBLIC services such as electricity for light and power, gas (and later electricity) for cooking and heating, coupled with convenience of running water, have during many years been considered as privileges for the inhabitants of the cities and bigger towns. They are also among the important reasons for the increasing movement of the population from the countryside to the cities.

The energy and enterprise displayed by the electrical engineering profession in bringing the electric power production and distribution in the cities and towns of Great Britain up to its present very high standard, deserves "honorable mention." The power-stations of the larger British cities, by the incorporation of modern labour and fuel saving devices, have been developed in a really astonishing manner. In fact, to such an extent as to compare approximately with the cost of energy transmitted from the average hydro-electric plants in Sweden.

The growing use of electricity for light and power has given rise to many difficulties in the design of the distribution system, but cable engineers have risen to the need, and have been able to overcome the most difficult problems arising from the demand for higher tensions for the underground transmission mains.

The bigger the population of the city or town, and the wealthier its inhabitants, the faster is the increasing consumption of electricity, and also the easier for an enterprising local electricity supply undertaking to procure the necessary capital for a highly efficient plant.

Rural Supply as By-Product.

It might be considered quite natural that under these conditions the electrification of the smaller towns, and especially the country-side, was of little interest for electricity supply engineers. It was a problem which was only occasionally tackled, when a transmission-line for a town or some large industry happened to pass, and the costs of the tapping were reasonable; i.e., such a rural supply was only treated as a by-product. Even to-day, the idea of the majority of English electricity supply engineers seems to be that electrification of the country-side can only be carried out where it is economically justified through the supply *en route* to larger towns and industries.

The remarkable qualities which electricity possesses, not only as a comfortable and efficient source of light, as well as

Fig. 1.—Winch Controlling hoisting tackle for barns. Energy is supplied by a 5 h.p. motor.

for domestic and other power applications, but also for more specialised heating and cooking purposes have, however, made an electricity supply an essential social utility of pre-eminent importance for modern conditions of life, even in the country. Hence, with the development of electric power transmission at high voltages, the problem of providing the population of the country-side with all the facilities which electricity affords in the daily life of the city has grown acute.

Rural electrification has accordingly passed the stage of being occasionally considered for a very few convenient situations, to a problem which must be faced for very much larger districts, and ultimately, in its last stage, as a supply to the nation as a whole.

In this respect, the National Grid System of the Central Electricity Board now under development in Great Britain, will, if successfully carried out, be of pioneer importance in the history of electric power supply all over the world.

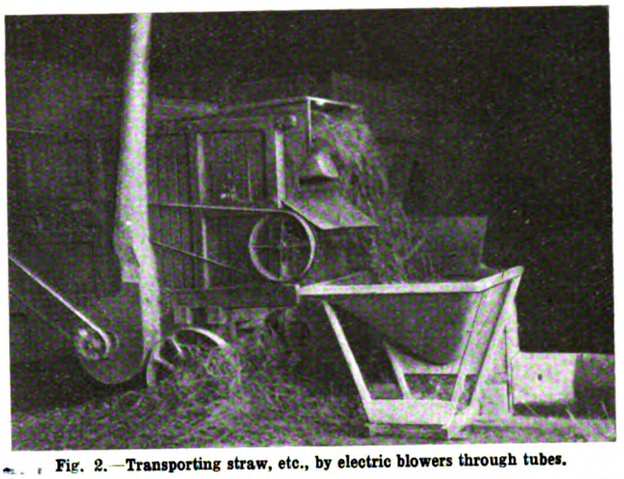

Fig. 2.—Transporting straw, etc., by electric blowers through tubes.

But the sequel of this great idea, the electrification of the country districts, leaves many problems which require solution, and must be solved. If this matter could be taken into consideration for a certain district as a whole, for example, a county complete with all its cities, towns, villages, hamlets and farms, it would be relatively a simple one. The difficulty is, however, that generally, several of the larger communities in the area already have their own distribution system. Even if the Central Electricity Board successively, as I suppose is the intention, should build out an intermediate transmission system of say 33 000 V which could serve as a bulk supply grid for all these existing undertakings, the question of the further development is by no means easily settled.

District Supply Undertakings.

How are other existing smaller towns and villages which are not yet electrified to be supplied with power? Apparently the Electricity (Supply) Act of 1926 does not make any provision for their needs in so far as a distribution system is concerned.

Shall this 33 000 V system of the Central Electricity Board be extended and brought to practically every small village, which will then buy its necessary power from the Board and carry out its own little administration for local distribution, or shall special district electricity supply undertakings be formed to buy in bulk from the National Grid at the 33 000 V, and take over the responsibility of distributing energy to the inhabitants of the unelectrified towns and villages in certain larger areas.

It will doubtless be of interest to state that the first mentioned system of distribution was adopted by the Swedish Central Electricity Board for the whole of Central Sweden, and unfortunately, it has been far from successful. I have from the beginning been an outspoken opponent of this method. One very important reason for the failure of their system is that an electricity supply undertaking necessitates a more highly qualified management than such a small unit can economically support.

The practice in the Netherlands is an excellent example of the advantages to be gained by co-operation over large areas. Practically all the small municipal organisations which originally had their own management, have, during recent years, been amalgamated into large undertakings, supplying power to all the inhabitants of a province (a Dutch province is of about the same average size as an English county). Even

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towns up to 40 000 inhabitants have preferred to give up their own distribution organisation, and have joined in with the larger provincial undertakings.

However, assuming such larger provincial or county undertakings could be established in England, the question might still be raised whether they really would become sound commercial propositions, or whether they would more or less rely upon State or municipal aid. No doubt it must be considered a matter for State or municipal aid if the electrification is to be carried out on the same principles as in large towns, and so that every remote cottage in the country can be in the position of buying electricity at its door.

As I have lately thoroughly studied the possibilities of the electrification of one county in England*—Lincolnshire,

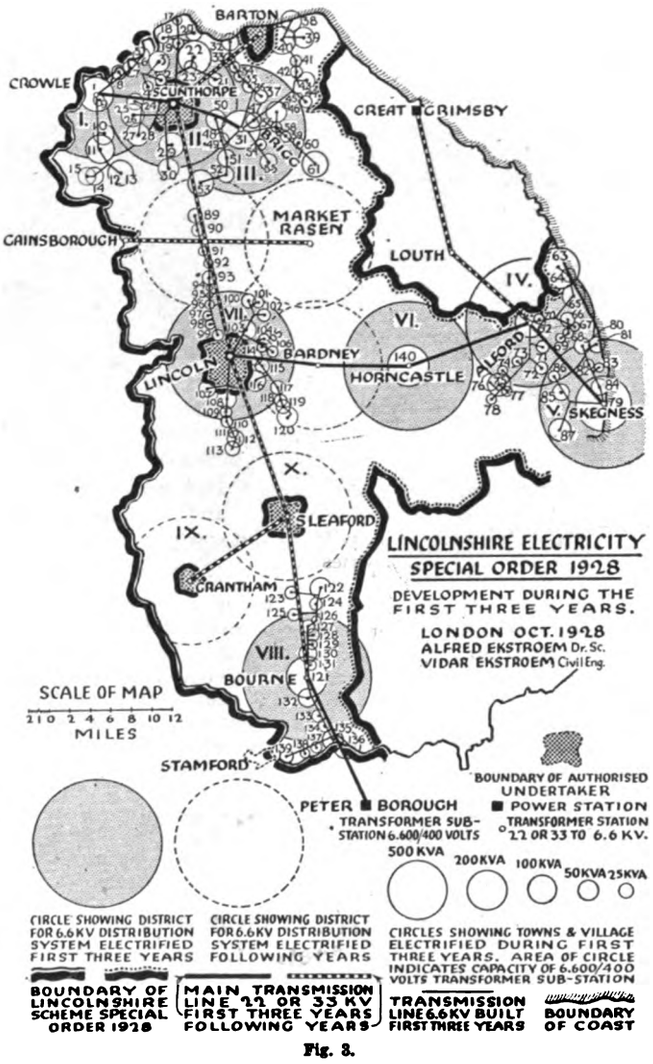

Fig. 3.

in connection with the Special Order applied for by Mr. R. Borlase Matthews—it may be of interest to know how this scheme works out as regards these alternative methods.

Lincolnshire Distribution System.

The map (Fig. 3) shows the proposed distribution system that has been decided upon for the portion of the oounty that it is proposed to electrify during the first three years.

From the municipal electricity works at Peterborough, Lincoln, Grimsby, and from the waste heat stations of the Scunthorpe Steel Works, it is proposed to build 33 kV lines to Bourne, Bardney, Horncastle, Alford, Skegness, Brigg and Crowle, and eventually to Sleaford, Grantham, Gainsborough, Market Rasen and Barton. From each of these towns a 6.6 kV distribution system will radiate, whereby all consumers living within a radius of six miles can be connected up. In each village one or more 6 600/400 V transformer stations will be erected for the purpose of supplying the inhabitants at 400/230 V. The intermediate pressure of 6 600 V has been selected as, due to the results of recent experience, it can be installed and operated at very little more cost than a 1 500 or 3 300 V system, though over a larger radius.

It is proposed to carry out the whole transmission system with overhead lines, though as an engineering proposition when the current density justifies it, underground mains will be laid in the centre of the larger towns.

To begin with, the power supply will be obtained from the above-mentioned central electricity stations. In the second year of supply, the whole system will probably be connected to the grid of the Central Electricity Board.

As to the reliability of overhead line service, it may be of interest to state that in the Eastern district of Central Sweden (the rural area around Stockholm) about twice as large as the Lincolnshire area, the *total hours of interruptions averaged per consumer and per annum* during the last five years have been as follows :

	1923	1924	1925	1926	1927
Hours ..	13.1	11.7	15.5	8.9	7.2

I presume that everybody will admit that a supply with an interruption—with tendency to decrease—of an average of 10 hours totally per annum per consumer is a reasonably reliable service under rural conditions.

Electrified Inhabitants.

In the Lincolnshire area it has been found an economical proposition to construct the distribution system in such a manner that in most urban and rural districts 80% to 90% of all the inhabitants can be supplied with electricity.

In fact, in this respect Lincolnshire is very favourably situated. The reason for this is the very peculiar configuration of the villages, in that almost all the inhabitants within the urban and rural districts live very closely together, generally within a radius of 600 yards from a central point, while their farming lands surround each village. This especially favourable circumstance is, no doubt, a result from that time when the Scandinavian vikings made their raids upon this country and forced the inhabitants to herd together so as more easily to defend themselves against these invaders.

In fact, in another part of the county of Lincolnshire (Holland), which evidently was put into cultivation at a later period—as it was largely unrecovered marsh land in the early days—the configuration is quite different. The dwellings of the farmers are there generally placed in the middle of their fields. Electrification prospects in such an area are evidently considerably less favourable.

It is proposed within the first three years to offer a supply to 50% of all persons living within the area of the Lincolnshire Electricity Special Order.

The capital necessary for the transmission system and the consumers' equipment to supply about 60% of all the inhabitants within the whole area is calculated at about one and a half million pounds sterling.

As this area is 3% of the total rural area in the whole of Great Britain, the great importance of rural electrification—systematically carried out—in Great Britain is readily seen, not only for its rural population, but also for the electrical industry as a whole.

Advantages of Rural Electrification.

Reference has already been made to the valuable qualities of electricity in the home for light, cooking and heating purposes, or what is now generally called domestic uses. As to electric light, I will only point out the increased demand for abundant light, and the importance of a suitable arrangement of switches, so that, in passing from one room to another, the room which is being entered can be conveniently illuminated before the lamps in the room that is being vacated are extinguished.

Even if it is acknowledged that finality has not been arrived at in the matter of constructing cheap and reliable devices for cooking and water heating for the average family, it may not be considered too optimistic to say that it is only a question of a relatively short time before this is achieved. The tariffs already quoted for these purposes in many places in England are such as to secure a wide development of this use, thus giving the house in the country the possibility of the same, or rather higher, comfort than that which electricity offers to the urban inhabitants.

As to the very important convenience to the country home to always have running water at its disposal, the modern electric house service water pump has already reached such a high degree of perfection and the demand of electrical energy for its use is so negligible, that wherever electricity is available this device will very soon be generally adopted.

* See THE ELECTRICIAN, Vol. CI, p. 658, for a brief account of the Inquiry held by the Electricity Commissioners at Lincoln.

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As to the heating of rooms a consumption for more exceptional use can only be assumed, as a general use for this purpose will necessitate such a low energy price as it might not at present be considered possible to attain.

What electricity means to the average farmer is seldom really understood. The convenience of good lighting as well as running water, as mentioned for the home, is undoubtedly still more important for stable and barn. There are, however, other applications of electricity here, which perhaps are even more valuable, if they are properly applied.

Electric Milking Machines.

As the most important I do not hesitate to specify the use of electric milking machines. I have eight years' experience of this application on my own farm near Stockholm, where every day about 80 cows have been milked regularly in this way with *only* the very best results; and I may mention that in Sweden at present more than 5 000 farmers are using milking machines.

The importance of the internal transport problem and the important task of the electric motor in this connection has become more and more obvious. Systematic labour-saving electro-mechanical transport devices are therefore a very vital question.

This is illustrated on page 99. The whole load of hay or corn, as it arrives from the field, is rapidly raised in one lift from the cart or wagon by an electric elevator, after which, by means of a small trolley running on a rail under the ridge of the roof, operated by a simple switch it is unloaded at the desired spot in the barn or loft. (See Fig. 1.)

If the corn has been stored in the barn for the winter, it must eventually be carried back from its place of storage to the thrashing-machine. By fitting a claw fork to the elevator, it will then be easy enough to raise about half a wagon load at a time and convey it out of the barn direct to the feeding platform of the thrashing machine.

In fact, these transporting arrangements have led to quite new principles in the design and construction of stables and barns of a very interesting nature, which cannot, however, be discussed here for lack of space.

Electric exhaustion has of late years found an interesting use in connection with thrashing work. For many years, exhaustion has been used for transporting the chaff by blowing it from the thrashing machine through tubes several hundred yards long to the storage rooms.

It has also been found practical to transport straw from which the corn has just been thrashed, direct from the thrashing machine in tubes of a length of a couple of hundred yards or so, either to the straw-rick or to the loft, where it is to be stored. (See Fig. 2.)

Of recent years at Ahlby Farm, near Stockholm, the grain has, simultaneously with the other work of thrashing, been conveyed direct from the thrashing machine by means of an exhaustion and injector device through a 60 yards' long pipe-line right up to the fourth floor of the granary.

It has been stated by a very eminent British agriculturist that the drainage problem is one of the most important things that the farmer has to solve to-day. Now one very important application of rural electrification is the possibility of obtaining an efficient and cheap drainage of waterlogged pasture and arable land. This is readily accomplished by means of electrically driven pumps, preferably of the automatic type. It will readily be appreciated that by these means a considerable capital expenditure can be saved, that would otherwise have to be sunk in the construction of deep ditches and channels —which are necessary if the ordinary fall of the water has to be allowed for. It is a very simple matter to elevate water the few feet required when electric pumps are available. It is true that where drainage works are on a larger scale, steam engines and oil engines have been employed. The labour of attendance, however, generally kills the steam and oil engines, apart from their initial greater capital cost.

In the area of the South Swedish Electric Power Co. there are five districts, each containing some hundreds of acres, which have now been drained for a considerable number of years with the greatest success. Each station is equipped with an electric pump of 25 to 50 H.P. capacity. Current is supplied, between midnight and 6 a.m., at ⅛d. per kWh. When other methods of pumping were employed, it was not an economic success as it is at present.

For the county of Lincolnshire, where large areas have been reclaimed from the sea, more particularly in Holland and Axholme, electric pumping will be of the utmost interest.

Handicrafts and Small Industries.

The advantages, both from a social and an economic point of view, of industrial activity in the country—perhaps particularly of small industries and handicraft—are perfectly clear. We have numerous examples in the south of Sweden of small workmen in the country, for instance, smiths, wood carvers, etc., who, after having at first introduced a small electric motor connected to the rural supply system, have now extended their handicraft to prosperous factories employing a considerable staff of helpers. Generally speaking, there is every reason to believe that cheap power would give an invaluable impetus to the development of industrial enterprise in country districts.

DEVELOPMENT OF GLASS INSULATORS FOR TRANSMISSION SCHEMES.

Some Advantages of Glass for Electrical Purposes—Examination Under Polarised Light—Possible New Uses—The Proper Sealing Method.

By NORMAN E. NORTH.

NOTWITHSTANDING the exceptional advantages of glass as an insulating material, it is only during the last thirty years that it has been extensively used in connection with the transmission of electric power. This, however, may be explained by the fact that glass insulators require shapes, weights and thicknesses which could not be manufactured in the then state of the art.

Although glass insulators were at first slow in taking favour with the electrical industry, and particularly the electricity supply undertakings, it is now being appreciated that glass, with its many advantages, represents the most modern practice, and in view of the very favourable reports from users, it is now being used very extensively in various parts of the world, in connection with the distribution of electrical energy over large areas.

For telegraph and telephone lines it is used practically exclusively in continental Europe. The Governments of Canada, U.S.A., and Mexico have also adopted glass insulators, and in Spain, notwithstanding the fact that the lines were to be supported by porcelain insulators, they are being replaced by those manufactured of glass. Glass insulators are used in all the French Colonies, with their varied climates, and the other countries of Europe, and the British and Dutch Colonies are reporting favourably on their use.

Glass, being a material obtained by the complete fusion of its elements, is homogeneously perfect, a state which no porcelain can attain. It is thus not necessary to submit it to porosity tests.

Its transparency enables one to perceive the minutest defects in the mass, and to eliminate all pieces susceptible of causing trouble in service. Special apparatus only applicable to transparent material is used to disclose internal stresses which may have taken place in manufacture, thus avoiding the placing in service of pieces susceptible to cracking.

As is well known, porcelain is very susceptible to these internal stresses, and being opaque, it is materially impossible to discover them. X-ray apparatus has been tried in Germany for porcelain, but its action is very limited, and only applicable to actual internal cracks; and, of course, cannot be used for the detection of internal stresses.

To a large extent porcelain, which may be full of pin holes and other defects, depends on its glaze for its insulating qualities; moreover, the re-distribution of moisture by endosmose may be a factor of importance, as investigated by S. Evershed in 1914. Endosmose is the motion of films of water along the walls of an insulator, due to the water being electro-positive to practically all solid insulating materials, and being, therefore, drawn through the pores of the solid towards their electro-negative ends. The alignment of threads of moisture has the effect of partially short circuiting the dielectric.

As the flashover values for most porcelain insulators depend almost entirely on their glaze, and as this glaze depends on

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the manufacturer's skill, the risk of failure may be considerable. In the case of glass insulators this risk is entirely eliminated, as no surface treatment is required and little effect is caused by chipping or other damage in transit or during erection.

Glass has an electrical resistance approaching infinity, and it has a mechanical resistance better than porcelain; its consistency is assured by vigorous chemical control and the rate of melting by the most efficient modern pyrometric apparatus.

Glass is the only solid electrical insulating material used which is isotropic. It is, therefore, the only insulating substance used for electrical application which transmits light, heat and electricity equally in all directions, a factor which is most important in every case in which the material is continuously submitted to the influence of a dielectric field.

Glass acts in relation to the lines of force as an ideally homogeneous body, and this is an advantage, the importance of which will be fully appreciated by engineers engaged in this field.

In a solid isotropic body, temper, lamination or a difference in the chemical composition effects simultaneously the transmission of light, heat and electricity. In other words, temper, lamination or alteration in chemical homogenity are susceptible to make an isotropic body lose its essential qualities by producing irregularities in the transmission of light, heat and electricity.

Thus, in an isotropic body, all the physical properties are altered simultaneously, and proved alteration of any one of them will indicate clearly and surely the alteration of all the others.

The electrical conductivity measurements (however intensive one may make them) are long and tedious, and the percentage of errors with which in ordinary industrial practice they are inevitably effected, deprives them of all practical utility.

It is the same with the measurement of calorific conductivity for industrial uses, and no real or trustworthy indications can be obtained for commercial purposes.

But these are not the greatest advantages of glass over all other insulating materials. It has already been mentioned earlier how another of its physical properties, namely, its transparency, still further enhances this advantage, and thereby places glass in a class of its own.

Polarised Light Test.

Now let us recall to mind the work of the celebrated physicist, Faraday. In 1845 he discovered the fact that, as soon as glass under the influence of an exterior agent suffered the slightest alteration of its physical properties, under an examination under polarised light it immediately showed the phenomenon of double refraction.

It is the application of this most important discovery which has made possible the immense progress which has taken place in the last twenty-five years in the electro-technical glass industry.

The examination of every piece of glass under polarised light indicated instantaneously and with an extraordinary sensibility, the state of the molecular equilibrium of the piece under examination.

Glass, naturally, has already the great advantage of being an isotropic transparent body, and thereby ensures the rapid and sure means of verifying after manufacture that these vital qualities have not been altered in the slightest degree, thus affording proof of its suitability to stand up to service conditions.

Generally glass is the only body used in electrotechnology which has the two united qualities referred to above, although, to be thoroughly impartial, it ought to be mentioned that, in a much lesser degree, celluloid possesses somewhat similar characteristics.

The delicate question of re-baking has been the object of very special improvements, and this operation, upon which depends the very existence of the finished insulator, is watched over by pyrometers. The piece when once re-baked is submitted to an examination in polarised light, which enables every part showing the least defect to be discarded.

This method, which is of an incomparable sensitiveness, is only applicable to transparent bodies, and its application constitutes one of the most important superiorities of the glass insulator.

There is no necessity for the usual immersion test for proving he freedom from inherent internal stresses of glass insulators. Although this test is indicated in the B.E.S.A. Specifications, because no satisfactory alternative has yet been found, it, nevertheless, is generally admitted as not satisfactory, because this test often causes damage which cannot be observed by the naked eye, and only materialises into a fault when the insulators are put into service.

The general testing of glass insulators after completion of the manufacturing process is very comprehensive, and almost invariably includes standard dry flashover; rain at different degrees, and magnitude; and various methods of mechanical testing.

To the engineer-designer the application of glass insulators will suggest many interesting possibilities. One might suggest, as an example, the utilisation of their transparency for oil filled terminal bushings, thus dispensing with the usual glass gauge which is integral with the bushing and placed at what is, both electrically and mechanically, the weakest point.

Again, in the case of compound-filled apparatus, this transparency can be utilised to indicate the state of the compound when actually in service.

The following notes are intended as a guide to those using or assembling insulators, and should be carefully followed if satisfactory results are to be expected.

The Sealing Medium.

Sulphur should be absolutely barred. The makers will not guarantee any insulators which have been sealed with this substance. It should be the same with all cement that is liable to swell.

Contrary to general impression, the sealing of insulators with pure Portland cement is not advised. This substance has already caused considerable inconvenience to those who have used it for fixing insulators (glass or porcelain) on to their iron work.

The co-efficient of expansion of cement is much higher than that of glass. Under the influence of heat during summer, actions are produced which might cause the breaking up or loosening of the insulator.

Sealing by utilising plaster of Paris mixed with powdered glue is the most satisfactory method known. Care must be taken to obtain good plaster for moulding. The melting is done in a double saucepan with carpenter's glue exactly similar to that used by joiners. It is dissolved in water, before being used as a mixture, in the proportion of one tablespoon of the powdered glue to one quart of water.

It is not advisable to mix more than 10 lb. of plaster at a time, otherwise it will very probably become hard during use. This hardening process begins about forty minutes after mixing. The mixing of the plaster can be done in any kind of receptacle, provided that the inside is uniform and smooth.

First of all, pour out the required quantity of thin watered glue, then add the plaster gradually so as to obtain a mortar having the consistency of a soft paste.

The sealer then takes in his hands a sufficient quantity to fill half the cavity of the insulator in which the sealing is being effected. This quantity naturally varies according to the size of the insulator. Afterwards he rolls this mortar into a ball, either between his hands or on the table in front of him, and places it inside the insulator, which has previously been fixed in a suitable support.

This done, the workman pushes the pin right to the bottom of the insulator. He keeps the latter in position with one hand, whilst, with the other, he heaps together the plaster and presses it round the ironwork by means of a specially bent round wire tool.

This tool may easily be made from a long piece of brass wire having a ring at one end, and turned into a semi-circle at the other end. The hook thus formed is then bent at right angles to the stem.

When the sealing operation is completed, the insulator should be placed on a drying board, where it should be left for about an hour in order to give the plaster time to set. At the end of this time the pieces may be baked, but care must be taken. At the end of a day or two they may be put into position.

The method of mixing, which has been described above, is excellent for the fixing of iron work, but it should not be employed if it is a question of joining the different pieces (skirts) of the insulator.

It should further be noted that, until such time as the sealed parts are perfectly hard and dry, there would be considerable danger in exposing them to a temperature below zero.

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TRANSFORMER STATIONS AND THEIR APPARATUS.

Current Practice Reviewed—Alternative Arrangements of Apparatus—Wood Pole, Steel Structural and Kiosk Type Stations.

By THEODORE RICH, A.M.I.E.E.

THE supply of electricity over extensive rural areas from overhead lines has led to the development of special arrangements and apparatus for those points at which the current is stepped down. Across the Atlantic, a system of 2 200 V high tension, 60 periods, with lamps about 115 V was developed at the end of the last century. Single phase transformers hooked on to cross arms with plug fuses were largely used. The combination of a low primary and low secondary voltage tended towards the limitation of the higher voltage distribution radius, and the multiplication of intermediate voltage distribution points resulted in excessive light load losses through the large number of small transformers required.

At home, until comparatively recently, overhead line supplies were, to a material extent, limited to areas in which there was an appreciable amount of industrial load, so that the " traffic " could often bear the capital charges required by expensive apparatus.

On the Continent, as in America, it was realised that the apparatus used to supply rural areas must be of the simplest and cheapest character possible consistent with safety; section links and porcelain tubular fuses being used largely in France and Italy at transformer stations.

At first, a large amount of work was done at 3 000 V; the pressure crept up, and now a great deal of village supply work is done at 10 000 to 15 000 V, the greater capacity and elasticity of the higher group of voltages very much more than covering the small increased cost in transformers and accessories.

In Great Britain, development has been taking place on somewhat similar lines. Voltages have been rising, and simple accessories have been coming more into vogue, and makers of appliances are realising that it is capital outlay and not wholesale current costs that tends to limit progress. There is some danger that supplies from colossal power stations over expensive grid lines may lead to a demand by the Central Board for the installation of expensive protective apparatus, not merely at the grid tapping stations, but also at final step-down points. Although the presence of a large primary driving force must have some effect, where intermediate lines are also overhead, there is material protection through line reactance, and that of transformers.

Some people have been heard to say that a great deal of the rural distribution work abroad is carried out by cross country h.t. lines solidly linked in at both ends; but this is comparatively rarely the case. The tree system is still very usual, and the existence of a line on a map between two feeding points does not necessarily mean the feeding of a line from both ends simultaneously to the same intermediate points. As a rule, such lines are sectionalised by isolating links or aerial switches to suit operating conditions. Directly one starts feeding a line from both ends, differential relays, elaborate switchgear, with operators at least within call, and so on, have to be considered, and costs begin to pile up. The use of 220/250 V to earth instead of 110–125 V, as employed in many countries, naturally widens the areas of supply from any given step-down point, and it makes for larger transformers which, in turn tend to justify more expensive apparatus; the larger radius usually means a better diversity factor, and a reduction in light load losses.

In the U.S.A., owing to a parentage of the single-phase system, and the cramping influence of the two big trusts, single-phase

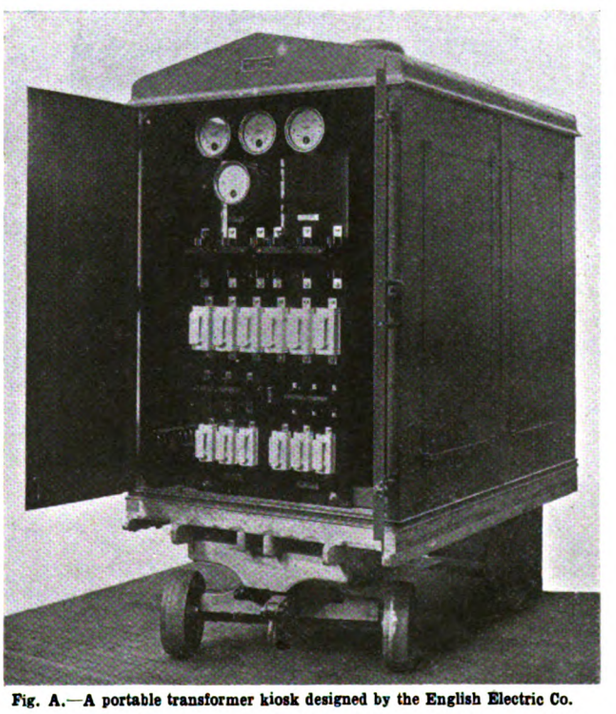
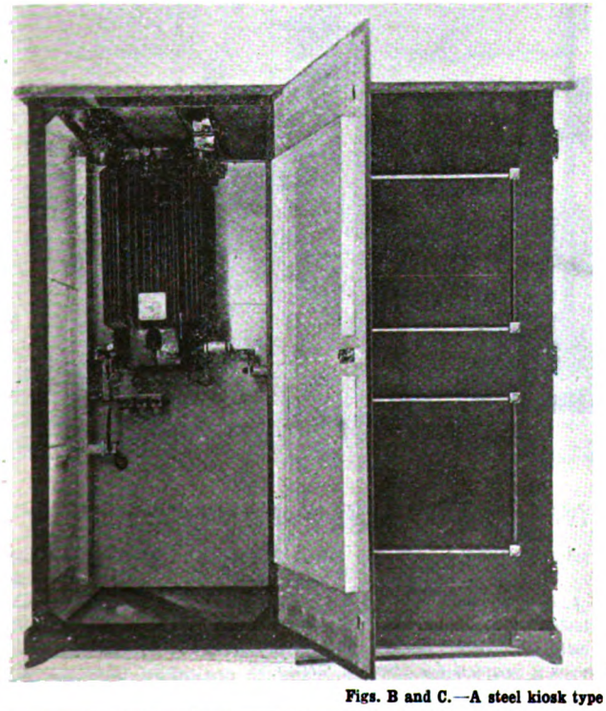
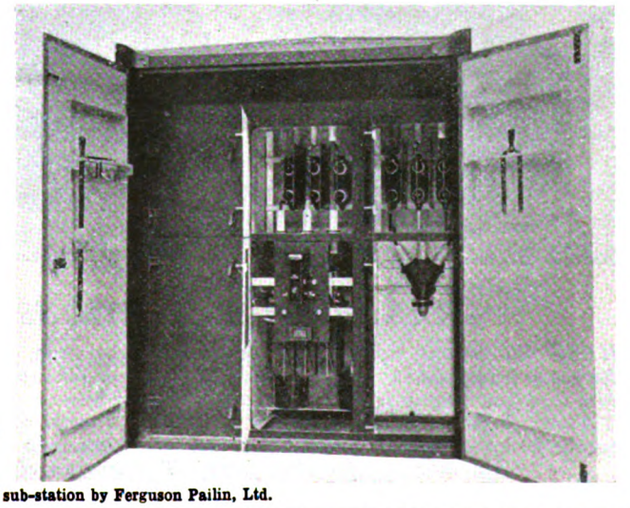


Fig. A.—A portable transformer kiosk designed by the English Electric Co.





Figs. B and C.—A steel kiosk type of sub-station by Ferguson Pailin, Ltd.

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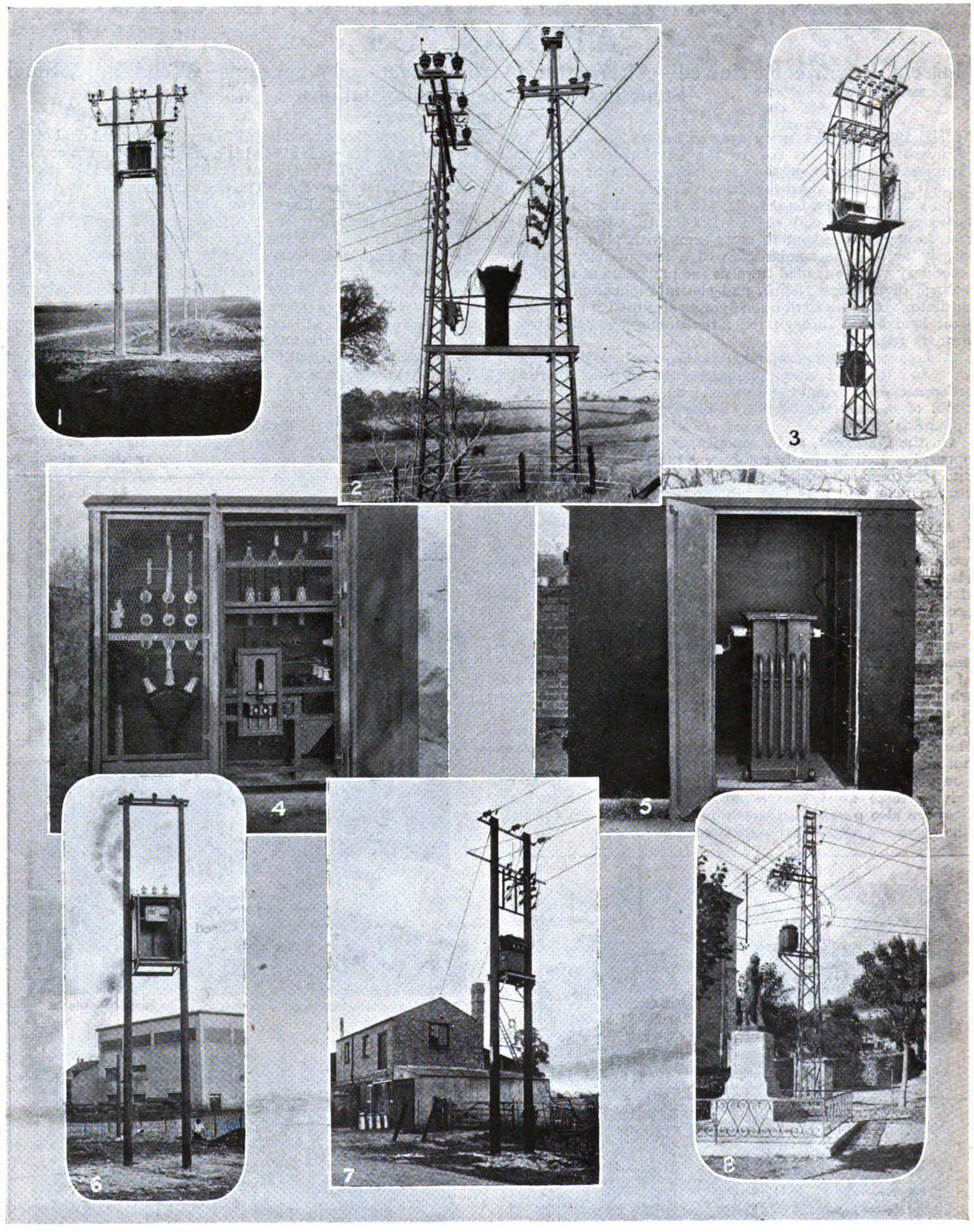

TRANSFORMER STATIONS AND THEIR APPARATUS.

THESE illustrations, referred to in the article on pages 103, 105 *and* 106, *show* :—(1) *A French pole transformer station suitable for heavy transformers* ; (2) *a British arrangement for supporting transformers between lattice steel posts* ; (3) *a French design in which the l.t. switchgear is housed in a steel cupboard below* ; (4) *a "J. and P." steel kiosk for* 11 000 *V* ; (5) *steel kiosk showing* 50 *kVA transformer* ; (6) *a transformer enclosed in a metal cabin, with a platform on either side* ; (7) *a transformer station at the anchor terminal of a* 11 000 *V line* ; *and* (8) *a station in the South of France arranged with a horn switch, kicking coils and porcelain fuses. The structure also carries a bracket for street lighting.*

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transformers were largely used, to a great extent in open delta or delta on the three-phase side, the existence of three-phase transformers being practically ignored for many years for commercial reasons. On the Continent, the first long distance experimental transmission from Lauffen to Frankfort, was made with three-core, three-phase transformers, and, apart from single-phase lines, three-phase transformers are the rule, there being many transformers of about 10 kVA on 15 000 V, 50 period lines.

At home, Continental practice has been followed in the use of three-phase transformers, mainly of the core type, the shell type never having been really popular outside America. In order to bring out the neutral point for lighting, a star winding on the l.t. side is usual, a delta on the h.t. side of the step-down transformer being more desirable from the point of view of higher harmonics than a star.

Choice of Types.

When a transformer is attached to an overhead line, the latter must have an anchor terminal or fixed through point at about 20 ft. from the ground, and connection must then be made to the transformer windings, either through end bells and a length of cable, which, according to some authorities, provides a certain measure of protection against lightning and other surges, through outdoor type pass-through

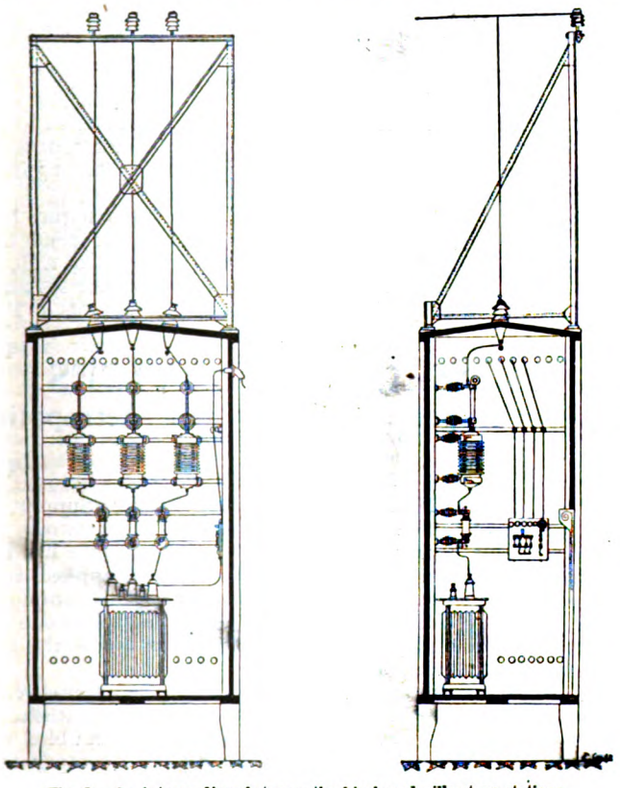

Fig. 9.—An intermediary between the kiosk and pillar type stations.

insulators on the cover of the transformer tank, or by means of individual leads passing through side glands, any protective apparatus being placed between the line and transformer terminals.

There are several ways in which the apparatus at a step-down point can be arranged :—

(I.) The transformer can be supported on posts or on an angle-steel structure well out of reach of the public, with the transformer tank either in the open or inside a protecting cabin of some kind.

(II.) The transformer can be placed on or near the ground : (*a*) In a fenced enclosure with metal-clad apparatus and three-core cable connections to the overhead line, or with the h.t. connections on the top of the transformer tank specially guarded with grid work ; (*b*) in a low brick, masonry, concrete or composite building, the connections being brought down from above by means of an armoured cable or a vertical protective trunk of some kind ; (*c*) in a kiosk of metal or concrete, usually with cable connections ; (*d*) in a cabin, with a chimney-like structure above it, which acts as an anchor terminal for the incoming h.t. and outgoing l.t. mains ; (*e*) an enclosed structure of brickwork, masonry, or concrete, tall enough for the h.t. line to be looped in direct through a side or end wall.

In America, owing to the difficulty of getting bricklayers in country districts, and to the influence of the old 2 200 V system, outdoor sub-stations are the rule ; some of them look very untidy, although great improvements are now being made in this respect.

On the Continent, however, permanent structures are very largely used as step-down points.

In England, as all forms of building work are exceedingly expensive, transformers on wood posts are very fashionable.

In America it is the usual practice to hook transformers on to the cross arms of stout poles, and to connect up to 2 200 or 4 000 V h.t. mains by means of fuses, frequently of the plug type. Stout wood posts are comparatively easy to get in that country, and at such a low pressure, simple outlet bushings with insulated tails looped up to the h.t. line are sufficient.

Outside America — except in Japan, which has followed American practice — the hook supported transformer has never been very popular ; distribution voltages have been higher, stout timber expensive, therefore the tendency has been to use a more solid support. So the practice has grown up of using two poles—in some Dominions areas three—with wood or steel cross bearers, often on a sort of platform between the posts. The high tension apparatus is placed, in many cases, above the platform level at a height convenient for the incoming conductors, the loops into the transformer being placed at the back, so as to be more out of reach of anyone standing on the platform. Owing to the larger normal distributing radius, and the fact that thinly populated areas have hardly been touched at home, larger transformers are placed on elevated platforms at home than abroad, where in some places those elevated do not exceed 10 to 15 kVA.

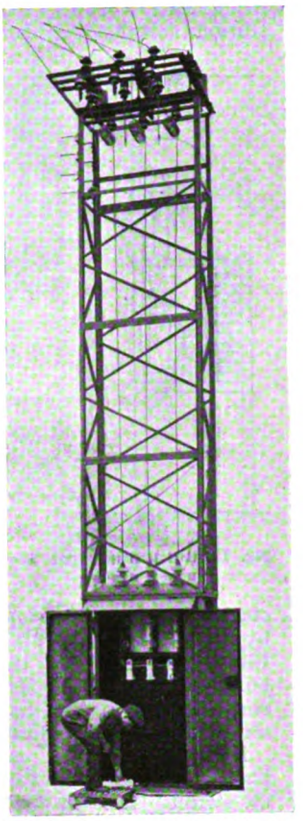

Fig. 10.—A construction in which the transformer is placed in a steel chamber inside an angle-iron structure.

By using angle or channel cross-bars for the support of apparatus a convenient point becomes available, on to which to hang the tackle for raising the transformer into place. With a pole type transformer the ground space is small, but it is awkward if anything does go wrong in bad weather. Twin-pole stations have been used to a material extent in New Zealand, France, Scandinavia, Switzerland, Germany, and have been used recently in North Wales and elsewhere.

Fig. 7 (page 104) shows a transformer station at the anchor terminal of an 11 000 V line. Connection is made above through a vertical horn-break switch and tubular fuses and porcelain end bells on the back of the transformer. The

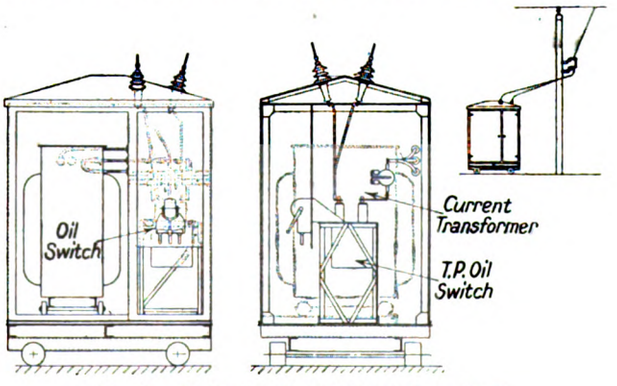

Fig. 11.—The l.t. side of a portable transformer kiosk.

four overhead l.t. leads are for 230/400 V. This station was equipped by Messrs. Johnson and Phillips.

A modified wood pole type station is to be seen in Fig. 12. The transformer in this case is protected by an oil-filled

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safety switch fuse, the down coming h.t. leads to the transformer cover on the sub-platform being shielded by a netting. This is a design of the English Electric Co.

In order to make a support of more permanent character than can be done with wood poles, armoured concrete is being used somewhat extensively abroad. Fig. 1 shows a station suitable for heavy transformers designed by the Société Parisienne pour L'Industrie de Chemins de Fer. It is fitted with surge dischargers and switch fuses operated from the ground level. A ring of spikes is placed round each post to deter the adventurous small boy.

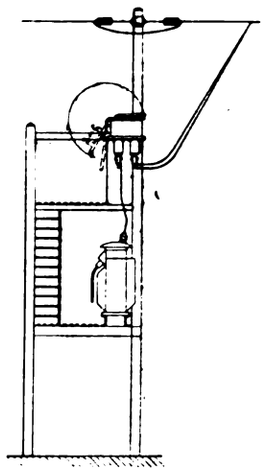

Fig. 12.—A modified wood pole type station.

When transformers are large, one arrangement is to make up a platform between two lattice steel posts. Fig. 2 shows such a station connected to a 33 000 V line used to supply the town of Lydney and also a farm; as will be seen it is a tapping off a through line at an angle. The h.t. line is tapped above. It passes through the horn break switch on the left, and then to the fuses on the right with vertical pass-through type inlet insulators on the transformer. This station was equipped by Messrs. Ferranti, Ltd.

On the Continent a type of station has been developed with the transformer supported by an angle structure taking up but a small ground space. Fig. 8 is a station in the South of France arranged with a horn switch, kicking coils and porcelain fuses, the same structure carrying a bracket for street lighting; this was constructed by Messrs. Merlin and Guérin, of Grenoble,

Fig. 3 is a station on a very small base. A substantial platform with hand rail and manhole is provided. The l.t. switchgear is in the steel cupboard below; it contains a four-pole switch with fuses, meter and earthing device.

One arrangement which has its advantages is to place the transformer in a little metal cabin above the ground and provide a platform on each side, one side for the h.t. and the other for the l.t. Fig 6 shows one of these cabins during erection. These two stations were designed by Messrs. Grammont, of Paris.

The Kiosk Type Station.

Where the potential load justifies the expense, the kiosk type of sub-station is very convenient. The leads are brought down from the overhead line in cable and led into the kiosk, which can contain links, and an oil switch. Fig. 4 shows a steel kiosk by Johnson and Phillips for 11 000 V. The station in question has two sets of h.t. terminals with change-over links. The switchgear compartment is fitted with an inner door filled in with expanded metal. Fig. 5 is the transformer. The bottom angle iron can be removed to allow the transformer to be wheeled in and out. The space is sufficient for a transformer of 150 kVA. Figs. B. and C (page 103) show a somewhat similar kiosk made by Messrs. Ferguson, Pailin, Ltd.

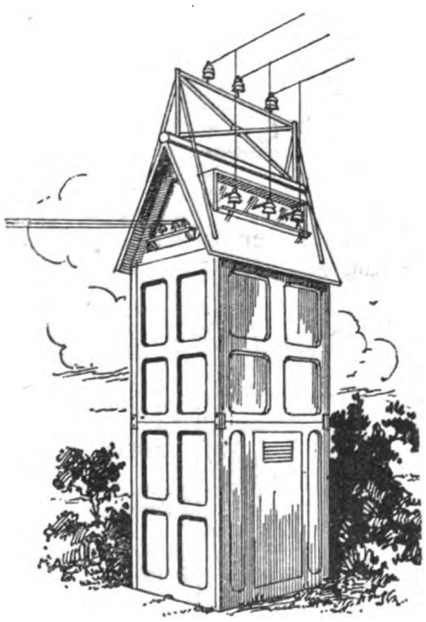

Fig. 13.—A construction of pre-cast concrete slabs.

Due very largely to the fact that in early days the three-phase system was in the hands of undertakings controlled from abroad, it is only of recent years that contractors, cement makers, quarry owners and brickmakers at home have begun to realise the extraordinary elasticity of three-phase current for the purpose of supplying power at short notice with the aid of light h.t. conductors, and therefore it was only recently that electrical manufacturers were called upon to supply h.t. appliances suitable for such work. Fig. A (page 103) shows a portable transformer kiosk used for brickmaking and similar work, designed by the English Electric Co., suitable for driving large motors. It is arranged for a 100 kVA transformer and oil circuit breaker. The l.t. side of a kiosk of very similar type is shown in Fig. 11. This type of portable station is made by the English Electric Co.

An interesting form of station which might be termed an intermediary between a kiosk and a pillar station can be seen in Fig. 9, of a type developed by Messrs. Soulé, of Bagnères-de-Bigorre, in the Pyrenees. It is built up of light armoured concrete slabs with angle iron corner pieces. The station shown has Ledoux shunted self-induction coils, a roller shutter is arranged in front, and the floor is kept well up so that the transformer can be easily got out of a lorry. They have been arranged also with aerial disconnecting switch interlocked with the shutter, so that access cannot be obtained while the transformer is alive. The smallest size of this general type is made about 5 ft. square inside and in larger sizes they are used for pressures up to 30 000 V.

Fig. 13 is a station built up like a telephone kiosk out of pre-cast concrete slabs. It is made by the Société de Fabrication d'Appareils en Ciment Armé, of Angers.

A type of station that has some vogue abroad is one in which the transformer is placed in a steel chamber inside a tall angle iron structure, which reaches to a height sufficient to take in the h.t. mains and let out those of l.t. at a sufficient height from the ground. The h.t. leads are guarded by boxing in the framework with netting. Fig. 10 shows one of these, 23 ft. 6 in. high, with a base 4 ft. 3 in., by 2 ft. 3 in., the structure being made up of 2·4 by 2·4 angles. The cabin is independent of the frame, so that the latter can take the strain of a double pull at the top, without any tendency to throw stresses on the cabin itself. This type is made by Messrs. Grammont, of Paris.

PROTECTIVE DEVICES.

Recent Experiences on North Metropolitan Co.'s Network.

By "OUTSIDE SUPERINTENDENT."

THE North Metropolitan Electric Power Supply Co. operate an extensive 33 kV overhead line network, and during the past year considerable useful experience has been gained in relation to the protective circuits applied to it. Pilot wire discriminative protective devices are employed, and the pilot cable consists of multi-cored telephone and protective circuits on a catenary suspension below the main transmission conductors.

The system originally installed was of the opposed e.m.f. type with bias restraint, which was not completely satisfactory on feeders above five miles in length. The troubles were mainly due to insufficient pilot wire capacity compensation in the protective circuit, and induced voltages in the pilot cables by earth faults. This type of system has since been superseded by one of the circulating current variety, and, up to the present, it has given satisfaction for the few months that it has been in service. It is an improvement upon the closed core opposed e.m.f. type as it avoids saturation of the current transformers, and possesses efficient means of pilot wire capacity compensation.

It has also been proved that pilot wire systems should not be earthed, otherwise instability will result, due to the induced voltages and unbalanced capacity effects. Experience has also shown that the insulation resistance of the pilot cables and protective circuits must be carefully watched to prevent them becoming earthed, for reasons mentioned above.

The problem of induced voltages, especially with overhead line systems, requires investigation, mainly to avoid the pilot and telephone circuits being subjected to excessive pressures. The pilot lead and screens in the overhead portion of the network carry considerable earth return currents, and the pilot wires in consequence are subjected to induced voltage rises.

Fault conditions on overhead lines are in almost every case initially to earth, but they are frequently accompanied by a concurrent fault on another phase at some point of the network. These conditions are probably aggravated by methods of earthing, and with an extended network multiple earthing

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seems to be essential, in any case to avoid a portion of the network being isolated from an earthed point.

During the gales on November 19th last, a large quantity of straw blew across one line, causing a phase to phase fault. This condition operated the overload protection at another point in the network, which was set with an inverse time lag varying from 4 seconds down to 1 second.

The section on which the straw had accumulated was protected by a pilot wire discriminating system of the circulating current type, which, however, did not operate. The apparent explanation is that the straw formed a high resistance fault, which did not pass sufficient current to operate the pilot wire relays, which required 300–500 A to operate.

High phase fault settings are objectionable, especially in outlying districts remote from the generating point. The probability of high resistance faults and the operation of the overload devices before the discriminating devices endangers continuity of supply.

BIRD GUARDING.

Some Methods for Eliminating Interruptions.

IT is strange that in the British Isles we seem to have more trouble than most other countries with regard to short circuits due to birds. It may be that in democratic France, where gun licences cost so much less than with us, sportsmen of sorts go about and blaze at all and sundry on the wing. It may be that our game preservation tends to encourage the multiplication of birds, and indirectly enables nightingales to send their warbles over the wireless. Possibly the native birds are as slow as some other bipeds at home at learning about what is not good for them. We do not have the problems that beset some engineers in the tropics when they find an industrious pelican starting to make a nest on the top of a steel lattice post; but all the same, in no country in the world has the bird problem brought so many devices and methods into being. There is some evidence that in the same way that horses cease to shy at motor-cars and dogs "gang warily" across the road, even brother crow is beginning to realise that a high tension line is not the most desirable perch on which to feed a fledgling.

In one way it seems illogical to provide a sort of "comfy" armchair for a bird in the form of a cross-arm, and then put on it the equivalent of a piece of barbed wire in the form of a spiked insulator to keep him away.

The greatest difficulty lies at the line support, although in

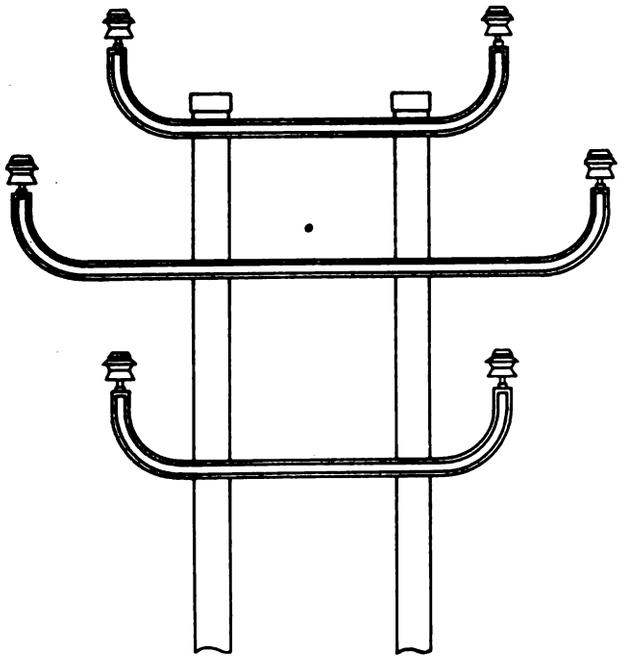

Fig. 1.—A type of support specially made to eliminate bird troubles.

some cases extra spacing and special arrangements of double circuits have been adopted to minimise trouble between the posts.

One device is to arrange the insulator brackets in such a way that no attractive seat is provided; another to put an insulating sleeve over a short length of the conductor with a cap over the insulator top; a third is to put an insulating sleeve over the metal cross-arm; and a fourth to make the cross-arm itself of insulating material.

Birds like a comparatively level place when they sit down

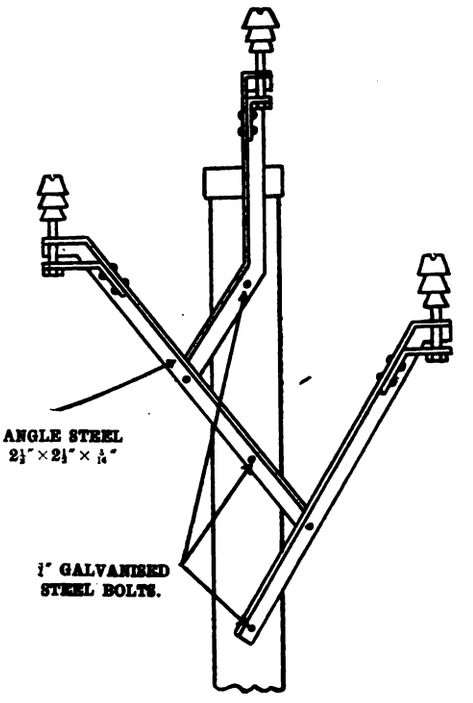

Fig. 2.—A modified herring-bone system which does not prove attractive to birds.

upon their haunches, so that if the supporting arm is at a steep angle until well clear, they will cogitate on mundane affairs elsewhere.

Fig. 1 shows an arrangement of two circuits, the brackets being of channel steel. The arrangement was of a design used by Messrs. Johnson and Phillips for a Scotch colliery company for 22 000 V, with 300 ft. spans. Fig. 2 is a modified herring-bone system of supports which affords no enticement for birds. This is being used for 11 000 V around Basingstoke by Mr. Swarbrick, and in the North Metropolitan Co.'s area.

Regarding the second arrangement, the Key Conduit Co. has had on the market for some time a simple guard composed of a split tube of insulating fibre which can be put on to the arm inside the insulator pin. Bakelised wood is now being tried out on the Continent for cross-arms.

SETTING POLES WITH DYNAMITE.

Details of an Unusual Method Developed by Florida Power Co.

DYNAMITE seems an unusual and a somewhat alarming agent for use in the erection of pole lines, but the following account of a method developed by the Florida Power and Light Co., after experience in building over 1 000 miles of wood pole transmission lines shows that the explosive method has its uses.

It is pointed out at the outset that, though the method is applicable to conditions ranging from nearly dry soil to wet, swampy land, some practice is required before the attainment of encouraging results, particularly if long, heavy poles are used.

For pole sites on swamp land a 1½ in. pipe is worked into the ground by employing a ½ in. rod for a plunger inside the pipe. With this agitation at the point of piercing, the pipe is easily pushed downward by the weight of two men applied on "Stilson" wrenches at opposite sides of the pipe. The pipe is forced to a depth representing the depth desired to set the pole, the plunger rod removed, and several sticks of dynamite dropped into the pipe and pushed to the bottom.

Sometimes when there seems to be danger of the pipe clogging with earth when driven, a blasting point is used.

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This is nothing more than an 8 in. length of 1½ in. pipe flattened out wedge shape on one end and coupled to the drill pipe, thereby allowing the pipe to be driven with mauls. In this case after the dynamite had been inserted, the drill pipe may be unscrewed from the blasting point. It is evident that with this scheme a new point is required for each shot. The drill pipe is lifted out while the charge is held in position by a stick or wooden rod, and is ready for the pole, which is set directly over the dynamite.

When the blast occurs, the pole quivers and hesitates a moment, then slides into a hollow cylinder formed in the ground by the force of the expanding explosive gases.

The weight of the pole at the instant of fire tends to prevent an upward thrust, and what little ground disturbance takes place is seen around the pole. There is no sharp report, but rather a dull thud. As the pole slides into place, gases from the shot leak out between the soil and the circumference of the pole. This pressure would indicate that the confined gases tend to retain the pocket walls awaiting the pole.

No advice can be given as to quantity of dynamite to be used. This is something to be worked out by each individual foreman. With practice a man can make a close estimate of required powder for a certain depth under certain soil conditions. Variations in depths and soil conditions make dynamite requirements vary from three to twenty sticks.

A great upheaval of soil about the pole indicates an overcharge. Likewise, when a pole neither punctures the earth's surface nor goes to the required depth, an insufficient amount of dynamite has been used. To correct a "jam" the drill pipe must be worked at an angle to a point under the butt of the half set pole, and a fresh charge inserted. When exploded this will, as a rule, send the pole to the required depth.

MECHANICAL · CONSTRUCTION.

Fig. 1.

A BRACKET construction made up of galvanised strip, braced from below, with guards by Crompton-Parkinson, is shown in Fig. 1. It is used in North Wales.

A type of insulator steel spindle and saddle used for round-top wooden cross-arms by the Ohio Brass Co. is shown in Fig. 2.

Various arrangements of conductors are to be seen in Fig. 3. Figs a, b, c and d show triangular arrangements which are convenient for balancing purposes. Figs. a and b are convenient from the points of view of minimum pole heights. Fig. b is a herring-bone pattern, which is getting popular in America. Fig. c is a cheap swan-neck bracket used in France and Germany. Fig. d has a support for an earth wire above the other conductors. Fig. e is an unbalanced arrangement sometimes used for roadside lines abroad, the insulators being easily visible to a linesman on patrol.

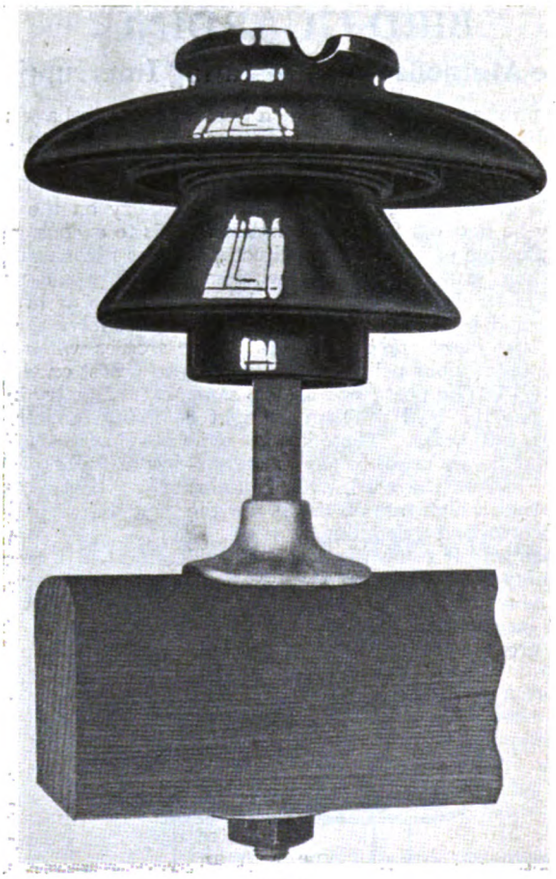

Fig. 2.

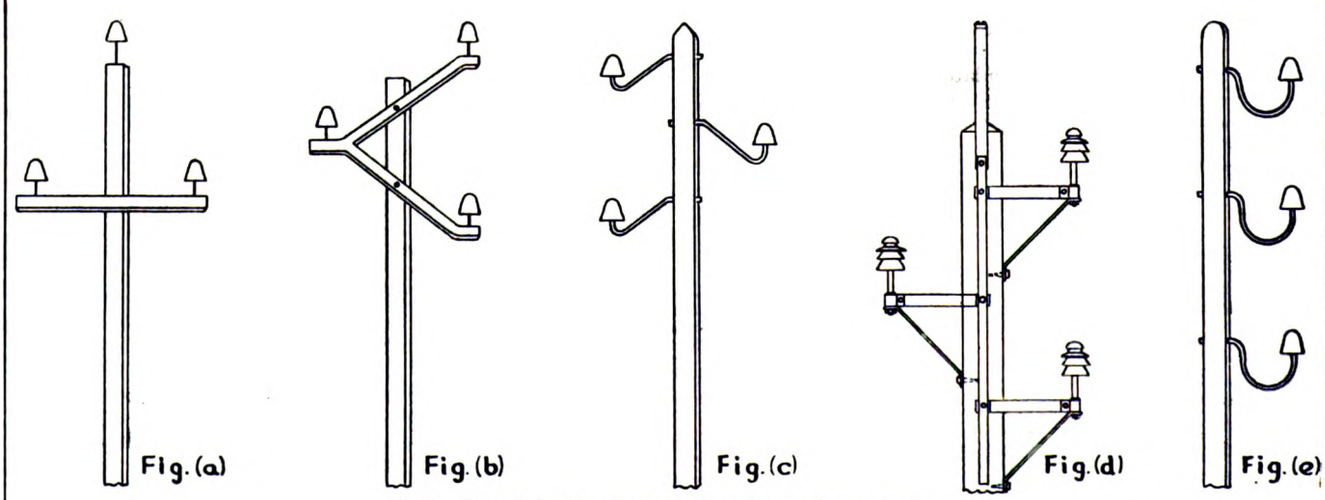

Fig. 3.—Illustrating different methods of arranging a three-phase line.

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SUSPENSION INSULATORS FOR H.T. TRANSMISSION LINES.

Overcoming Difficulties Due to Expansion of Cement—The "Spring Ring" Insulator—Increasing Tensile Strength—Employment of Steatite—New Insulators for Special Purposes.

By C. S. GARLAND, A.R.C.S., B.Sc., M.I.Chem.E.

WHILE the old pin-type insulator was satisfactory up to 40 000 or 50 000 V, at higher tensions the size of the insulator itself became unwieldy, and a margin of safety had to be accepted which was not regarded as sufficient protection at these higher voltages.

These difficulties gave rise to the development of the suspension insulator, the first of which was made in America by Hewlett about the year 1907. This type of insulator is still used to a limited extent in America, and to some extent also in England. As a consequence of its difficulty of manufacture, the insulator was costly, and, unless made with very great care, unreliable, and for these reasons the Hewlett has been gradually replaced by the cap and pin insulator.

The cap and pin insulator offers the great advantages, electrically and mechanically, that it is symmetrical, it has a long creepage distance between the two metallic parts, and offers a quick and easy method of assembling the units together, while at the same time allowing them a sufficient freedom of movement in relation to one another under working conditions. The circular symmetrical form also makes for simplicity and certainty in the methods of manufacture, and while maintaining a high puncture voltage, it has been found

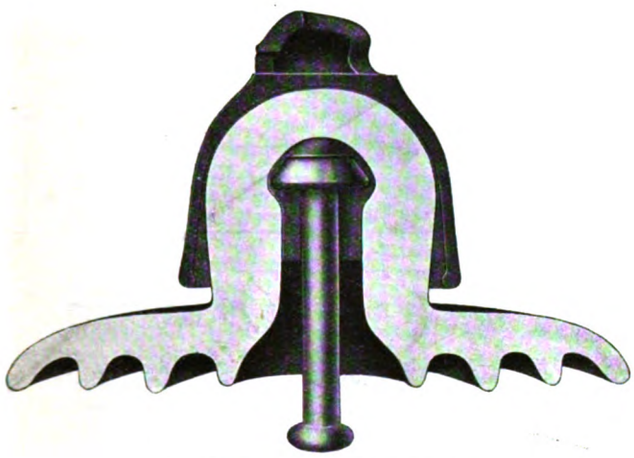

Fig. 1.—"V" ring insulator.

possible to increase the mechanical strength of the insulator and of its fittings, to an almost unlimited extent, so that, at present, insulators of this type with an ultimate breaking strength of 20 tons are regular articles of manufacture.

The caps are made of cast steel or malleable iron, and are cemented on to the head of the insulator by Portland cement. The unavoidable expansion of the cement used in this position is taken up by the elasticity of the cap, and holds the porcelain head of the insulator under ever-increasing compression, so that the longer the life of the insulator the more strongly is its cap held fixed to the porcelain body.

In the early insulators cement was also used for fastening the pin into the hollow head of the insulator, but in this position the expansion of the Portland cement is a very objectionable feature, as it acts in a direction entirely opposite to that between the cap and the outside of the insulator, and tends to burst the insulator.

The inevitable expansion of the cement, as the subtle chemical changes take place over several years, has a disruptive effect on the insulator, and many records of the failure of high tension transmission lines can be traced to the setting up, in the course of from one to five years, of fine cracks in the porcelain by this expansion, forming ultimately a leakage path for the current, and puncture of the insulator.

It is undeniable that satisfactory cemented insulators have been manufactured, and have lasted for several years, but the nature of this material made it impossible to guarantee that reliability which the importance of the service rendered by the high power lines demanded, and there was created an urgent demand for some means of fixing the pin, which would be certain and secure, and would not depend upon the skill and care with which the cement was selected, mixed and applied.

The first successful effort to overcome these difficulties was the very ingenious ball-headed insulator produced by Mr.

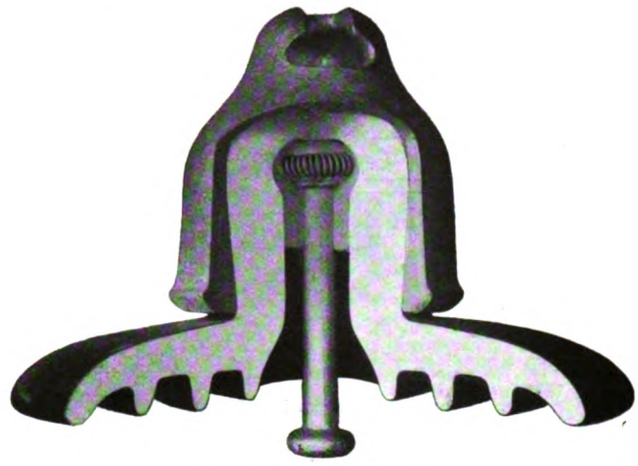

Fig. 2.—Spring ring insulator.

Scheid of the Hermsdorf-Schomburg Co., in which an already fired porcelain sphere, from which a sector had been cut and through which a hole the size of the pin had been bored at right angles to the flat surface thus created, was placed in the hollow head of the insulator before firing. The size of the sphere and the size of the hollow head were so calculated that when the insulator was fired there was just freedom for the sphere to be rotated in the hollow spherical space. For assembly, the flat surface was brought to the bottom position, when a nut and washer were placed upon it, and these then rotated with the sphere to the top of the hollow space. The pin, which carried a screw thread, was then passed through the hole in the sphere and screwed into the nut. The small spaces between the sphere and the pin, and the sphere and the insulator, were then filled with a lead alloy.

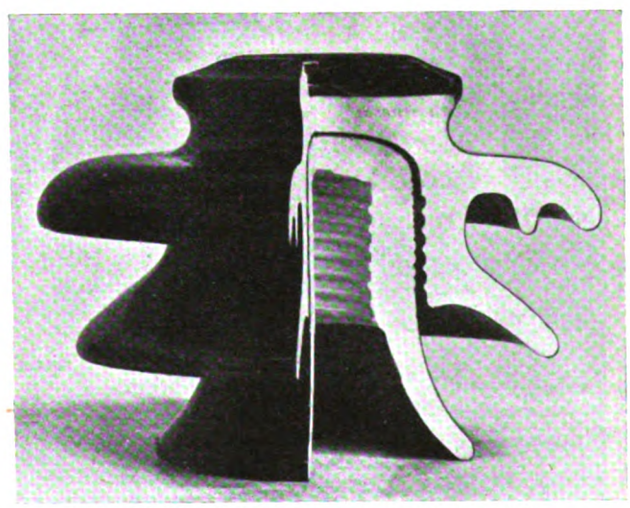

Fig. 3.—A "Motor" insulator, cut away to show construction.

This type was superseded by a method of fixing the pin by which a copper ring was put with the pin into the cavity in the insulator head, which was made slightly conical in form, and the copper ring then pressed out by means of a hydraulic press to a "V" shape, from which the insulator (Fig. 1) takes its name, so that the pin and ring could no longer be drawn out from the insulator. This converted the tensile stress of the pin into a pressure stress in the porcelain.

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On account of its greater ease of manufacture and consequent lower cost, this was preferred to the ball top insulator, particularly as it gave higher mechanical and electro-mechanical strengths, and some millions of these insulators are in use on the Continent.

The latest development in this direction is the so-called spring ring insulator (Fig. 2) which secures a still higher

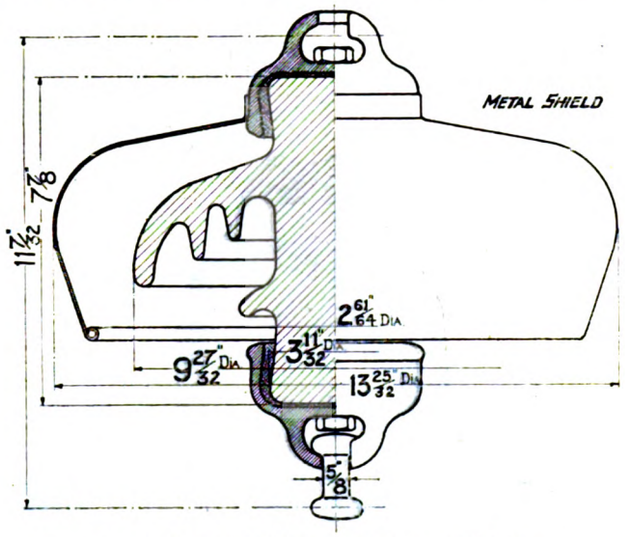

Fig. 4.—A metal shielded insulator for use in Palestine.

mechanical strength and more uniform distribution of pressure over the space in the insulator. A flexible spiral spring, made of strong steel wire of high tensile strength, is forced into the spherical space at the head of the insulator after the pin. The spring ring is able to contract in order to pass the narrow neck of the hollow in the insulator, but after expansion into the upper chamber it can no longer be withdrawn. The spring is secured in place by means of a serrated collar and special pin, and, in order to protect the assembly from the weather,

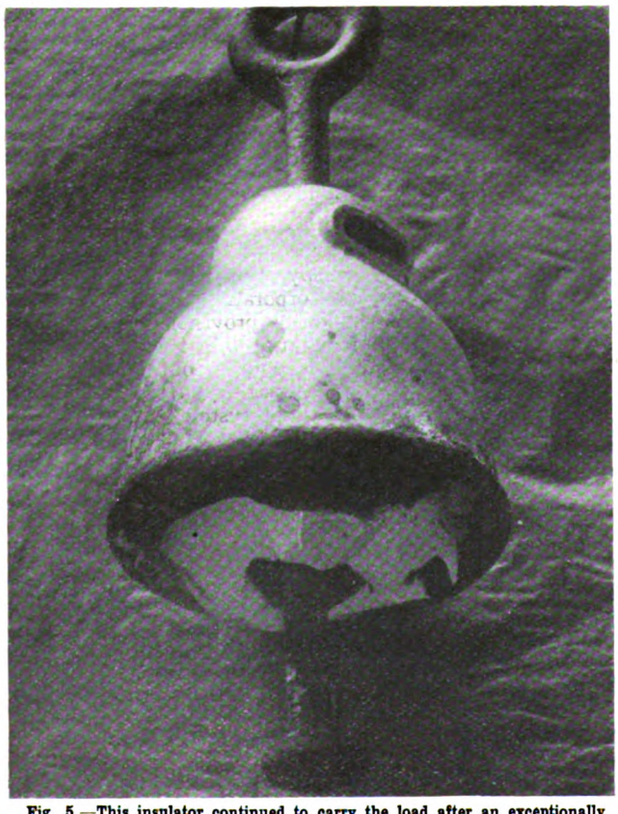

Fig. 5.—This insulator continued to carry the load after an exceptionally heavy lightning stroke.

and further to prevent any relative movement, the space is filled with a special lead alloy. This lead alloy does not increase to any substantial extent the mechanical strength of the insulator, but it does assist in the even distribution of the pressure over the porcelain surface. The construction is such that the line cannot fall unless the whole of the porcelain inside the cap is broken away, a contingency which cannot occur in service. Fig. 5 shows an insulator which, after an exceptionally heavy lightning stroke, continued to carry the load until a convenient opportunity for replacement was available.

This method of fixing the pin has admitted of the manufacture of insulators of a very much higher mechanical strength than had been hitherto possible, and has promoted economy in high tension transmission, by giving a sufficient mechanical strength to admit of the use of single strings only for the many tension points which are necessary when lines have to be carried over a thickly populated country, and where, hitherto, double or even treble parallel strings of suspension insulators have been required. The unit seen in Fig. 6, which is the standard for 220 kV transmission lines, has a mechanical strength of 18 to 20 tons.

In parallel with this development of the now standard cap and pin insulator, the basis of the successful use of which was the employment of porcelain in compression, an extensive series of researches was carried out, with the object of so increasing the tensile strength of the porcelain body itself as to admit of its being used in tension, so that much greater thicknesses of porcelain could be imposed between the metal parts of the insulator units. In the course of this it was discovered that certain qualities of Steatite, which is a naturally occurring

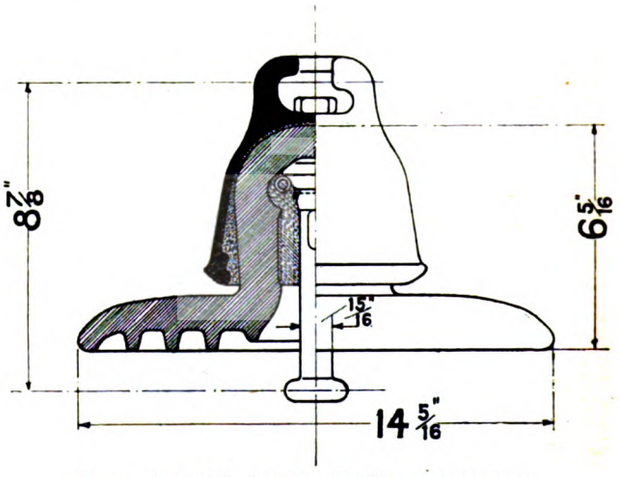

Fig. 6.—An insulator used for 220 kV transmission lines.

magnesium silicate, have electrical resistance properties equal to those of porcelain, and very much higher tensile and bending strengths. The use of this material has rendered possible the production of an insulator which is absolutely puncture-proof under all known voltages, the so-called "Motor" insulator (Fig. 3) named after the company which produced it. This consists of a solid body of Steatite which can carry one or more weather protecting shields, having a long creepage surface, and the tensile strength of which is so great that it can be safely used for wide river crossings in the form shown, the standard method of attachment being by a cap of the same type at both ends of the insulator. These caps are then lined together with ball headed pins in the usual way. Such insulators, owing to their difficulty of manufacture and their construction in a material which is much more expensive than porcelain, only come into consideration in normal high tension transmission lines under exceptional circumstances. Their flashover values are so high that one double shedded insulator will take the place of several normal cap and pin insulators, and the smaller sizes are being extensively used for the electrification of railways in all parts of the world. In these circumstances, where the insulators are much nearer to the ground, their resistance to fracture by stone throwing or shooting is of merit. In a series of tests these "Steatite" insulators were shown to be undamaged when steel bullets from a large bore revolver were fired at them point blank.

An interesting development of insulators for special purposes is shown in Fig. 4 of a metal shielded insulator which has been produced for use in Palestine from Haifa to Jaffa near the shores of the Red Sea, where considerable trouble was anticipated from the combination of salt spray and drying winds. The complete metal shield over the standard "Motor" insulator shown gives full protection against the incrustation of salt on the surface of the insulator itself and avoids the necessity for frequent cleaning.

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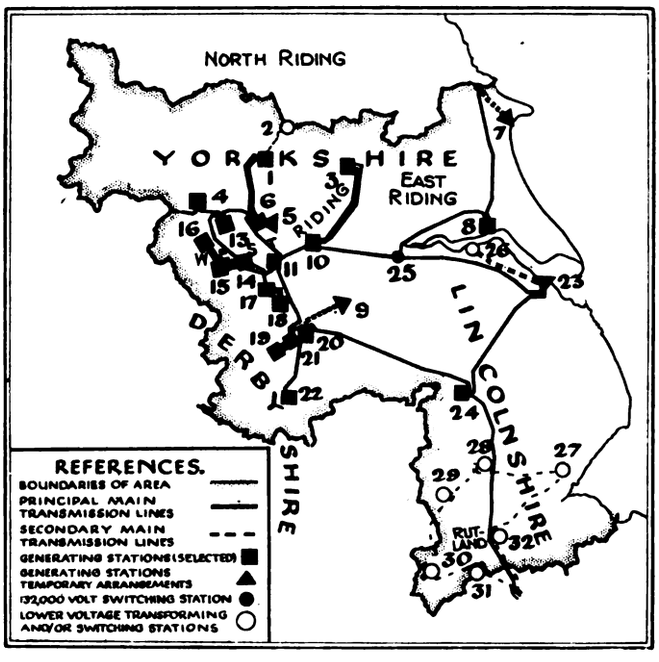
MID-EAST ENGLAND ELECTRICITY SCHEME.

Details of Scheme for Area Embracing Coal, Iron and Steel Industries—Seventy-three Authorised Undertakers Involved—Eighteen Stations Out of Forty to be "Selected."

PARTICULARS of the Mid-East England Electricity Scheme have been submitted to the Central Electricity Board by the Electricity Commissioners, and it is estimated that the scheme if adopted will improve the maximum load in the area from 372 381 kW in 1927-28 to 933 000 kW by the end of 1940-41, or 2·48 times. The area of the scheme is about 7 545 square miles in extent and embraces the whole or part of the area of supply of 73 authorised undertakers, as shown in the accompanying map. The cost of the scheme as estimated by the Commissioners is £2 907 156 in the case of the Central Board, in addition to an expenditure by undertakers of about £1 709 594 on extensions of certain existing stations. It is further estimated that the full advantage of the scheme can be secured with the saving of about £2 149 834 on the capital expenditure (up to the year 1935-36), as compared with the same expenditure that would be necessary if the present system were continued.



Illustrating the Mid-East England Electricity Scheme, the "selected stations" being (1) Harrogate, (3) Foss Islands, (4) Keighley, (6) Kirkstall, (8) Hull, (10) Ferrybridge (11) Wakefield, (13) Valley Road, (14) Thornhill, (15) Huddersfield, (16) Halifax, (17) Barugh, (18) Barnsley, (19) Blackburn Meadows, (20) Prince of Wales, (21) Neepsend, (22) Chesterfield, and (24) Lincoln. The "temporary arrangements," switching and transformer stations, main and secondary transmission lines are indicated, the numbers representing: (2) Boroughbridge, (5) Leeds, (7) Bridlington, (9) Doncaster, (23) Grimsby, (25) Reedness, (26) Barton-upon-Humber, (27) Boston, (28) Sleaford, (29) Grantham, (30) Oakham (31) Peterborough, (32) Stamford.

The Commissioners have determined that 18 stations out of the 40 public generating stations now in operation or under construction in the area shall be selected stations, the names of these being Barnsley (Barnsley Corporation); Barugh, Ferrybridge, Thornhill (Yorkshire Electric Power Co.); Blackburn Meadows, Neepsend (Sheffield Corporation); Chesterfield (Chesterfield Corporation); Foss Islands (York Corporation); Halifax (Halifax Corporation); Harrogate (Harrogate Corporation); Huddersfield (Huddersfield Corporation); Hull (Kingston-upon-Hull Corporation); Keighley (Keighley Corporation); Kirkstall (Leeds Corporation); Lincoln (Lincoln Corporation); Prince of Wales (Rotherham Corporation); Valley Road (Bradford Corporation); and Wakefield (Wakefield Corporation). Certain extensions and alterations will be made to these stations as follows: Blackburn Meadows an additional 25 000 kW of 3-phase 50-cycle generating and equivalent boiler plant for operation by 1935-36, and a further 25 000 kW of 3-phase 50-cycle generating and equivalent boiler plant for operation by 1936-37. In the case of Ferrybridge an addition of 50 000 kW of 3-phase 50-cycle generating and equivalent boiler plant will be made for operation by 1935-36, and a further addition of 50 000 kW of 3-phase 50-cycle generating and equivalent boiler plant for operation by 1938-39. Kirkstall will receive an addition of 50 000 kW of 3-phase 50-cycle generating and equivalent boiler plant for operation by 1937-38, with a further addition of 50 000 kW of similar plant for operation by 1939-40. The Prince of Wales station will take an additional 32 000 kW of 3-phase 50-cycle generating and equivalent boiler plant for operation by 1937-38, and a further addition of 50 000 kW for operation by 1940-41. An addition of 50 000 kW of 3-phase 50-cycle generating and equivalent boiler plant for operation by 1938-39 will be made in the case of Thornhill.

The routes to be taken by the 132 000 V lines are shown in the accompanying map and each line will be capable of transmitting not less than 50 000 kW. The routes to be taken by other lines for operation at voltages between phases not yet determined are also given.

In connection with these lines, transforming stations are to be provided for the purposes of supply to or from the undermentioned places, each such station to comprise transformers having in aggregate a rating in kVA of not less than that specified unless otherwise determined: Barnsley (15 000), Blackburn Meadows (100 000), Chesterfield (10 000), Ferrybridge (120 000), Foss Islands (30 000), Grimsby (20 000), Halifax (15 000), Harrogate (20 000), Huddersfield (15 000), Hull (30 000), Keighley (30 000), Kirkstall (80 000), Lincoln (10 000), Rotherham (Prince of Wales) (60 000), Thornhill (90 000), Valley Road (60 000), Wakefield (20 000). For interconnection between the systems of the Board and those of authorised undertakers, overhead lines for operation at 33 000 V between phases will also be provided, the routes to be followed being shown on the map. In this case also transformer stations are to be provided for the purposes of supply to or from the following places, each such station to comprise transformers having in aggregate a rating in kVA of not less than that specified unless otherwise determined: Barton-on-Humber (600), Boroughbridge (400), Boston (4 000), Bourne (400), Bridlington (4 000), Doncaster (10 000), Grantham (2 000), Oakham (300), Peterborough (8 000), Rotherham (Prince of Wales) (10 000), Sleaford (600), Stamford (1 000).

Those stations falling under the description of "temporary arrangements" are also indicated in the accompanying map.

It is contemplated by the Commissioners that the growing load will be dealt with by allocating so far as possible the base load output to the Ferrybridge, Kirkstall, Thornhill, Blackburn Meadows and Prince of Wales stations, while the scheme also provides for the working of three other stations under temporary arrangements between the Board and the owners, these being the stations at Doncaster, Grimsby, and the Whitehall Road station belonging to Leeds Corporation. It will be noted that the scheme does not make any provision for new selected stations, neither is any generating plant of non-standard frequency in the area. It is pointed out, however, that since in some cases supplies are distributed at a non-standard frequency the alteration of these systems is not essential to the scheme and no financial estimates have been provided in this connection.

It is estimated that by the end of the financial year 1935-36 the capital expended under the scheme, and by the owners of selected stations on construction and extension will be £4 616 750, of which, as explained in the opening paragraph, £2 907 156 will be spent by the Board on transmission lines and transforming stations (including capitalised interest), and £1 709 594 by owners of selected stations on extensions. On the basis of individual development, it is stated, a capital expenditure of £5 406 584 would have been necessary by 1935-36.

By that year a proportion of the existing spare plant in the several generating stations will have been released for revenue-earning purposes, such released plant amounting in all to about 80 000 kW., and representing an actual expenditure of about £1 360 000. These figures thus show how the Commissioners have arrived at their economic conclusions.

Additional advantages will also accrue by reason of reductions in the cost of generation and savings in capital expenditure, which otherwise would have been necessarily incurred on secondary transmission lines by the individual undertakers concerned.

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CORRESPONDENCE.

The Editor welcomes the free expression in these columns of genuine opinion on matters of public interest, although he disclaims responsibility alike for the opinions themselves and the manner of their expression.

"Showroom Radio Demonstrations."

[To the Editor.]

Sir,—The subject of "Showroom Radio Demonstrations" is one of great importance, for probably there is no greater source of harm to the prestige of radio in the world of music than the horrible noises which sometimes pour forth from the doors of cycle-cum-radio dealers.

One cannot help feeling, however, that the circuit suggested by "A Radio Engineer" is far from the ideal for the purpose of supplying "plenty of volume to overcome traffic noise," combined with faithful reproduction, from a moving coil or high-class cone type of speaker.

To begin with, the half-megohm coupling resistance following the first valve is shunted by a condenser, the impedance of which at 5 000 cycles is only about 10 000 Ω. The amplification due to a typical high μ value at that frequency would thus be only about one-tenth of its nominal value, rising to about three-quarters of the full value at the lowest musical frequencies.

Assuming that some form of volume control on the second valve has been omitted for the sake of simplicity, or that detuning is to be relied upon (for otherwise the second high μ valve must be hopelessly overrun by signals of sufficient strength to make the first valve efficient as an anode-bend detector), we have the output of the last valve fed through a condenser of 0·01 microfarad capacity, which will offer an impedance, in series with the speaker, of nearly half a megohm at the lowest frequencies.

Finally, the output from a valve of from 4 000 to 6 000 Ω impedance, biassed presumably with about —9 V on the grid, is hardly calculated to overcome traffic noise.

More suitable values for some of the components would be: C.2, 0·0001 mfd.; C.8, 1·0 mfd.; R1 and R2, 0·25 mΩ; V.3, 2 000 Ω impedance; and 20 Henries would be ample inductance for the output choke.—

I am, etc.,

C. E. Field.

Harrow,
January 18th.

[The circuit suggested by "A Radio Engineer" is obviously one which will give more than the average degree of purity, a condition which is brought about by working each valve at the correct point on its characteristic well below its full efficiency with respect to volume. The views of other readers will be welcomed.—Ed.]

"Fallacies of Load-Factor."

[To the Editor.]

Sir,—I quite agree with Mr. Edward V. Clark that supply engineers in this country think a great deal too much about load-factor, but what astonishes me is that Mr. Clark himself concludes his article with a blessing on bulk supply with a load-factor tariff! Why not sell bulk supply as bulk on a flat rate, or graded for quantity, or by time controlled-meters?

In his observations on company and municipal practice, Mr. Clark does not appear to be aware of the large and growing custom of selling electricity on the rateable value tariff, which has nothing whatever to do with load-factor. This tariff was devised by a municipal engineer and is more extensively used by municipalities than companies.

Experience shows that this form of tariff produces sound financial results, and the explanation appears to be partly on account of improved load-factor, which is left to take care of itself, but more probably due to the increased consumption per consumer, which reduces the consumers' charge per kWh sold, and the charges per mile of distributing main per kWh sold. If the peak load is increased, the new kW of plant is obtained at a lower rate, owing to larger plant, which also tends to improve the fuel consumption.

It is becoming more and more apparent that the factor of size in consumption, per consumer, tends to a more rapid decrease in the cost of supply than the small increase in load-factor that efforts in this direction are likely to produce.

I agree with Mr. Clark that proposals to supply hot water on a large scale are not worth the candle, and I think that it will be found that most municipal engineers prefer to use a coke stove for this purpose for their own personal requirements.

The question of load-factor has been discussed in greater detail in a series of articles and correspondence under the heading of "Electricity Supply and the Consumer" in issues of The Electrician dated February 26th, 1926, April 16th, 1926, October 22nd, 1926, August 19th, 1927, November 11th, 1927, and April 6th and 13th, 1928.—I am, etc.,

J. Rutherford Blaikie.

29, Stanley Street, Bedford.
January 21st.

[A further interesting letter on this subject is unavoidably held over.—Ed.]

Contractors and Registration.

[To The Editor.]

Sir,—Study of the position with regard to the registration of contractors, and the suggestions which have been made in various quarters that immediate attempts should be made to secure compulsory registration, leads the writer to agree with most of the remarks under "Current Topics" in your January 18th issue. The chief difficulty in the way of suggesting the right solution of the problem seems to lie in the divergence of views as to the approximate total number of reputable electrical contractors, i.e., those who could satisfy the Registration Board of their suitability for enrolment on the National Register.

It has been suggested that the number of contractors satisfying these requirements, and who have not yet been registered is much smaller than some estimates allow. Personally, I think 5 000 is an outside figure for registerable contractors in this country. If this figure is anywhere near correct, it should only take another year or so to get them all entered on the voluntary National Register. This done, it would be a comparatively simple matter to press for compulsory registration.—I am, etc.,

"A Northern Contractor."

January 19th.

AN ELECTRICAL CARNIVAL.

Details of Important Social Function to be held in Newcastle—Novel Competitions and Prizes.

As a point of local interest an electrical carnival is being promoted in Newcastle under the auspices of the Electrical Development Association and the Electrical Association for Women. The carnival will be held in the Oxford Galleries, New Bridge Street, Newcastle-upon-Tyne, on February 7th, and the guests will be received by the Lord Mayor and Lady Mayoress. The function promises to be one of the best electrical efforts that has ever been promoted in the country, and it is interesting to note that practically every firm manufacturing electrical apparatus have together very generously provided a large selection of prizes. These will be awarded for treasure hunts, treasure dances, balloon dances and other novel competitions. The surplus moneys from the carnival will be given to the Hospitality Fund of the Electrical Association for Women to entertain the delegates at their Conference at the North East Coast Exhibition. The chairman of the dance committee is Mr. W. F. T. Pinkney, and tickets are 5s. each.

BOOKS RECEIVED.

"The 'Swift' Percentage of Weight Reckoner." (London: Gall and Inglis.) 4s. net.

"Mechanical World" Year Book, 1929. (Manchester and London: Emmott and Co.) Pp. 167. 1s. 6d. net.

"Journal of the Institution of Electrical Engineers." Vol. 67. No. 385. (January.) (London: E. and F. N. Spon.) 10s. 6d. net.

"The British Journal Photographic Almanac, 1929." Edited by George E. Brown. (London: Henry Greenwood and Co.) Pp. 799. 2s. net.

"Conduction of Electricity Through Gases." By Sir J. J. Thomson, F.R.S. Vol. I. (Cambridge: University Press.) Pp. 491. 25s. net.

"Handbook of Procedure and Evidence in Arbitrations." By W. T. Creswell. (London: Institute of Arbitrators, Inc.) Pp. xvii+167. 6s. net.

"Electrical Transmission and Distribution." Edited by R. O. Kapp. Vols. I. and II. (London: Sir Isaac Pitman and Sons.) Pp. xvi + 476. 6s. net (each).

"The Past and Future Developments of Electricity, and Its Bearing on World Peace." By H. G. Massingham. (London: Hutchinson and Co.) Pp. 31. 6d. net.

"Discussion of the National Electrical Safety Code." (To accompany the Fourth Edition of the Code.) Handbook Series of the Bureau of Standards, No. 4. (Washington: United States Government Printing Office.) $1. Pp. vi+334.

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NEWS IN BRIEF.

All-Electric Houses for Clydebank—Secretary Wanted by the I.M.E.A.—The Prince of Wales and the B.I.F.—The A.S.E.E. Annual Dinner—The Royal Institution and Faraday—London Local Group of the E.P.E.A. to Hold Dance.

DUNDEE T.C. is to oppose the Grampian Electricity Supply Order.

Clydebank T.C. is to erect, on a site at Park Hall, 346 all-electric houses.

Applications are invited for the position of electrical engineer to New Mills U.D.C.

A shift charge engineer is wanted for Worcester Corporation's Hylton Road station.

An installation assistant and an assistant meter tester are wanted by Coventry Corporation.

It was announced at a recent meeting of Preston T.C. that the fourth generating set at Ribble power station had been completed.

Gainsborough U.D.C. is about to erect, as an experiment, six electrically lighted one-storey houses on the Burn Street housing site.

Reading Corporation tramway employees have subscribed £5 1s. to the Mayor of Reading's fund for relieving distress in mining areas.

At a meeting of the Royal Institution on January 31st, Sir Wm. Bragg will give the first of three lectures on the early history of X-rays.

Bermondsey (London) Electricity Committee has agreed to wire new flats under the L.C.C. housing scheme in Hankey Place, on condition that the buildings are not piped for gas lighting.

The E.D.A. will be showing a cinema film entitled "Rural Electrification" at the Plaza Theatre, London, on January 28th. The film is of their own production and prizes are offered for a new title.

The Incorporated Municipal Electrical Association invites by February 4th applications for the position of secretary (male) to the Association. The commencing salary will be £700 per annum.

A contract, amounting to about £5 500, for the concrete foundations for a sub-station at Port Dundas, Glasgow, and also a similar contract, estimated at £5 000, for the Motherwell sub-station, have been placed by the Central Electricity Board.

South Shields Housing Committee, having been asked by tenants in Prince Edward Road, to consent to a supply of gas for cooking purposes, the Borough Electrical Engineer has been asked to submit a quotation for the installation of electric cookers in the houses.

The interest taken by the Prince of Wales in the British Industries Fair is shown by the fact that the first public dinner which he will attend since the illness of the King will be the banquet at the Mansion House on February 18th, the opening day of the Fair.

Preston Watch Committee recommends the erection of four automatic electric traffic signals. These will be 9 ft. in height, equipped with three vertical coloured lights denoting "stop," "caution" and "go," and each light will be lettered with its signal word as a precaution against mistakes by colour-blind drivers.

The N.W. Students' Section of the I.E.E. has arranged a visit to the works of the Allied Newspapers, Ltd., to-morrow, Saturday. On January 29th, Mr. D. J. Watkins will read a paper, entitled "Electric Locomotives." A dance will be held on February 9th, in the University Women's Union, Manchester.

The annual dinner of the Association of Supervising Electrical Engineers, will be held at the Hotel Cecil, London, on February 23rd. Mr. S. B. Donkin, will preside, and will be supported by, among others, Sir Brodie Henderson, Lt.-Col. K. Edgcumbe, Sir Wm. Noble, Messrs. T. P. Wilmshurst, Frank Hodges, G. Scott-Ram, G. Heys-Jones, Roger T. Smith, A. H. Dykes, F. Gill, J. S. Highfield, W. E. Highfield, A. M. Sillar, and A. P. Trotter.

Bristol Electricity Committee reports that it is desirable to appoint the preliminary staff for the Portishead generating station, which will be rated as a class "H" station under the salary scale approved by the National Joint Board for the Electricity Supply Industry. The Committee recommends that it be authorised to appoint a station superintendent at a salary of £672 3s. 2d. per annum and a boiler-house superintendent at a salary of £511 5s. 8d. per annum.

Coxhoe (co. Durham) P.C. is arranging for the electric lighting of the roads at Quarrington Hill.

An electrical engineer is required by the Government of Nyassaland, for the Public Works Department.

Seaham Harbour U.D.C. has received sanction to a loan of £3 000 in connection with the assisted wiring scheme.

The next A.M.I.E.E. examination will be held on May 29th, 30th and 31st, 1929. Entry forms must be completed and returned by April 1st.

The Business Efficiency Exhibition, whereat a number of electricity items are to be seen, opened at the White City, London, on Wednesday.

The Royal Institution has called a meeting for February 5th to set afoot preparations to celebrate in 1931 the centenary of the discoveries of Faraday.

Direct communication in both directions between Singapore and London was established on January 7th by the Eastern Telegraph Co., eliminating relaying stations.

The Electricity Department of Shanghai Municipality requires a system control engineer, two assistant charge engineers and two distribution engineering assistants.

Mr. Wm. M. Morgan read a paper on electric arc welding, at a meeting of the Glasgow and West of Scotland Association of Foremen Engineers and Draughtsmen, on January 16th.

Burnley Workhouse Committee recommends that, subject to sanction by the Ministry of Health, two wireless receiving sets and accessories be purchased at a cost not exceeding £85.

The London Local Group of the E.P.E.A. has arranged a dinner and dance to be held at the New Prince's Galleries, Piccadilly, W.1, on March 16th. This constitutes the first social function of the group.

A new tramway pole lighting system has been approved by Lytham St. Annes Council. The existing type of lamp will be gradually changed over to arc lamps, the cost being spread over a period of years.

Mr. H. de A. Donisthorpe, of the General Electric Co., Ltd., lectured on "Radio Progress and Valve Applications," and demonstrated uses of the photo-electric cell, at the Grammar School, Jesmond, Newcastle-on-Tyne, last week.

The Midland Electrical Engineers Ball, held at the Grand Hotel, Birmingham, on November 16th last, resulted in a sum of seventy-five guineas being handed over to the Benevolent Fund of the I.E.E. for the second year in succession.

It is reported that a new motor invented by a Swedish engineer, Mr. W. H. Uggle, and constructed by Luth and Rosens Elektricka Aktiebolag, consumes less power than other motors and renders possible smoother weaving and higher production per working unit.

The Brazilian Traction Light and Power Co. has been informed that the Brazilian Federal Supreme Court upholds the validity of the Rio de Janeiro telephone concession, which was disputed by the predecessors of the present municipal administration.

The annual meeting of the Iron and Steel Institute will be held on May 2nd and 3rd, at the Institution of Civil Engineers, when Prof. H. Louis will assume the office of President. The annual dinner will be held on May 2nd at the Connaught Rooms, Queen Street, W.C.2.

In order to extend its scope the title of "Electro-Farming" has been changed to "Rural Electrification and Electro-Farming." The change is attributed to the fact that "it seems that for the next few years rural electrification, which in reality includes a still wider field, will be a matter of greatest importance."

A special course of five lectures on electrical sub-stations is being held on Tuesday evenings as from January 22nd at the School of Engineering and Navigation, High Street, Poplar, London, E.14. The lectures are to be delivered by Mr. H. Brazil and the subjects covered include: Why sub-stations are necessary; numbers and position of sub-stations; protective devices for e.h.t. circuits; types of converting plant; rotary converters; motor converters; motor generators; storage batteries, their use in the future; boosters; automatic regulators; traction sub-stations; rotating plant versus mercury arc rectifiers; noise and its prevention; continuity of supply; suggestions for the best means of maintaining.

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PERSONAL.

THE North Western Branch of the Institution of Mechanical Engineers has elected Mr. H. L. Guy as chairman for the year. Mr. Guy, who was trained at the Cardiff University College, has been for some years chief engineer of the mechanical department of the Metropolitan-Vickers Electrical Co., Ltd. He has been responsible for many important developments in steam turbine practice, including the design of some of the largest and most efficient units which have been built in this country. For his last paper, "The Economic Value of Increased Steam Pressures," presented to the Institution in November, 1926, he was awarded the Hawksley Gold Medal. This medal is the premier award in the gift of the Institution and is given only for original work of outstanding merit. Considerable interest is therefore attached to a paper Mr. Guy is to present before a meeting of the Institution in Manchester on January 31st on the subject of "Some Tendencies in Turbine Design." It is also of interest to note that the programme of the Summer Convention of the Institution, which is to be held in Manchester, is to include a visit to the Metropolitan-Vickers works.

Mr. H. L. Guy who has been elected chairman of the N.W. branch of the Institution of Mechanical Engineers.

Sir Basil Blackett and Sir Andrew Duncan have been recommended to fill vacancies on the Court of the Bank of England.

Mr. V. W. Dale underwent a successful operation on January 16th, and is, we understand, making satisfactory but necessarily slow progress.

The appointment of Mr. Wm. Forbes as manager of Cardiff tramways at a salary of £1 150 per annum has been confirmed by the City Council.

Ald. E. Huntsman, deputy Lord Mayor of Nottingham, has been reappointed chairman of the East Midland Joint Industrial Council (District No. 7) for the Electricity Supply Industry.

The appointment of Mr. F. A. Fitzpayne as transport manager in succession to Mr. R. Stuart Pilcher, who goes to Manchester, was confirmed by Edinburgh Town Council on January 17th.

Mr. J. Aldworth, who has retired from the managership of Nottingham Corporation tramways, after 30 years' service in that capacity, has been presented with a gold hunter watch by the traffic and depot staffs.

The marriage of Mr. Edward Victor Newberry, of the test department at the Rugby works of the British Thomson-Houston Co., Ltd., and Miss Hilda Beatrice Over, was solemnised last week at the Rugby Parish Church.

Mr. Frank Buckley, general manager of the Corporation Tramways at Bury, Lancs, has been appointed general manager and engineer of the city of Norwich tramways. He takes up his new duties at the end of February.

Mr. R. Stuart Pilcher, transport manager to Edinburgh Corporation, was entertained at luncheon on January 15th by members and officials of Edinburgh Corporation, and presented with a gold watch and electric standard and table lamps, as a memento of his 10 years' service in Edinburgh.

We understand that Capt. P. Dunsheath, who has for the past nine years had charge of the research laboratories of W. T. Henley's Telegraph Works Co. Ltd. has been appointed research and technical manager at the company's head office in Holborn. The control of the laboratories at Gravesend is being taken over by Mr. W. C. Barry.

It is announced that with the object of still further centralising the executive and direction of the British Columbia Power Corporation, which controls the British Columbia Electric Railway Co., the president, Mr. George Kidd, has become chairman of the Board of Directors, and Mr. W. G. Murrin, the general manager, president. Mr. Kidd, who will remain in Vancouver in order to keep in touch with the power development plans at Bridge River, joined the British Columbia Electric Railway Co. in London 21 years ago, and went to Vancouver four years later as comptroller. Mr. Murrin left the London United Tramways 15 years ago to join the railway company.

THE SOCIAL SIDE.

UP to and including December 15th, the B.T.H. (London) Rugby Football Club had, out of 13 matches played, won 4, drawn 2, lost 7, the average being 65 points for and 136 against. The figures for the Siemens Club were, 9 games played, 4 won, none drawn, 5 lost, the average being 136 points for and 98 against.

Last month the staff of J. Dyson and Co., Ltd., electrical wholesalers, Bradford, held a dance at Sherwood House, when between 80 and 90 people were present. Numerous prizes were given for various dances, the music for which was provided by Arthur Jackson's Vauxhall Band. Mr. Harry Moss carried out the duties of M.C.

On January 19th, the annual staff dinner of Francis Polden and Co., Ltd., of 56, Cannon Street, London E.C.4, was held at Anderton's Hotel, followed by a concert by the "Merrie Villagers." The toast of "The Chairman and Company" was introduced by Mr. W. T. Buswell, to which Mr. Polden replied. Mr. James Oswald welcomed the ladies, to which Mr. Tucker, the Hoover representative with the company, replied. Mr. Polden proposed "The Staff," and Mr. Lamport and Mr. Gover responded.

An enjoyable time was spent by members of the Birmingham Electric Supply Department, their wives, children, and friends, on the occasion last month of their annual pantomime at the Temperance Hall, Birmingham. The performance was given by children of employees, who gave a clever interpretation of "Sinbad the Sailor." The Lord Mayor and Mr. E. J. Jennings, secretary of the Department, attend. The play was written by Mr. G. H. Luke, the producers were Messrs. R. New and F. J. Tivey, and the orchestra was conducted by Mr. J. Aspin.

The first annual dinner of the Elliott Long Service Association was held on January 11th, at the Green Man Hotel, Bromley Road, Catford, at the invitation of the directors of Messrs. Elliott Brothers (London), Ltd. Forty-one out of forty-eight members were present, illness being responsible for the absentees. The members of the E.L.S.A. share 1 589 years service between them, ranging from 54 to 25, which latter is the number entitling to membership. Keen disappointment was felt with regard to the absence of the president, Mr. W. O. Smith (chairman of the company), owing to illness. He holds the record for years of service, viz., 54 years, and should have occupied the chair. The vice-president, Mr. G. T. Cooper, with 50 years service, however, suitably performed that office.

On the invitation of Mr. and Mrs. Robson, the employees of Messrs. Robson and Coleman, their wives and partners, were entertained to a whist drive, supper and dance at the Minories Assembly Rooms, Newcastle, on January 18th, when about 100 were present. There were numerous prizes, including two season tickets for the N.E. Coast Exhibition. During the evening Mr. Turpin presented Mr. and Mrs. K. Smith with a timepiece and set of vases on the occasion of their marriage. Mr. Robson announced that one of the apprentices, D. Waite, had succeeded in obtaining the grant given by the Electrical Contractors' Association for an apprentice in the electrical contracting industry receiving the highest number of marks in the six Northern Counties for the London City and Guilds Examination in electric installation work. Music was supplied throughout the evening by Mr. J. P. Anderson's orchestra.

Obituary.

MR HERBERT R. WYATT, on January 1st. He was in business as an electrician at Liverpool.

MR. ALEXANDER TAYLOR. He was 13, years ago appointed assistant lighting superintendent at Calcutta, and in 1921 was promoted to the position of lighting superintendent.

MRr W. A. LYON, wireless manufacturer, Blackpool, at the age of 33. He served in the Royal Navy during the war, and his death is attributed in some degree to the hardships of the service.

MR. J. M. GORHAM, aged 73 years. He was a director of Drake and Gorham, Ltd., his association with the company dating from 1886. He retired from active interest in the business many years ago.

MR. F. HARDING, aged 71 years. He retired a short time ago from the position of manager of the Derby Corporation tramways after having been connected with that undertaking for 48 years.

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BUSINESS ITEMS.

WE are advised that the electrical department of BROWN BROTHERS, LTD., is now open.

Stirling Town Council has appointed GRAHAM AND MORTON, LTD., as electricians for the ensuing year.

We are advised by Mr. LIONEL CALISCH that his address is now 107, Avenue Louis Lepoutre, Brussels.

RICHARD B. ISLE AND CO., electrical engineers, have opened premises at 22, Priory Place, Doncaster.

Mr. L. E. HEMBER, electrical engineer, has opened new showroom premises at 4, Pepper Street, Lymm, Cheshire.

Mr. C. H. MORRIS, radio engineer, of 16, Tontine Street, Folkestone, has opened additional premises at 140, Foord Road.

G. E. WALLIS AND SONS, LTD., electrical engineers, have opened new showrooms at Bateman's Buildings, High Street, Ashford, Kent.

HOWLETT AND SONS, electrical engineers, of Windsor, are carrying out the electrical installation at the Windsor Hospital.

Mr. J. Raine announces that he will carry on the business of WILLIAM RAINE AND SON, electrical wiring contractors, etc., at 18, Houndgate, Darlington.

Copies of a confidential report upon the electric light and power services to Chile may be obtained from the Department of Overseas Trade upon quoting reference B.X. 4853.

It has been decided to instal Marconiphone amplifiers in Norwich Cathedral. These will be similar to the installations already in use at Canterbury, York, St. Martins-in-the-Fields and elsewhere.

Mr. F. W. Coomber, electrical and radio engineer, of The Tything, Worcester, has taken his son into partnership, and the business will be carried on under the style of F. W. COOMBER AND SON.

An agent and wholesaler in Brussels is desirous of representing British manufacturers of electrical domestic and other appliances. Further particulars from the Department of Overseas Trade, reference No. 425.

Mr. F. G. Southworth, who has for nearly three years been with Mr. W. R. Brown, electrical engineer, 18, Mill Street, Macclesfield, has been appointed manager of the showrooms of G. J. SCRAGG AND CO., LTD., electrical engineers and contractors, Abergele, near Rhyl.

The Union des Centrales Electriques du Hainaut has placed an order for the manufacture, laying and jointing of 88 miles of 30 000 V "H" type armoured cable with the A.C.E.C. (Ateliers de Constructions Electriques de Charleroi). This is the largest contract so far placed in Belgium for "H" type cable, amounting as it does to approximately £115 000.

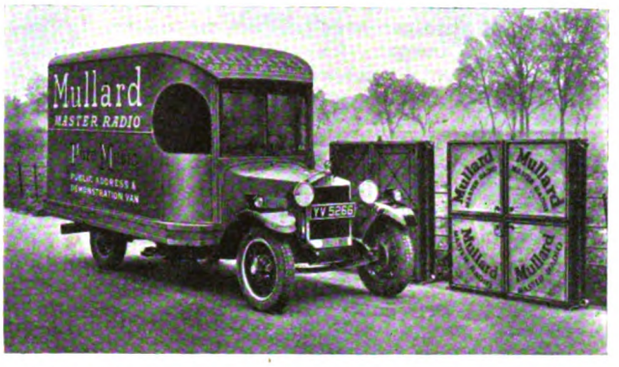
V. G. MIDDLETON AND CO., LTD., of 9, Carteret Street, London, S.W.1, announces that in order to strengthen the connection between that company and W. J. Furse and Co., Ltd., of Nottingham the name of the former has been changed to W. J. FURSE AND CO. (LONDON), LTD. Mr. F. W. Marshall will continue to act as managing director and the office and engineering staffs remain unaltered. Attention is drawn to the facilities now offered by the use of offices in Nottingham, Manchester, Derby and Bristol.

For some time past PHILIPS LAMPS, LTD., have marketed a range of commercial and industrial electric light fittings, and although up to the present the range has been limited, it has met with considerable success. As a consequence it has been decided to manufacture a comprehensive range suitable for all commercial and industrial purposes. Foremost amongst the new fittings will be a number of diffusing units to be known by the trade name of "Phililite." More detailed particulars and illustrations of the new fittings will be published shortly.

J. H. HOLMES AND CO., of Portland Road, Newcastle, announce that the firm is now reconstructed under conditions that involve no break with the traditions of the past. The style of the company is now J. H. HOLMES AND CO., LTD., and the directors are Messrs. W. Hall, N. D. Newall, and Sir Arthur N. L. Wood, with Mr. R. Robinson as manager. Accompanying this information were two leaflets describing and illustrating "Holmes-Clatworthy" duplex motor equipments for newspaper presses and "Castle" electro-plating motor generators respectively.

The Mint Authorities at Calcutta recently decided to change over from their own power house and take supply from the Calcutta Electric Supply Corporation. To effect this conversion, the GENERAL ELECTRIC CO., LTD., has installed substation plant consisting of h.t. truck cubicles, transformers, rotary converters and d.c. slate switchboard with interconnecting cable work. It is interesting to note that in 1906 upwards of 1 000 kW of generating plant, in addition to motors for the complete electrification of the Mint, were supplied by the General Electric Co.

A contract recently obtained by the GENERAL ELECTRIC CO. (INDIA), LTD., was in connection with the public water supply at Benares and covered plant and apparatus controlling the supply of unpurified Ganges water from the Bhadaini pumping station, to the filtering station at Bhelupura, and for the supply of filtered water from Bhelupura to the city. The electrical plant at Bhadaini consists of two h.t. vertical spindle slip-ring motors of a total output of about 700 B.H.P., and that at Bhelupura comprises four h.t. slipring motors with horizontal shafts and having an aggregate output of 1 100 B.H.P. The plant is complete with starting and control equipment, cables and all accessories.



The latest addition to the fleet of demonstration vans of the Mullard Wireless Service Co., Ltd.

The ENGLISH ELECTRIC CO., LTD., has received orders from the Bradford Corporation Tramways for 11 complete single-deck four-wheel electric trolley omnibuses, and 6 complete double-deck top covered six-wheel electric trolley omnibuses. The single-deck vehicles will each have a seating capacity for 34 passengers and will be equipped with a 60 H.P. motor, and the double-deck vehicles will each have a seating capacity for 56 passengers and will be equipped with two special 40 H.P. motors. Both types of vehicle will be equipped with the company's standard foot-operated controller and rheostatic braking. The English Electric Co. has previously received orders for 16 electric trolley vehicles from this Corporation.

A striking innovation in political campaigning methods was inaugurated yesterday (Thursday), when by a series of speech relays carried out by the MARCONIPHONE CO., LTD., for the Conservative Party, the Prime Minister was able to speak at the City Hall, Newcastle-on-Tyne, his words also being heard by meetings at Berwick, South Shields, Stockton, West Hartlepool and Whitley Bay. On February 22nd Mr. Neville Chamberlain, M.P., will speak simultaneously to audiences at Swindon, Trowbridge, Abingdon and Chippenham, while on February 27th the Prime Minister will speak at Manchester, to Darwen, Macclesfield, Preston, Rochdale, Stockport, and Warrington; on March 21st he will be heard at Leicester (in person), Derby, Grantham, Mansfield, Nottingham, Northampton and Retford.

THE "BLUE BOOK."

New Edition to be Published next week.

NEXT week the forty-second issue of the ELECTRICAL TRADES' DIRECTORY will be published. It will be a sumptuous production, and a valuable storehouse of information for all associated with the industry. The "Blue Book" is the only publication that contains a complete alphabetical directory of the electrical industry and this has been very carefully revised. The whole edition has undergone that thorough revision for which this publication has earned such a reputation. A notable feature of the 1929 issue is the inclusion of a complete list of electrical contractors for England and Scotland. The price of the directory is as usual 25s. and postage 1s. extra (inland), and 2s. abroad. Orders should be sent to the publishers without delay, Messrs. Ernest Benn, Ltd., 154, Fleet Street, London, E.C.4.

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ELECTRICAL CONTRACTORS' DINNER.

Col. Wilfrid Ashley's Scheme for Testing Demand in a Rural Area—Suggestions for Ensuring Good Electrical Installation Work—An Appeal to the Electricity Commissioners —Demand for Compulsory Wiring Code.

THERE was an attendance of nearly 300 members and guests at the annual dinner of the Electrical Contractors' Association, held at the Savoy Hotel, London, on Tuesday. Mr. W. H. Walton (the President) was in the chair, and was supported by Col. Wilfrid Ashley, Lt.-Col. K. Edgcumbe, Mr. T. P. Wilmshurst, Mr. Frank Hodges, Col. R. K. Morcom, Mr. C. W. Sully, Mr. Ll. B. Atkinson, Mr. A. Nichols Moore, Sir John Gatti, Mr. A. C. Cramb, Mr. D. N. Dunlop, Col. W. A. Vignoles, and many other well known personalities in the industry.

Proposing "The Allied Associations and Honorary Officials," Col. ASHLEY said the E.C.A. was a prosperous section of the most deservedly prosperous industry in the country. In the last seven years the output of electricity had been practically doubled, and it went on increasing at the rate of approximately 20 per cent. each year. Its progress was such that not even the motor car industry could equal it. In 1927, for the first time, we took the foremost place as exporters of electrical machinery and apparatus, beating for the first time both the U.S.A. and Germany, which before the war were far ahead of us in this field. In congratulating the Central Electricity Board on the progress it had made during the past two years, Col. Ashley said that the developments for which that body had been responsible would undoubtedly place the electrical industry on a firmer footing than it would have enjoyed if the Electricity Act had not been passed. It was anticipated by the Weir Report that in consequence of the 1926 Act a saving of £44 500 000 would accrue to electricity consumers by 1940. If, as he believed, this proved to be correct, he could claim that there was virtue in some Acts of Parliament, or at least those with which the Ministry of Transport had to do.

Work of the Central Board.

In the two years of its existence the Central Board had gone about its work in a very tactful manner and overcome obstacles in a surprisingly easy way. The Electricity Commissioners had prepared, and the Board had accepted, four great area schemes which represented a very considerable advance towards the completion of their task, covering, as they did, some 64 per cent. of the population of this country. Already the Board had placed contracts for about £3 250 000 for electrical apparatus, transmission lines, etc. The E.C.A. could do, and was doing, a great deal to help forward this great industry, particularly in the harmonious relations which they maintained with the Trade Union side.

He understood that one of the main objects of the Association was to ensure to the public installation work of good quality. In his view they should not only do good work but should receive a good return for it—absurdly low prices and good work did not go together. Members of the public were safe from the possibility of accidental shocks and other untoward events if they employed reliable installation contractors.

With regard to rural electrification, Col. Ashley said he hoped for results from a committee which the Electricity Commissioners had appointed to carry further the work done by the Committee on Rural Electrification. He also hoped that at no distant date it would be possible to develop it in such a way that a body which was interested could offer a supply to everyone in a certain area, providing the wiring and apparatus on the hire or hire-purchase systems. He was very anxious to do this in order to test the desire of the rural population for electricity.

Mr. W. H. WALTON, in reply, said it was becoming increasingly necessary to raise the standard of electrical safety in this country, and the only way to achieve this was to work unceasingly to secure the use of better electrical materials and better workmanship in the homes and business premises of the nation.

Certain of their manufacturing friends seemed to find it difficult to stand together in mutual support of perfectly legitimate trade ends. Others, again, seemed to hesitate to prepare clear-cut trading policies, or to adhere to them when so defined. It was the settled policy of the E.C.A. to promote fair trading conditions among its own members and to demand them, in reasonable terms, from all other sections of the industry.

Emphasising the responsibility of the trade to give to the public a high standard of electrical workmanship, Mr. Walton declared that he was definitely not satisfied with the quality of much of the electrical work going into the homes of the people at the present time.

The increasing public contact with electrical equipment had synchronised with increased supply pressures in many areas, and with a torrent of cheap, mass-produced wiring material, accessories and equipment. Electricity was perfectly safe under proper control, but it was an easy matter to-day to find installations and equipment that were dangerously unsafe to place in the hands of the people. It was no part of the policy of the E.C.A. to turn installation workers into a close corporation. They desired to keep no competent man out of the business, but they did say that some definite qualification or experience should be required from those undertaking this vitally important work.

If this could not be achieved the next best thing was to adopt some reasonable code of wiring regulations to which all electrical workers might be required, under penalty, to adhere. Some such control was one of the urgent needs of the moment which the industry could not ignore. He submitted that a duty had been imposed on the higher electrical authorities to investigate the question with a view to safeguarding the user.

In other directions, Mr. Walton said, the relations existing between the Association and electricity supply engineers all over the country continued to develop on the most friendly lines. More than one central station engineer had been moved to wonder whether installation work, after all, represented the care-free gold mine which he pictured in his dreams.

It was gratifying to note that more and more supply authorities had entered into agreement with E.C.A. members for the execution of "assisted" wiring work at contract rates, and in many parts of the country these businesslike agreements were in force and giving satisfaction to all parties concerned.

Mr. T. E. ALGER, referring to some of the shoddy work that was being put into British homes, recalled the statement that the electrical contractor was the last link in the electrical chain. He hoped the Electricity Commissioners would realise the weakness of some of the links in the chain they were forging. He also hoped that the Commissioners would seek powers to enforce minimum regulations which would ensure safety to the user wherever he might be.

Col. K. EDGCUMBE, who, with Mr. T. P. Wilmshurst and Mr. Frank Hodges, responded to the toast of "The Guests," said he was glad to see the definite move to ensure sound electrical installations, for though it was easy to wire a house after a fashion, it was difficult to see that good work was done.

The Electrical Contractors' Association was held in high regard by the Institution of Electrical Engineers, a regard in which he had a personal share. Theirs was the only section of the industry that was in direct touch with the general public. It was all very well to produce a "cheap and abundant supply," but all their work would be of no avail if the public did not use their product.

He hoped that Col. Ashley would be able to do something with a view to ensuring that good wiring was a *sine qua non*.

Mr. T. P. WILMSHURST said that in 30 years' experience as a supply engineer he had seen far too much of the type of "contractor" whose chief qualifications were a glib tongue and a pair of pliers.

Too Big for Politics.

Mr. FRANK HODGES thought the only praise due to the Government was for having lived while electricity had developed by itself. Actually, the 1926 Act had its birth in another party which he refrained from naming. He desired to see the electrical industry as far removed from politics as possible. It was too big for politics.

The toast of "Our Chairman" was proposed by Mr. WALTER RIGGS, and briefly acknowledged by Mr. WALTON.

A selection from silhouette portraits specially cut during the evening by Baron Scotford is given on page 117, and a photograph taken at the beginning of the dinner is reproduced on page 121.

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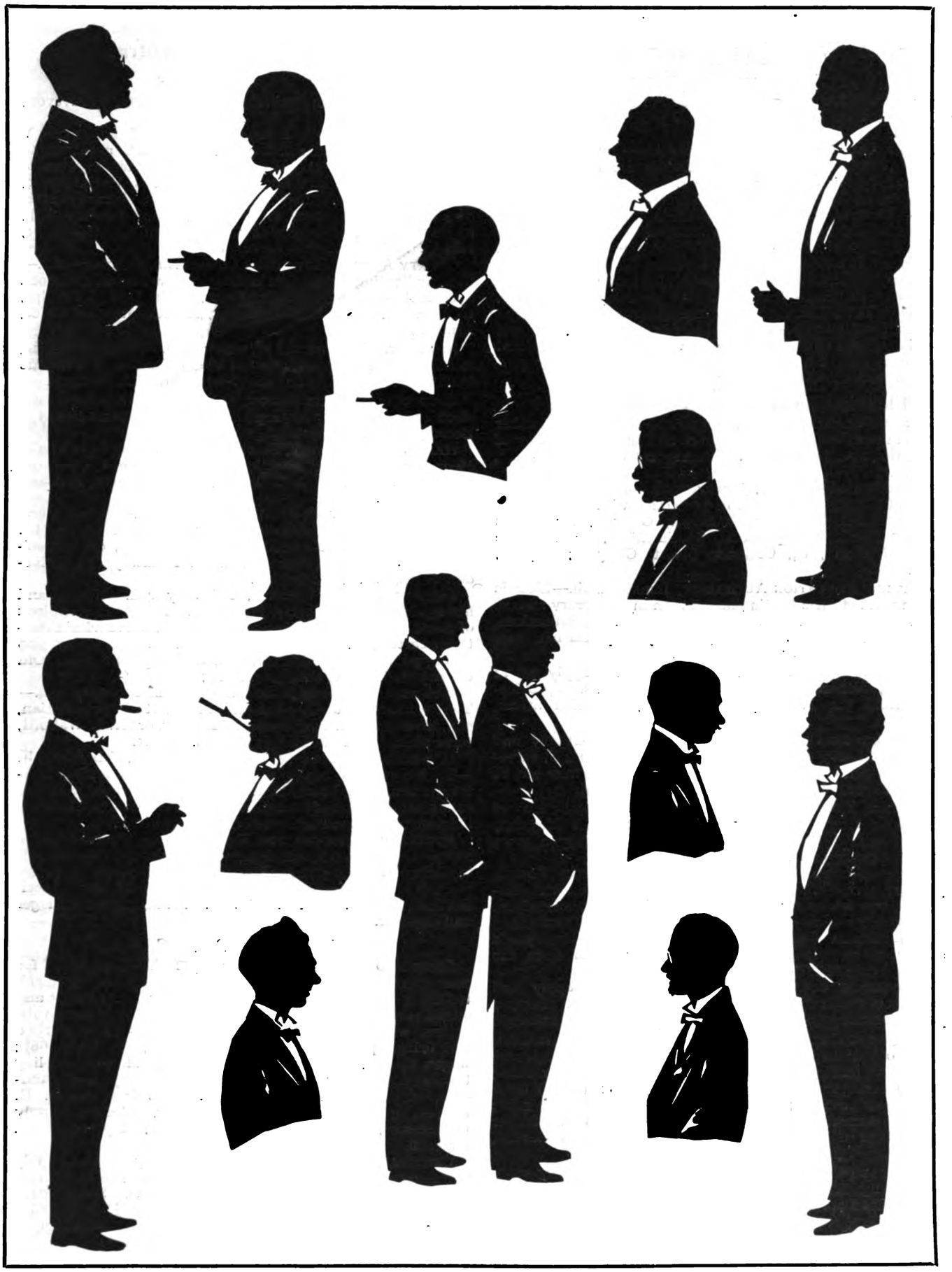

E.C.A. DINNER SILHOUETTES.

THESE silhouettes, specially cut for THE ELECTRICIAN during the E.C.A. annual dinner on Tuesday, portray several well-known Association people in a slightly different "light." Some of the profiles are readily recognisable, but no prizes are offered to successful solutionists. (For report of speeches and flashlight photograph of the diners see pages 116 and 121).

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BUSINESS OPENINGS.

Latest Particulars of Electrical Engineering and Wiring Installation Contracts for which Tenders are being Invited at Home and Abroad.

WE give below the latest particulars of contracts for which tenders are invited. The closing date is given, when available.

AYLESBURY CORPORATION.—Manufacture and supply of 11 000 V switchgear. Full particulars from Mr. W. A. Turnbull, borough electrical engineer.

CHEADLE AND GATLEY URBAN DISTRICT COUNCIL, January 25th.—Electric lamps, meters, cable protection boards, service cables, meter boards, and ironclad cut-outs, for 12 months. Specification, etc., from the Engineer and Manager, Electricity Department, 37, High Street, Cheadle.

NEWRY URBAN DISTRICT COUNCIL, January 25th.—Supply of single and three-phase electricity meters. Specification, etc., from Mr. W. M. Cronin, town clerk, Town Hall, Newry.

CHICHESTER CORPORATION, January 28th.—Supply and erection of 40 kW motor-generator, with starting panel, shunt regulator, etc., for Apuldram outfall works. Further particulars from the City Engineer.

Electrical Equipment of Municipal Houses.

DENNY CORPORATION, January 28th.—Electrical and other works in connection with erection of 28 houses. Schedules of quantities, etc., from Messrs. J. Strang and Wilson, architects, Falkirk.

GLASGOW CORPORATION, January 28th.—Electrical installation and heating installation, in connection with conversion of Family Home, St. Andrew's Street, Glasgow, for use as additional police headquarters. Specifications, etc., from the Office of Works, 64, Cochrane Street, Glasgow; deposit, £3 3s.

GLASGOW EDUCATION AUTHORITY, January 28th.—Electric lighting and electric heating installation in temporary annexe at St. Roch's School, Garngad Road, Glasgow. Specifications, etc., from Education Offices (Property Department), 129, Bath Street, Glasgow; deposit £1 1s.

ABERDEEN CORPORATION, January 29th.—Supply of 12 tramcars, with trucks and electrical equipments. Specifications from the Tramways Manager, 2, Marischal Street, Aberdeen.

BASINGSTOKE CORPORATION, January 29th.—Supply and erection of heavy oil engine, direct coupled to 800 kW, three-phase, 50 period alternator. Specifications, etc., from Mr. F. Swarbrick, borough electrical engineer; deposit £1 1s.

BELFAST CORPORATION, January 29th.—Installation of automatic telephones in the infectious Diseases Hospital, Purdysburn. Specification, etc., from Mr. R. Meyer, town clerk; deposit, £2 2s.

DUMFRIES AND GALLOWAY JOINT SANATORIUM BOARD, January 29th.—Electric wiring work, in connection with erection of two houses for employees at Lochmaben Sanatorium. Specifications from the Clerk, County Buildings, Dumfries.

CHELTENHAM CORPORATION, January 30th.—One year's supply of electric light fittings. Tender forms from the Borough Engineer.

EDINBURGH CORPORATION, January 30th.—Supply and erection of traffic lamps at various points in the city. Further particulars from the City Architect, City Chambers, Edinburgh.

LIVERPOOL CORPORATION, January 31st.—Twelve months' supply of various materials, including (E.S.1) cables, compound, and tapes; (E.S.2) insulated cables; (E.S.3) electricity meters; (E.S.4) cartage: (E.S.5) incandescent lamps; (E.S.6) brass and copper castings; (E.S.7) a.c. motors and starting gear; (E.S.8) stoneware troughing, etc.; (E.S.9) oils. Tender forms from City Electrical Engineer, 24, Hatton Garden, Liverpool. State number of form desired.

RAMSGATE CORPORATION, January 31st.—Re-wiring stage electric lighting installation, at Royal Victoria Pavilion. Particulars from the borough engineer, Mr. T. G. Taylor, 16, Albion Place, Ramsgate.

CHEADLE AND GATLEY URBAN DISTRICT COUNCIL, February 1st.—High tension overhead line (contract 45); and outdoor type transformers (contract 56). Specifications from Mr. R. W. Willis, 37, High Street, Cheadle, Cheshire; deposit £1 1s. for each contract.

OTLEY URBAN DISTRICT COUNCIL, February 1st.—Electricians' work in connection with erection of 40 houses on Westbourne housing estate. Specifications can be seen and quantities obtained on application to the Council's Surveyor; deposit £1 1s.

RIPON CORPORATION, February 1st.—Overhead 11 000 V transmission line and small quantity of e.h.t. underground cable (contract No. 2). Persons desiring to tender were to communicate their intention to Mr. W. C. C. Hawtayne, 9, Queen Street Place, London, E.C.4, before January 11th. Specifications, etc., were to be issued, about January 18th, to persons who, after receiving notice from Mr. Hawtayne, sent to the Town Clerk a deposit of £2.

COUNTY ARMAGH EDUCATION COMMITTEE, February 2nd.—Electric lighting installation in Lurgan New Technical School. Specifications can be seen at the office of Mr. J. St. J. Phillips, 16, Donegall Square South, Belfast, or the Education Office, Armagh.

AMPTHILL GUARDIANS, February 4th.—Electric heating installation, in the board room at the institution. Particulars from the surveyor, Mr. Leonard Foster, Flitwick, Bedford.

EASTBOURNE CORPORATION, February 4th.—Automatic electrically-operated pumping plant. Specifications from the Borough Engineer; deposit £1 1s.

HALIFAX CORPORATION, February 4th.—Wiring 64 houses at Moor End Road for electric light. Particulars from the borough engineer, Mr. A. C. Tipple, Crossley Street, Halifax; deposit £2 2s.

LONDON COUNTY COUNCIL, February 4th.—Manufacture, and supply at East Greenwich power station, of h.t. and l.t. cables, concrete core re-actors, control battery, etc. Specification from General Manager, L.C.C. Tramways, 23, Belvedere Road, S.E.1; deposit £2.

LONDON COUNTY COUNCIL, February 4th.—Wiring and fittings for electric lighting, heating and cooking in one block of dwellings, consisting of some 86 tenements and administrative quarters, on Ossulston Estate, St. Pancras (about 999 wiring points). Specification, etc., from Chief Engineer, Old County Hall, Spring Gardens, S.W.1; deposit £1.

HOLBORN (LONDON) BOROUGH COUNCIL, February 5th.—Twelve months' supply of electric lamps, etc. Specification, etc., from Mr. J. E. Parr, borough surveyor, or Mr. L. Walford, town clerk, Town Hall, High Holborn, W.C.1.

HAMMERSMITH (LONDON) BOROUGH COUNCIL, February 6th.—Twelve months' supply of electric lighting sundries, insulated wires, joint boxes, meters, h.t. and l.t. paper insulated cables, etc. Forms of tender, etc., from the Borough Electrical Engineer. Stamped addressed envelope to be sent.

PORTSMOUTH CORPORATION, February 6th.—Twelve months' supply of stores and materials to the tramways department, including insulating materials, lamps, and motor windings (section Q), overhead line materials (section R), etc. Specification and form of tender from Mr. B. Hall, general manager and engineer.

Plant for Sheffield Power Station.

SHEFFIELD CORPORATION, February 14th.—Equipment for new generating station at Blackburn Meadows, Sheffield, including turbo-alternator, with condensing, evaporating and steam preheating plant (specification B.M. 67); water-tube boilers, with chimneys, superheaters, stokers (or pulverised fuel firing equipment), economisers, valves, etc. (B.M. 68); wagon tippers, conveyors and elevators (B.M. 70); cooling towers (B.M. 72); and overhead electrically and hand-operated cranes (B.M. 73). Specifications from Mr. S. E. Fedden, general manager and engineer, Electric Supply Department, Commercial Street, Sheffield; deposit, £3 3s. for each.

CENTRAL ELECTRICITY BOARD, February 15th.—Supply and laying of 66 000 V cables in London area, in connection with South East England Electricity Scheme. Specification (S.E.E.-L.C.1) and form of tender from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit, £2 2s.

CENTRAL ELECTRICITY BOARD, February 18th.—Supply and erection of 132 000 V overhead transmission lines, in connection with the North-West England and North Wales Electricity Scheme. Specification (No. N.W.E.-P.L. 1) and form of tender from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit, £2 2s.

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CENTRAL ELECTRICITY BOARD, February 18th.—Supply and erection of 132 000 V overhead transmission lines, in connection with the Central England Electricity Scheme. Specification (No. C.E.-P.L. 1) and form of tender from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit, £2 2s.

CENTRAL ELECTRICITY BOARD, March 4th.—Supply and erection of 132 kV outdoor switchgear, for transforming stations, in the area covered by the North West England and North Wales Electricity Scheme. Specification (N.W.E.-P.S.1) from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit, £2 2s.

CENTRAL ELECTRICITY BOARD, March 4th.—Supply and erection of 132 000 V transformers in connection with the North West England and North Wales Electricity Scheme. Specification (N.W.E.-P.T.1) from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit, £2 2s.

Overseas.

UNLESS otherwise stated, particulars of overseas contracts are to be had from the Department of Overseas Trade (Room 52), 35, Old Queen Street, Westminster, London, S.W.1. *Note.—An asterisk denotes that local representation is, in practice, essential.*

EGYPTIAN MINISTRY OF THE INTERIOR, January 27th.—Transformer kiosks, cables and accessories, in connection with extension of electricity supply from Mit-Ghamr power station. (Reference B.X. 4 893.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, January 29th.—Accumulator batteries and counter E.M.F. cells (schedule C. 390). (Reference B.X. 4 906.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, January 29th.—Single core, paper insulated, lead covered cable. (Reference B.X. 4 954.)

WAIRARAPA (N.Z.) ELECTRIC POWER BOARD, January 29th.—Supply of 15 sets of earth leakage protection equipment (contract No. 78). (Reference B.X. 4 950.)

CHILEAN MINISTRY OF MARINE, January 30th.—Two electric travelling cranes. (Reference A.X. 7 353.)

EGYPTIAN MINISTRY OF THE INTERIOR (SECTION DES MUNICIPALITES ET COMMISSIONS LOCALES), January 31st.—Diesel engine-driven generator set, d.c. rotary balancer and accessories, for Kafrel Zayat electric station. (Reference B.X. 4 931.)

MANAWATU-OROUA (N.Z.) ELECTRIC POWER BOARD, January 31st.—Supply of automatic re-closing 11 000 V switchgear, for pole platform mounting (contract No. 57). (Reference B.X. 4 988.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, January 31st.—Supply of electrically driven locomotive turntable (tender No. 1 386). (Reference A.X. 7 253.)

VICTORIAN ELECTRICITY COMMISSION, February 4th.—Supply of 22 000 V switchgear and accessories, for Richmond Terminal Station. (Reference B.X. 4 901.)

VICTORIAN ELECTRICITY COMMISSION, February 4th.—Supply of 11 000 V switchgear, for installation in the Richmond Terminal Station (specification No. 29/3). (Reference B.X. 4 898.)

VICTORIAN ELECTRICITY COMMISSION, February 4th.—Supply of 11 000 V switchgear, in connection with the Yallourn power station extensions. (Specification No. 29/5.) (Reference B.X. 4 897.)

VICTORIAN RAILWAY COMMISSION, February 6th.—Supply of a.c. line relays (contract 42 491). (Reference B.X. 5 042.)

GHENT MUNICIPALITY, February 11th.—Supply of 16 electric portal cranes. (Reference A.X. 7 398.)

LOUGH DERG, PETTIGO, CO. DONEGAL, February 14th.—Supply and erection of two heavy oil engine-driven, continuous current, 10 kW, 220/250 V generating sets (section I); storage battery, on nickel-iron-alkaline system (section II); and d.c. switchboard (section III), for the Venerable Dean Keown. Specifications for each section from Messrs. MacEntee and O'Kelly, 23, Upper O'Connell Street, Dublin; deposit £2 2s.

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, February 26th.—Supply of induction coils and registers, for telephone work (schedule C. 394). (Reference B.X. 5 031.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, March 19th.—Supply of 110 000 V transformer, for Mangahao electric power scheme (section 204). (Reference B.X. 4 952.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, March 19th.—Supply of 11 000 V switchgear, for Mangahao power development (section 203). (Reference B.X. 4 953.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, March 26th.—Supply of telephones and dials (schedule C. 401). (Reference B.X. 5 023.)

EGYPTIAN MINISTRY OF THE INTERIOR, March 27th.—Supply and installation of electric lighting system for the town of Fashn. (Reference B.X. 5 037.)

VICTORIAN ELECTRICITY COMMISSION, April 8th.—Galvanised steel transmission line towers (specification 29/13). (Reference A.X. 7 401.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, April 9th.—Supply of induction voltage regulators, for Lake Coleridge scheme (section 215). (Reference B.X. 5 018.)

VICTORIAN ELECTRICITY COMMISSION, April 29th.—Steam turbo-generators (section 1), condensing plant, including circulating water pumps (section 2); and evaporating, de-aerating and feed heating plant, including boiler feed pumps (section 3). Specification, etc., from the Agent-General for Victoria, Victoria House, Strand, London, W.C.; deposit £3 3s.

TANGANYIKA GOVERNMENT, June 1st.—Concession for utilisation of Pangani River Falls for the development of electric power. Copies of the draft concession may be obtained from the Crown Agents for the Colonies, 4, Millbank, London, S.W.1.

STATE ELECTRICITY WORKS, MONTEVIDEO, July 8th.—Construction and equipment of 50 000 kW power station.

Tenders Accepted.

ADMIRALTY.—Siemens Electric Lamps and Supplies, Ltd., large quantities of Siemens vacuum and gasfilled lamps, for ship and dockyard use.

COLCHESTER CORPORATION.—W. T. Henley's Telegraph Works Co., Ltd., e.h.t. transmission line between the electricity works and the Wivenhoe sub-station, £3 778 16s. 2d. (lowest tender).

AUSTRALIAN POSTMASTER-GENERAL'S DEPARTMENT.—British General Electric Co., Ltd., installation in Sydney and Melbourne of apparatus for telegraphic transmission of pictures.

BRADFORD CORPORATION.—English Electric Co., Ltd., supply of 11 single-deck and six double-deck railless electric trolley vehicles, and spare parts, £28 279 8s. (Recommended.)

GENERAL POST OFFICE.—British Insulated Cables, Ltd., 21 miles of telephone cable between Blackpool and Preston, and 16 miles of cable to link Douglas, Castletown and Port Erin with new submarine cable between Fleetwood and Douglas.

CENTRAL ELECTRICITY BOARD.—Ferranti, Ltd., and Fuller Electrical and Manufacturing Co., Ltd., construction of 132 000 V transformers required in the area of the South East England Scheme. The contracts amount to approximately £400 000.

IRISH FREE STATE ELECTRICITY SUPPLY BOARD.—Metropolitan-Vickers Electrical Co., Ltd., supply of switchgear required in connection with the Shannon power scheme. It is stated that tenders at lower prices were received for switchgear of Continental manufacture.

SALFORD CORPORATION.—Metropolitan-Vickers Electrical Co., Ltd., protective switchgear at Agecroft power station, £305; and supply of two 1 500 kVA transformers at Agecroft power station, £1 528; General Electric Co., Ltd., supply of 1 000 kVA step-down transformer at Agecroft power station, £474. (All recommended.)

LONDON POWER CO., LTD.—Babcock and Wilcox, Ltd., six Babcock "C.T.M." water tube boilers, each capable of evaporating 250 000 lb. of water per hour under normal conditions and having maximum continuous rating of 318 000 lbs. per hour, with economisers, superheaters, air preheaters, etc., for new Battersea power station. The plant is to be constructed for a working pressure of 600 lb. per sq. in.

ST. PANCRAS (LONDON) BOROUGH COUNCIL.—Hackbridge Electric Construction Co., Ltd., supply of two 750 kW three-phase transformers, £649. (Recommended.) Also tendered: Johnson and Phillips, Ltd., £672; British Thomson-Houston Co., Ltd., £691; English Electric Co., Ltd., £696; Bruce Peebles and Co., Ltd., £705; Ferranti, Ltd., £710; General Electric Co., Ltd., £721; British Electric Transformer Co., Ltd., £738; Metropolitan-Vickers Electrical Co., Ltd., £794; C. A. Parsons and Co., Ltd., £798; Brush Electrical Engineering Co., Ltd., £804; Foster Engineering Co., Ltd., £818.

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ELECTRICITY SUPPLY.

Additional Plant for Carlisle—Transfer of Dalkeith Undertaking—Loan for Birkenhead Extensions—Electricity Supersedes Gas for Salford Street Lighting—Supply Wanted for Wellington, Somerset—Irish Electricity Board to Supply Mallow.

THE Holderness Trust proposes to carry out an electrification scheme in Driffield rural district.

Dumfries T.C. has decided to instal additional plant at the electricity works, at a cost of £16 000.

Uttoxeter U.D.C. has arranged to obtain a bulk supply from the Burton-on-Trent Corporation works.

Stockton-on-Tees T.C. has received sanction to a loan of £10 000 for prospective expenditure for mains and services.

Grimsby T.C. is applying to the Electricity Commissioners for permission to supply electricity to the borough of Louth.

Carlisle Corporation has received consent to the installation of a 15 000 kW turbo-alternator with three 30 000 lb. boilers, and auxiliaries.

The Ministry of Transport has sanctioned the erection of overhead mains at Hanslope by the Northampton Electric Light and Power Co.

Chesterfield Electricity Committee has obtained sanction to borrow £4 700 for the extension of the overhead equipment to New Whittington.

Haywards Heath and District Electric Supply Co., Ltd., is to erect an overhead extra high pressure line between Hassocks and Haywards Heath.

Plymouth Electricity Committee has sanctioned the extension of cable to a number of streets, the total cost involved being over £4 000.

Bradford electricity department is to erect and equip a transformer chamber in Beacon Road, at an estimated cost of £4 842, including mains.

Dalkeith T.C. has decided to sell its electricity undertaking to the Lothians Power Co., Ltd. The undertaking was purchased by the Council three years ago.

Aldershot T.C. has received sanction to a loan of £8 800 in connection with the supply of electricity to the Aldershot Park housing scheme, and North Town.

Birkenhead Electricity Committee has obtained sanction to borrow £30 000 for mains and services in Birkenhead, and £25 000 for mains and services under the Wirral scheme.

Torquay Electricity Committee seeks sanction for a further floating loan of £13 000 required, during the next twelve months, for the new mains and services throughout the area.

Middleton T.C. has decided to lay a h.t. cable to a special sub-station, to supply electricity to 70 new houses on the Mainway, Middleton Junction, at an estimated cost of £3 470.

The West Riding County Council has agreed to take a supply of electricity for the receiving home at Crookhill Hall, Conisborough, from the Doncaster Collieries Association, for power and heating.

The Kent Electric Power Co. has informed Sittingbourne U.D.C. that, under its existing statutory powers, it has been decided to provide a supply of electricity for the town and Milton Regis.

Chester Electricity Committee recommends that application be made to the Electricity Commissioners for an Order permitting the Corporation to supply electricity to premises in the parishes of Eddisbury and Delamere.

Salford Lighting Committee recommends that the Council give authority for substituting electricity for gas lighting on all principal roads. The light will be trebled and the increased cost is estimated at £1 700 per annum.

The supply of electricity at Eaglesham was switched on by Mr. Thomas Wallace on January 11th. The installation was carried out under the superintendence of Mr. Johnstone, engineer to the Clyde Valley Electrical Power Co.

Wellington (Somerset) U.D.C. has asked the Electricity Commissioners for information on the present position with regard to electric lighting for the town, and as to the possibility of the Council themselves undertaking the supply.

An inquiry has been held by Mr. John Bates, engineering inspector to the Northern Ireland Ministry of Home Affairs, into the application by Omagh Rural District Council for urban powers to enable it to supply electricity to the town of Fintona.

Bicester U.D.C. has received from the Commissioners an intimation that the application of the West of England Electricity Co., Ltd., for a Special Order has been refused, and the application of the Wessex Electricity Co. has been granted.

The London and Home Counties Joint Electricity Authority has called a conference of the local authorities within the area of the Twickenham and Teddington Electric Supply Co. to carry on negotiations for the purchase of the company's undertaking.

The Irish Free State Electricity Supply Board has informed Mallow U.D.C. that the Board proposes to supply electricity in the town, the distribution to be by means of overhead lines on wood poles. The Council has asked that iron poles be substituted.

Application is being made by Liverpool Electric Power and Lighting Committee for sanction to borrow £300 000 for prospective expenditure on electric mains.—The Council has decided to extend the electricity supply area so as to include the Sefton and Whiston rural districts.

Gravesend Electricity Committee is about to put in hand a.c. cables between Pelham Arms kiosk and El Teb, along Old Road West, £2 165; from Pelham Arms kiosk along Dover Road, a distance of 650 yards, £1 080; and through Dashwood Road to Meadow Road, in Cross Lane West, £450.

The Electricity Commissioners are to hold an inquiry on February 12th into the application of the Cleveland and Durham County Electric Power Co., for the revocation of the Order permitting Darlington Corporation to supply electricity to certain premises in the parish of Haughton-le-Skerne.

Aberdeen Corporation has approved an agreement with the Aberdeen District Committee of the County Council regarding the public lighting of the Mannofield special lighting district. The agreement is for four years, 22 lamps are to be erected, and the charge per 50 c.p. lamp is to be £1 11s. 6d. per lamp per annum.

Droxford R.D.C. has received from the West Hampshire Electricity Co. an intimation that the company proposes to apply for an Order to distribute electricity in an area including Droxford rural district, except the parish of Hambledon, and that it is proposed to obtain a supply in bulk from Southampton Corporation.

In consequence of objections to the erection of overhead transmission lines through Whinlatter Pass, in the Lake District, a conference has been arranged to take place at Carlisle on January 28th between local representatives of the Council for the Preservation of Rural England and officers of the Central Electricity Board.

Bradford Electricity Committee proposes to construct and equip a district transformer chamber in Roundhill Street, Manchester Road, at an estimated cost, including mains, etc., of £3 764.—The Baths Committee has authorised the chairman, the deputy chairman, Coun. Ellis and the baths superintendent to obtain full information with regard to electric heating and to report.

The Parliamentary Bills Committee of Dundee T.C. has decided to oppose the Provisional Order which has been presented by the Grampian Electricity Supply Co. for additional powers. To ensure that the Grampian undertaking cannot come into Dundee without the consent of the Town Council, the Committee wishes to secure a repetition of the protective clause, which was included in the 1924 Order.

It is reported that a project for drying the mud of the river Emscher, a tributary of the Rhine, and using it as fuel for the generation of electricity, is to be carried out, that an agreement for the delivery of 100 000 tons of such fuel by the Emscher Association to the Rheinisch Westfalische Elektricitätswerke has been signed, and that this quantity of fuel is expected to enable about 100 000 000 kWh of electricity to be generated.

Mr. W. Weekes, borough electrical engineer of Shoreditch (London) reports that the present demand on the power station (about 12 800 kW) is rapidly approaching the total capacity of the existing high pressure boiler plant, and that no time should be lost in making application for sanction to install a new boiler of at least 100 000 lb. per hour evaporative capacity. The cost of extensions of the boiler house and the provision of a boiler of the size required, with auxiliary plant and apparatus, is estimated at £27 000. The Electricity Committee recommends application to the Electricity Commissioners for the necessary sanction.

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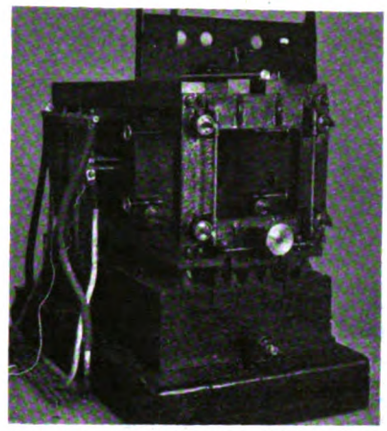
ELECTRICAL NEWS OF THE WEEK IN PICTURES.

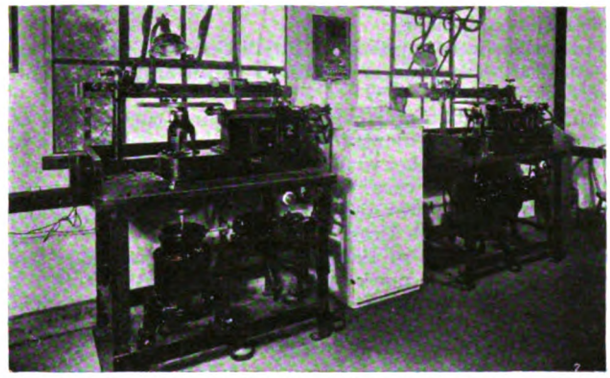
This picture of the operating theatre of a modern hospital shows the important part played by electric lighting in successful surgical operations. The use of reflectors for this work is becoming more and more general.



A large electro-magnet which was recently constructed at the National Research Laboratories at Bellevin. It was mainly subscribed for by readers of "Le Matin" in response to an appeal.

An electrical boot cleaner in Berlin. The customer sits on a high stool with his feet resting on a rail, while a revolving brush worked by a motor under the chair of the attendant does the work.

In view of the Business Efficiency Exhibition now open at the White City, London, this picture, also from Berlin, is of special interest, in that it shows a bank of electrically-connected typewriters being worked by one operator, who thus produces a number of "original" copies of the same letter by depressing the keys of one machine.



The recording room at a "talking" film studio. The machines are electrically driven, and are fitted with vacuum suction devices for collecting the wax dust as the impressions are made. The machines are fed from the studio where the scene is being photographed, through microphones, amplifiers and filter circuits, so that perfect synchronisation is obtained.

Members of the Electrical Contractors' Association and their friends at the Annual Dinner, which was held on Tuesday, at the Savoy Hotel, London. During the proceedings silhouettes of some of the personalities present were made by THE ELECTRICIAN, and these together with a report of the speeches are given on pages 116 and 117. There was an attendance of nearly 300, among whom were Col. Wilfrid Ashley (Minister of Transport), Mr. T. P. Wilmshurst (Electricity Commission), Sir John Brooke and Mr. Frank Hodges (Central Electricity Board) and Lt.-Col. K. Edgcumbe (President, I.E.E.).

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INDIAN SCHEMES.

Overhead Lines in Duplicate as Precaution Against Interruption of Supply.

MESSRS. Braithwaite and Co., the structural steel engineers of West Bromwich, recently decided to carry out extensive electrical conversion schemes at both their Bombay and Calcutta works. The original power station at Muland, Bombay, consisted of three Belliss and Morcom reciprocating engine sets driving Crompton generators of a total output of 600 kW and now three G.E.C. rotary converters of a total output of 750 kW have been installed in their place. A three-phase, 50 cycle, 22 000 V supply is taken from the Tata Hydro-Electric Power Co. by means of duplicate, but independent overhead lines; these lines are duplicated in order to ensure continuity of supply should a serious fault develop on one set of lines. Each line is protected by electrolitic lightning arrestor gear of the aluminium cone type and controlled by a 100 A, 22 000 V oil-immersed circuit breaker having a rupturing capacity of 250 000 kVa and incorporating the usual three-phase overload and no-volt. protection. The lines are paralleled on to common busbars by means of these switches. Normally only one line is in service and the arrangement enables the supply lines to be changed over without interruption of service. Three similar oil circuit breakers for controlling the three rotaries are connected to these common busbars.

All e.h.t. work is carried out in bare copper rod supported on 22 000 V porcelain insulators, and the whole is screened off by steel lattice work. Three 22 000/370 V transformers (two 330 kVA and one 165 kVA) are located in a lean-to building and supply current to three tap starting roller bearing rotary converters running at 1 500 r.p.m. The rotaries are of standard construction, and three G.E.C. rotary control panels complete the equipment.

All l.t. cables were supplied by Pirelli-General Cable Works, Ltd., and these were laid in keyfibre conduit and the conduit concreted in solid.

A further installation is at present being carried out at Messrs. Braithwaite's Calcutta works, and this consists of 2 kW rotary converters together with transformers and the attendant switchgear. In this case power is taken at three-phase, 50 cycle, 6 600 V from the Calcutta Electric Supply Corporation.

When the Maharajah Protap Bahadur Deo of Mayurbhanj State, in the province of Behar and Orissa, ascended to the "gadi," he decided to mark his accession by instructing the General Electric Co. (India), Ltd., to carry out the electrification of Baripada. The scheme entailed the erection of a power station installation consisting of a 70 kW oil engine-driven generating plant, in addition to pumping sets, and over eleven miles of overhead line work.

TRADE CALENDARS, ETC.

WE have received from the COUNTY OF LONDON ELECTRIC SUPPLY CO., LTD., a telephone card illustrated by a figure symbolic of electric energy. In the foreground is shown a power station with transmission lines emanating therefrom.

A very pleasing calendar has been received from Mr. Christopher Wade, of RICHARD WADE, SONS AND CO., LTD., of Hull. The illustration shows a charming girl dressed in green, looking into the mirror of her vanity bag. The calendar may be said to be both ornamental and useful.

This year's calendar of S. G. BROWN, LTD., Western Avenue, London, W.3, is entitled, "The 'Peke' of Perfection" and consists of a wood cut-out of loud speaker, the base of which is straddled by a Pekinese dog. The product is tastefully coloured and makes both a novel and pleasing ornament.

BRITISH BROWN-BOVERI, LTD., London, has sent us a calendar illustrated by an aerial view of Baden (Switzerland) and the Brown-Boveri works, and views of various electric mountain railways in Switzerland. A picture of the Tourtemagne outdoor sub-station of the Illsee-Turtmaun, Oberems is included, together with a view of the storage lake for the Lungern power station.

We have received from Mr. J. E. DODSWORTH, a copy of "The Engineer's Diary," obtainable from stationers and bookstalls, at popular prices. This is the eighth year of publication, and, the issue as usual, contains much information of value to the engineer, varying from absolute zeros to tables for weights and measures. The diary is of convenient pocket size, leather backed and contains a foreword by Sir Robert A. Hadfield.

HEATING ENGINEERS.

Economic Application of Electricity to Low Temperature and Heating Purposes.

IT was mainly the excessive cost of electricity supply that stood in the way of its general adoption for low temperature heating purposes, said Mr. Geo. Wilkinson, in a paper before the Institution of Heating and Ventilating Engineers, in which he described an economic application of electricity for heating purposes by means of a "change-circuit." Hot water systems on the central heating plan, with coke and oil fired boilers, combined with cast iron radiators or wall panels, would doubtless continue for an indefinite time as good practice in many large buildings used for business or other purposes, especially when organised and run under a common administration. This type of installation would, he hoped, gradually wean the British public from their weakness for the open coal fire. Again, gas fires and gas radiators (when ventilated) had a domain of their own, while for short-period heating the ordinary electric fire or radiator possessed features of safety, convenience and economy. After dealing with cost of supply and modern practical economies, Mr. Wilkinson said that from Government returns and assuming an increase in load factor from 25% to 75% it was clear that during the year 1927-8 there were available for heating purposes the total of 19 855 701 260 kWh at ¼ penny. This amount was being increased every day with the growth of the constant voltage supplies. Energy in the form of electricity instead of hard fuel had the advantage in that it could be delivered at any point where heat was required. Each floor, and if nçcessary, each radiator or panel might have its separate storage cylinder which would absorb the constantly varying amount of energy received from the "change-circuits" thus forming a heat reserve to be drawn upon at such times and rates as required to maintain uniform temperature under all weather variations. The absence of combustion and the products of combustion enabled these cylinders to be placed in positions where any radiation loss was usefully employed and the whole system lent itself readily to convenient applications not obtainable with any other form of heating.

TRADE PUBLICATIONS.

THE ELECTRIC HEATING CO., George Street, Croydon, has issued a new catalogue for domestic electric appliances, under the reference No. 508.

A questionnaire in the form of a postcard has been received from HERBERT MORRIS, LTD., Loughborough, dealing with the company's conveyors, and inviting further information from potential clients so that a representative may call.

The BENJAMIN ELECTRIC, LTD., Brantwood Works, Tariff Road, London, N.17, has sent us a special booklet explaining the Benjamin lighting service. The issue is well illustrated and gives full particulars of both the company's service and the advantages gained from good lighting.

Bulletin No. 54, published by ALLOY WELDING PROCESSES, LTD., 14/16, Church Street, London, N.1, gives applications of electric arc welding to the repair and maintenance of machinery on board ship. The company's Bulletin No. 57 deals with a new electric dynamo for welding purposes.

We have received from HOBDAY BROTHERS, LTD., 21/27, Great Eastern Street, London, E.C.2, a supplementary catalogue to the main radio publication No. 70. The purpose of this supplement is to include the outstanding features of the 1928 Radio Exhibition and wireless picture receivers. There is also incorporated a special chart to direct telephone callers to the department required.

L. G. HAWKINS AND CO., LTD., 30/35, Drury Lane, W.C.2, have issued a number of pages for inclusion in their general catalogue. These include descriptions of the electric washer and wringer, No. E. 1 250; "Blazer" electric fires; "Peter the Seer," which prevents windows being affected by atmospheric changes; and the "All over" electric hair clipper. A special leaflet dealing with the "Vio Ray" artificial sunlight apparatus has also been published.

A publication has been received from BRITISH INSULATED CABLES, LTD., Prescot, Lancs., which points out that during the past fifteen years they have manufactured, laid and jointed over 1 000 miles of trunk telephone cable, with conductors ranging from 10 lb. to 300 lb. per mile, for the British Post Office. The publication also gives in detail the mileage and date of the various balanced trunk cable contracts which they have carried out.

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COMPANY NEWS.

Quiet Market in Electrical Securities—Capital Issue for Austrian Electrical Works—Westinghouse Brake and Saxby Signal Company's Increased Profit and Dividend—Directors' Reports and Dividends—New Companies Registered.

CHANGES in prices of electrical securities have not been large or numerous during the past week. Yorkshire Electric Power ordinary have risen 1s. 6d. to 36s. 6d., while Charing Cross Electric ordinary have dropped 6d., and County of London Electric Supply ordinary 1s. In the traction section Central London 4% debentures have recovered one point, and stand at 81, and London Electric Railway 4% preference has risen from 73½ to 75. Among the manufacturing descriptions, British Insulated Cables ordinary have put on ½, the quotation being 91s. 3d.

Last Annl. Divd.	Description.	This Week.	Last Week.	1912 to 1927. Highest.	Lowest.
%	**Electricity Supply.**				
(d)	Brompton & Kensington Ord. ..	27/-	27/-	45/-	23/9
4	Central Elec. Sup. 4% Deb. ..	93	93	100	67
(a)	Charing Cross Elec. Ord. (£1) ..	26/-	26/6	60/-	10/-
4½	,, ,, ,, 4½% C.P. (£1)	17/6	17/6	19/6	10/-
(e)	Chelsea Elec. Sup. Ord.	27/-	27/-	39/6	10/-
10	City of Lond. Elec. L'ting Ord. ..	31/10½	31/10½	52/10½	20/3
6	,, ,, ,, ,, ,, 6% C.P. ..	23/-	23/-	40/-	15/6
7½	County Lon. Elec. Sup. Ord. ..	48/-	49/-	68/6	14/6
6	,, ,, ,, ,, ,, 6% C.P. ..	23/-	23/-	24/9	15/3
(g)	Kensington & K'bridge Ord. (£1) ..	26/6	26/6	104/6	3/-
(b)	Lon. Elec. Sup. Ord. (£1)	26/-	26/-	38/3	5/-
9	Metro. Elec. Sup. Ord.	47/6	47/6	43/-	8/-
4½	,, ,, ,, 4½% C.P. ..	17/6	17/6	18/6	9/6
7½	N'castle & Dis. Elec. Ltg. Ord. ..	30/-	30/-	22/6	7/9
6	N'castle-upon-Tyne Elec. Sup. Ord.	26/10½	26/10½	26/-	11/6
6	N. Metro. Elec. 6% C.P.	23/-	23/-	23/9	10/1½
6	Notting Hill 6% C.P. (£10) ..	10½	10½	10½	6/13/9
(e)	St. James & P.M. Ord. (£1) ..	27/6	27/6	62/-	22/-
1/4½	Shrops. Worcs. & Staffs. Power B. Or.	35/-	35/-	23/-	20/9
(f)	W'minster Elec. Sup. Ord. (£1) ..	27/-	27/-	52/-	18/-
4½	,, ,, ,, 4½% C.P. (£1)	17/6	17/6	21/6	13/-
8	Yorks. Elec. Power Ord.	36/6	35/-	32/9	12/6
6	,, ,, ,, 6% C.P. ..	24/-	24/-	25/-	14/3
	Railways and Tramways.				
8	Brit. Elec. Trac. Pfd. Ord. Stk. ..	124	124	152½	24
6	,, ,, ,, 6% Pf. Stk. ..	127½	127½	129½	53
4	Cent. Lon. Ry. Ord. Stk. (asstd.) ..	72½	73	89½	49½
4	,, ,, ,, 4% Deb.	81	80	103	56½
4	City & S. Lon. 4% Perp. Deb. ..	79½	79½	102½	50
4	Lon. Elec. Rly. Cons. Ord. Stk. ..	75½	75½	73½	10
4	,, ,, ,, ,, 4% Pf. Stk.	75	73½	84/2/6	43
4	,, ,, ,, ,, 4% Deb. ..	81	81	98½	52
5	Lon. & Sub. Trac. A. Deb. ..	97½	97½	89	65
4	Lon. Un. Trams, 1st Deb.	61	61	82	30
4½	Met. Elec. Trams, 4½% Deb. ..	70	70	101½	49
5	,, ,, ,, 5% Deb...	67½	67½	102/17/6	53
3	Met. Rly. Cons. Ord. Stk.	67	67½	84½	19
3½	,, ,, ,, 3½% Pf. Stk. ..	65	65	88½	40½
3½	,, ,, ,, 3½% Deb. ..	72	72	92½	51
4	Met. Dis. Rly. Ord. Stk.	80	80½	66½	12½
4½	,, ,, ,, 4½% 1st Pref. ..	82½	82½	91	45
6	,, ,, ,, 6% Perp. Deb. ..	116½	116½	146/12/6	80
4	S. Met. Elec. Trams, 4% Deb. ..	70	70	73½	48½
5	Underground Electric Rlys. Ord.	27/-	27/6	5/3	2/1½
—	Yorks. (W.R.) Trams, Ord. ..	5/-	5/-	27/-	1/-
4½	,, ,, ,, 1st Deb. ..	59	59	87	52
	Electrical Manufacturing.				
7	Brit. Elec. Transformer 7% C.P. ..	15/-	15/-	22/1½	11/6
15	Brit. Insulated Cables Ord. ..	91/3	87/6	86/3	26/6
6	,, ,, ,, 6% C.P. ..	22/6	22/6	25/6	14/6
7	British Thomson-Houston Pref. ..	23/-	23/-	24/6	19/7
7	,, ,, ,, 7% Deb.	104½	104½	109⅜	92/-
10	Brush Electrical Ord.	28/9	28/9	29/9	10/-
15	Callender's Cable Ord.	85/-	86/3	86/-	22/-
6½	,, ,, ,, 6½% C.P. ..	25/-	25/-	26/7	3/-
7½	,, ,, ,, 7½% B. Pref. ..	27/6	27/6	27/6	16/6
8	Crompton-Parkinson 8% Cum. Pf.	25/7½	25/7½	25/-	9/10
6	,, ,, ,, 6% Cum. 2nd Pf.	18/3	18/3	18/-	8/-
7½	Edison Swan Elec. Ord. (1st Pref. ..	25/7½	25/7½	26/-	5/-
5	,, ,, ,, 1st Deb Stk...	86½	86½	—	—
7½	Elec. Construction Ord.	26/10½	26/10½	25/9	6/7
7	,, ,, ,, 7% C.P. ..	22/6	22/6	25/3½	16/-
—	English Elec. Ord.	8/9	8/9	29/3	7/3
6	,, ,, ,, 6% C.P. ..	10/-	10/-	22/1½	10/6
7	Ericsson Telephones 7% Pref. ..	19/-	19/-	22/9½	12/7
35	Ever Ready (Gt. Britain) Ord. ..	31/6	31/-	93/9	18/6
6	Ferranti 6% Pref.	19/-	19/-	19/4½	16/9
7	,, 7% 2nd Pref.	19/-	19/-	19/3	13/9
10	General Elec. Ord.	59/4½	56/3	59/-	13/6
‡25	W. T. Henley's Ord.	117/6	117/6	108/9	23/3
12½	Johnson & Phillips Ord.	36/3	36/3	67/11	14/6
7½	Lon. Elec. Wire & Smith's Pref. ..	23/9	23/9	27/6	17/6
6	Metropolitan-Vickers Ord... ..	34/4½	35/-	37/-	13/1
8	,, ,, 8% C.P. (£2)	55/-	55/-	67/10	5/-
7½	Siemens Bros. & Co. Ord.	30/-	30/-	36/6	12/3
10	Telegraph Const. Ord. (£12) ..	25	25	56/2/6	19
	Telegraph.				
3½	Anglo-Am. Tele. Ord. Stk... ..	64½	64½	68½	40
10	Eastern Ord. Stk.	267½	265½	213⅜	113/2/6
3½	,, 3½% Pref. Stk.	68½	68½	84/17/6	49
4	,, 4% Deb.	79½	79½	103⅜	60
10	Eastern Extension Ord. (£10) ..	26½	26½	21½	10/12/6
22	Gt. Northern Telegraph (£10) ..	34½	34	42/12/6	19
10	Indo-European (£25)	51½	49½	47½	25
20	Marconi's Wireless T. Ord. ..	77/6	77/6	9/16/3	20/9
12½	,, Int. Mar.	70/-	7-/-	5/11/3	14/11
10	Western Tel. Ord. (£1)	26½	26½	23	11/3/6

(a) 1s. 7⅝d. per share. (b) £8 8s. 6·66d. per cent. (c) 1s. 6·949d. per share.
(d) 1s. 8·706d. per share. (e) 1s. 9·3d. (f) 1s. 0.912d. (g) 1s. 7·223d.
‡ Including 1s. bonus.

SINGAPORE TRACTION CO., LTD.—Div. of 5% on 7% cum. pref. shs. is recommended.

DELHI ELECTRIC SUPPLY AND TRACTION CO., LTD.—Intm. div. of 4%, less tax, payable Jan. 31.

SOUTH EASTERN POWER AND LIGHT CO.—Qrtrly. div. of 25 cents p. sh. on common stk. is announced.

THE home of "Black Cat" cigarettes, Messrs. Carreras' new building at Mornington Crescent, London, N.W., illuminated by G.E.C. floodlight projectors and Osram lamps.

PENN-OHIO EDISON CO.—Regular qrtrly. divs. have been declared on 7% prior pref., $6 pfd. stk. and common stk.

CONSUMERS' POWER CO.—Divs. of $1·25 on $5 pfd. stk, $1·50 on 6% pfd. stk, $1·65 on 6·6% pfd. stk, and $1·75 on 7% pfd. stk. are announced.

SCHLUCHSCEWERKE ELECTRIC CO., FREIBURG, SWITZERLAND.—This co. is about to issue a 6% loan of £1 450 000, of which £420 000 will be offered in Holland at 97%.

TENNESSEE ELECTRIC POWER CO.—Regular qrtrly. divs. h. bn. declared on 5%, 6%, 7%, and 7·2% qrtrly. 1st pfd. stk. and regular monthly divs. on 6% and 7·2% monthly 1st pfd. stk.

ALDERSHOT GAS, WATER AND DISTRICT LIGHTING CO.—Messrs. A. and W. Richards offered for sale by tender last week £110 000 4% pref. stk. of this co. at a minimum price of 70.

MONTREAL LIGHT, HEAT AND POWER CONSOLIDATED.—Div. on common shs. for qrtr. ended Dec. 1 of 60 cents p. sh., compared with 50 cents for corresponding qrtr. of last year, is now payable.

SOUTHERN CANADA POWER CO.—Output in year ended Sept. 30, 1928, 138 160 340 kWh, agst. 125 452 960. Gross earngs. of co. and subsidiary cos. £1 809 566, agst. £1 534 280. Net pft. £855 073, agst. £627 742.

ALLGEMEINE ELEKTRIZITATS GES.—Div. of 8% for the year 1928 (same as previous year) has been declared. Turnover for year was 500 000 000 marks, and orders in hand are estimated at 385 000 000. marks.

EINSTEIN'S ELECTRO CHEMICAL PROCESS, LTD.—The issue of 250 000 8% participatg. pref. shs. of £1 each and 250 000 4s. ord. shs. for which subscriptions were invited last week, was over-subscribed, and the list closed on Jan. 17.

COMMONWEALTH POWER CORPORATION.—Earngs. for year ended Nov. 30, 1928, $58 066 062, agst. $52 837 951. Amt. available for divs. $16 015 874. Qrtrly. divs. of 1½% on 6% pfd. stk. and 75 cents p. sh. on common shs., payable Feb. 1.

WESTERN UNION TELEGRAPH CO., INC.—Gross revs. for 1928, $139 244 596, agst. $134 460 816 for 1927. Deductg. total exes, $120 261 522, agst. $115 846 032, leaves $189 83 074, agst. $18 614 784, and after deductn. of int. on bonded debt, net income is $15 373 669, agst. $15 030 453.

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COMPANY REGISTRATIONS IN 1928.—Statistics compiled by Messrs. Jordan and Sons, Ltd., company registration agents, Chancery Lane, London, show that the total number of public and private companies registered in this country in 1928 was 9 012, with total cap. £220 506 126. Electricity, gas and water companies registered numbered 268, with total cap. £4 452 621.

AUSTRIAN POWER DEVELOPMENT.—Underwritg. took place on Tuesday of an issue of £2 000 000 6% sterling bonds to bearer of the Vorarlberger-Illwerke Aktiengesellschaft. The issue price has been fixed at 92%, giving a yield of £6 12s. 4d. per cent. Discount is to be allowed at 3% p.a. on paymts. in full. The lists were opened yesterday (Thursday). The co. proposes to erect two electric power stations to use the water power of the river Ell.

S. SMITH AND SONS (MOTOR ACCESSORIES), LTD.—In accordance with capital increase and rearrangmt. sanctioned at recent mtg., 50 000 new pfd. ord. shs. of £1 and 280 000 dfd. ord. shs. of 1s. (ranking for full year's div. for year beginng. Aug. 5, 1928, *pari passu* with existg. pfd. and dfd. ord. shs. respectively) are offered to existg. pfd. and dfd. ord. shhldrs. respectively in proportn. of one new sh. for every three shs. held. Pfd. ord. shs. are issued at 30s. p. sh., and dfd. ord. shs. at 3s. p. sh. In each case right of renunciation is given, and letters of right may be split (once only) up to Feb. 4.

Company Meetings.

HASLAM AND NEWTON, LTD.—Mr. J. H. Lord, presiding at the statutory meeting on January 15th, said the shares allotted for cash should have brought in £350 000, and they were now only £24 7s. 6d. short of that amount. The cash balance, about £33 000, and the investments, £15 500, brought them to a little in excess of the estimated amount of working capital mentioned in the prospectus, namely, £46 500. The investments were of a temporary nature, and would be realised before long. The Haslam side of the business had just entered into a contract for a period of years to supply a minimum of 100 complete refrigerator units weekly, on a fixed and satisfactory profit basis. Newton Bros. profits had exceeded the estimate made at the time of the issue. The works were busy, and profitably employed. Like all electrical engineers engaged on specialities, they looked forward to increasing turnover with satisfactory profits. Newton Bros., who had long been associated largely with British Government contracts, had secured a German Government contract for extra high tension direct current generator equipment, in which they specialised. There were certain further developments on the electrical side under consideration, but it would be unwise to refer to them more particularly at the moment, as no definite decision had yet been taken. Ford and Weston, Ltd., the subsidiary company referred to in the auditors' certificate in the prospectus, was a well-established and substantial building business in Derby. The work in hand was sufficient to occupy the energies of the company for some time to come.

WESTINGHOUSE BRAKE AND SAXBY SIGNAL CO., LTD.—Lord Southborough, presiding at the recent annual meeting, said the net profit for the year under review was £144 822, against £107 117. Their profits had benefited by the redemption of the first mortgage debentures, and in lieu of these they had now an arrangement with their bankers, who provided them with moneys required in connection with the business. Sales for the year showed a substantial increase, and the dividends from their associated companies were maintained. At the general meeting last year suggestions were made that the board should consider the question of presenting "a consolidated balance-sheet." The board were of the opinion that it was not wise, or opportune, to proceed with the project under the conditions which governed the constitutions of the company and its so-called subsidiaries. It was inadvisable for commercial reasons to disclose particulars of the accounts or profits of those companies in which the company was interested. The profits available, including £7 582 brought forward, amounted to £152 464. They had transferred £7 000 to depreciation reserve accounts for special displacements, and had transferred £20 000 to general reserve, making it £80 000. They recommended the payment of a dividend of 10%, less tax, against 8% last year, which would leave a balance of £13 227 to be carried forward. They, like other industries, were subject to the keenest competition. He believed that such good fortune as they had enjoyed sprang from the wise policy of their managing director in continually analysing methods of production for the purpose of adopting new and more scientific methods. The net figure of £172 839 at which plant and machinery appeared in their balance-sheet, represented only a few thousand pounds more than their actual expenditure on replacing, improving, and increasing their plant and machinery during the last six years. With regard to the question of the payment of an interim dividend, the board, for what they thought good and sufficient reasons, decided against it at the moment. They would reconsider the question next July.

New Companies.

ROTAPEX ELECTRIC CO., LTD.—Cap., £100. Electricians, engineers, etc. Reg. office: 62, Berners Street, London, W.1.

E. BARLOW (METAL WORKERS), LTD.—Cap., £1 000. Mechanical and electrical engineers, etc. Solicitors: Brett and Co., 24, Kennedy Street, Manchester.

WIRELESS SLOT MACHINES, LTD.—Cap., £100. Manufacturers of wireless, telegraphic and telephonic machines, etc. Reg. office: 3, London Wall Buildings, London, E.C.2.

HAYWARD AND SHEPHERD, LTD.—Cap., £500. Electricians, dealers in electrical appliances, etc. Solicitor: Ethel M. Dolbey, 29b, Holland Park Gardens, London, W.14.

PYE (CAMBRIDGE), LTD.—Cap., £100. Manufacturers of and dealers in wireless sets and apparatus, electrical appliances, radio engineers, etc. Solicitors: Bartlett and Gluckstein, 199, Piccadilly, London, W.1.

H.2.O VALVE, LTD.—Cap., £500. To adopt agreement with J. Bland for acquisition of his interest in patent No. 31 434/26, completed specification dated June 11th, 1928, and to carry on the business of electrical engineers, etc. Reg. office: 101, Dale Street, Liverpool.

STOTTS WIRE-COVERING MACHINES, LTD.—Cap., £2 000. To adopt agreement with Lottie Stott and N. Stott, to develop and turn to account business of inventor and producer of wire-covering machines carried on by said Lottie Stott at Sorrel Bank Works, Pendleton, Manchester, and to carry on business of manufacturers of and dealers in wire and materials for the insulation of wires or other electrical conductors, etc. Reg. office: 323, Bolton Road, Irlams-o' th'-Height, near Manchester.

ELECTRICAL TRADE MARKS.

This list has been specially compiled for us from official sources by GEE AND CO., Patents and Trade Mark Agents, 51 and 54, Chancery Lane, London, W.C. 2, from whom further information may be obtained.

B480 993. Class 4. Lighting carbons for electrical purposes, namely, projector carbons, arc light carbons, photographic carbons, forced carbons and searchlight carbons. National Carbon Co., Inc. (a corporation organised under the laws of the State of New York), 30, East Forty-second Street, City, County and State of New York, United States of America; manufacturers. May 25th, 1927. Address for service in the United Kingdom is, c/o Marks and Clerk, 57 and 58, Lincoln's Inn Fields, London, W.C.2.

SILENTNITE

496 853. Class 8. Component parts of wireless telephonic apparatus. John Wilson, 32, St. James' Road, Church, near Accrington, Lancashire; engineer. November 9th, 1928.

T.R.E.

496 891. Class 8. Wireless telephonic instruments and apparatus included in Class 8. James Dorn, 91, Charlotte Street, London, W.1; manufacturers. November 9th, 1928.

Registration of this Trade Mark shall give no right to the exclusive use of the letters "T. R. E."

Opposition to the registration of the following trade marks can be lodged up to February 9th.

488 993. Class 11. Electrical apparatus for aspiropulsative massage for surgical or curative purposes. Oreste Sinanide, 53, Sloan Street, London, S.W.1; medical practitioner. February 29th, 1928. (By Consent.)

Raifixa

BETA.—496 093. Class 13. Electric lamps (ordinary). John Wilson Naylor, 15, Whiteley Wood Road, Sheffield; manufacturer. October 18th, 1928.

TESA.—496 903. Class 8. Pocket lamp batteries and high tension batteries. PLAZA.—496 904. Class 8. Pocket lamp batteries and high tension batteries. E. H. Malsner and Co., Ltd., 4, Attneave Street, London, W.C.1; merchants. November 10th, 1928.

496 665. Class 13. Electric lamp fittings of ordinary metal. Harry Frederick Grinstead, trading as H. F. Grinstead, 1, Hills Place, Oxford Street, London, W.1; merchant. November 5th, 1928.

SPEEDIX.—496 247. Class 50. Fluid tight packings, jointings in the nature of packings and electrical insulating substances of asbestos, mica, resin, oils and bitumen. Dick's Asbestos Co., Ltd., Cory Buildings, 117, Fenchurch Street, London, E.C.3; manufacturers. October 23rd, 1928.

Opposition to the registration of the following trade marks can be lodged up to February 16th.

LISSEN.—493 682. Class 8. Wireless telephonic and telegraphic apparatus and parts thereof. Lissen, Ltd., Lissenium Works, Friars Lane, Richmond, Surrey; Manufacturers. July 28th, 1928. (To be Associated. Sect. 24.) Advertised before acceptance, the applicants alleging distinctiveness.

ELECTRAMONIC (sign).—492 387. Class 8. Gramophones and wireless telephonic instruments. The Electramonic Co., Ltd., Bear Gardens, Park Street, Southwark, London, S.E.1; manufacturers. June 14th, 1928. (To be Associated, Sect. 24.)

GIVRITE.—493 934. Class 8. Electrical resistances; high tension voltage cut-outs, rheostats and similar apparatus. Société Anonyme le Carbone, 37 and 42, Rue de Paris, Gennevilliers; manufacturers. August 9th, 1928. (Date claimed under International Convention, April 20th, 1928.)

AVONTONE.—497 105. Class 8. Sound reproducing instruments. Johnson and Co., 62, Wellington Road, St. Paul's, Bristol; cabinet makers. November 15th, 1928.

LEAD MARKET REPORT.

Whereas the lead market opened last week with an easier tone, James Forster and Co. state that by Tuesday prices were down to £21 15s. for January and £22 for April. Owing to the arrival of the Burma lead recently declared, the contango narrowed again to 3s. 9d. per ton against 8s. 9d. earlier in the month.

Closing prices on January 18th were £22 for January, £22 1s. 3d. for February, £22 2s. 6d. for March, and £22 3s. 9d. for April, 1s. 3d. to 5s. per ton lower on the week.

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Revolutionary Improvement in Switchgear

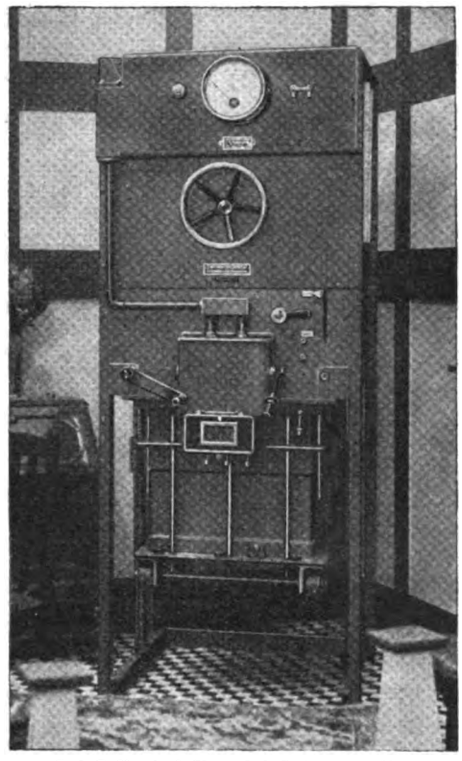
THE EVOLUTION OF A GREAT ACHIEVEMENT

As the first practical expression of the *Whitehead Principle of Isolation*, the cubicle shown here will occupy a position of great historical importance as the pioneer that led the way to a New Era in Switchgear.

THE first published description of the *Whitehead Principle of Isolation* appeared in May, 1928, to be followed by other articles and correspondence which disclosed the great interest taken in this notable advance in switchgear design.

A perusal of the recent issues of the technical Press will reveal that this ingenious invention has already influenced designers in the production of new types of switchgear.

But the essence of the *Whitehead Principle*, which is exclusive to S. & C. Switchgear, is to abolish the necessity for a movable circuit breaker in order to isolate the switchgear from the line. In present-day draw-out and drop-down gear the circuit breaker with all its components is suspended, and this unwieldy mass has to be moved (and correctly aligned again) when the switchgear is to be isolated for inspection or repair, a great complication merely to connect and disconnect six ½-inch or 1-inch plugs and sockets.



S. & C. Vertical Shrouded Switchgear Unit.
Cardiff Exhibition, November, 1928.

The *Whitehead Isolating Carriage* permits of the use of a normally fixed simple circuit breaker instead of the usual movable complicated circuit breaker. But British conservatism is difficult to move from accepted practice and present-day switchgear design cannot easily be dislodged from the trench where it is dug in.

Even S. & C. designers, at the outset, could not entirely break away from stereotyped forms, as will be seen from the illustration herewith of the first cubicle to be made embodying in a practical manner the *Whitehead Principle*.

This cubicle, however, was successful in demonstrating that the *Whitehead* innovation was of real practical value, fulfilling the claims for simplicity, compactness, complete protection, easy and accurate operation with the elimination of alignment troubles. But it also served to show the direction for further developments so that the great benefits of the *Whitehead Principle* would be utilised to the full.

The next step in the Evolution of S. & C. Vertical Shrouded Switchgear will be discussed in a succeeding advertisement.

SWITCHGEAR AND INDUCTION REGULATORS

SWITCHGEAR & COWANS LTD
Old Trafford Manchester

Masters of SwitchCraft

D.R.K. 170.

District Offices and Representatives throughout Great Britain and Overseas.

Telephones: 1107-1108 Trafford Park. Telegrams: "CONTROL, MANCHESTER." LONDON OFFICE: 28, Victoria Street, S.W.1

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COMMERCIAL INFORMATION.

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debt. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

BULLEN, A. G., AND CO., 79, West Walls, Carlisle, electrical engineers. £10 15s. 3d. November 13th.

FERGUSON, Archibald, 141, Slater Street, Warrington, manufacturer and electrical contractor. £22 16s. December 1st.

GARD, Mr. W., Bank Street, Coleford, electrical engineer. £18 6s. 1d. November 26th.

HARRIS (A. AND B.), LTD., 47, Victoria Street, S.W., electrical engineers. £11 4s. 9d. December 13th.

HONNORATY, Lawrence Reginald, Ryecroft, Wiggan Lane, Sheepridge, electrical agent. £13 10s. 7d. December 6th.

MACLEAN, Hector, 79A, High Street, Stockton-on-Tees, wireless dealer. £15 10s. 10d. November 27th.

MUTIMER, Charles William, 288, Upper Richmond Road, East Sheen, dealer in wireless. £27 4s. 1d. September 26th.

NEW WILSON ELECTRICAL MANUFACTURING CO., LTD., 65/66, Basinghall Street, E.C., electrical engineers. £20 6s. 1d. December 14th.

Mortgages.

[NOTE.—*The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—allowed by the date of the Summary, but such total may have been reduced.*]

ANTI-VIBRATION ELECTRIC LAMP CO., LTD., London, E.C.—Registered January 2nd, series of £3 000 debentures (of which £2 000 is already registered), together with bonus of 2 % on £1 000, present issue £500 and bonus; general charge. *——. December 14th, 1927.

BARNETT (C.), LTD., London, E., wireless accessory dealers.—Registered December 29th, series of £1 000 debentures, present issue £500; general charge.

Private Meetings, etc.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

MOHAWK RADIO, LTD., wireless dealers, 252, Fratton Road, Portsmouth. The statutory meeting of the creditors of the above was held last week at the offices of the Society of Incorporated Accountants, 50, Gresham Street, E.C. Mr. A. A. Reeves, I.A., of 2, Tyrrel Street, Bradford, the liquidator of the company, occupied the chair. The statement of affairs submitted showed ranking liabilities of £2,270, of which £813 was due to the trade and the balance to cash creditors. In addition, there was a fully secured creditor for £13, holding security valued at £50. The assets consisted of stock and trade marks £480, estimated to realise £230; book debts £39, expected to produce £35; furniture, fixtures and fittings, £59, valued at £50; plant in workshop £75, estimated to realise £60; and surplus from fully secured creditor, £37; making a total of £412. After allowing £20 for preferential claims, the net assets were £392, or a deficiency of £1 828. The estate showed approximately 3s. 6d. in the £. The liquidator stated that the principal cash creditor was Mr. T. O. Peet, who had advanced the company sums totalling £742, whilst Mrs. Peet had lent £300. The Mohawk Service and Fitting Station, Ltd., were also creditors for £356. The issued capital of the company was £800, all of which was fully paid.

The liquidator reported that the business was commenced in December, 1926, as the Mohawk Radio Co. During the half-year to June, 1927, the turnover was £936, with a gross profit at the rate of 45 per cent., and there was a net profit of £106. The company was registered on December 10th, 1927, but it took over the business as from June of that year. The consideration payable to the vendor in respect of the plant and stock transferred to the company was £797, and nothing was paid for the goodwill. During the year to June, 1928, the sales were £1 882, but the gross profit was only at the rate of 11%, and after allowing for all the expenses there was a net loss of £973. Since June of last year, the sales had only been £740, with a gross loss of £421 and a net loss of £1 270. No definite resolution was passed, but the opinion was expressed that the voluntary liquidation of the company should be continued with Mr. Reeves as liquidator.

London Gazette, etc.

Company Winding Up Voluntarily.

NEWTON BROTHERS (DERBY), LTD.—By special resolution, December 31st, confirmed January 15th. H. C. Waddington, of Greenhalgh, Sharp and Co., Trafalgar House, Waterloo Place, Pall Mall, London, S.W.1, incorporated accountant, appointed as liquidator.

Winding-up Petition.

COUNTY ELECTRICAL AND WIRELESS STORES, LTD. A petition for winding-up has been presented by County Electrical and Wireless Stores Ltd., Garrick Yard, St. Martin's Lane, London; and is to be heard at Royal Courts of Justice, Strand, London, on January 28th.

Bankruptcy Information.

BUCKLEY, Harry, 23, Asylum Road, Old Kent Road, S.E.15, electrician. Receiving order, January 15th. Creditor's petition. First meeting, January 28th, 12 noon, and public examination, February 20th, 11 a.m., Bankruptcy Buildings, Carey Street, London, W.C.2.

LAWRENCE, Henry Frederick, 43, Canterbury Road, Margate, Kent, electrical engineer. Receiving order, January 16th. Debtor's petition.

ROYSENTUL, Jacques, 45, Woodbury Grove, Finsbury Park, London, electrical engineer. Receiving order, January 17th. Creditor's petition. First meeting, January 30th, 12.30 p.m., and public examination, February 26th, 11 a.m., Bankruptcy Buildings, Carey Street, London, W.C.2.

Notice of Dividend.

HAMMOND, William Alexander, 31, Middle Street South, Great Driffield, Yorks, wireless dealer. First and final dividend, 10s. 8d. per £, payable January 25th, Official Receiver's office, 37, Scale Lane, Hull.

Notice of Intended Dividend.

JONES, Edward Denis, Royal Sportsman Hotel, Portmadoc, Carnarvon, electrical engineer. Last day for receiving proofs, February 2nd. Trustee, I. D. Hooson, St. Peter's Churchyard, The Cross, Chester, Official Receiver.

Partnerships Dissolved.

NELSON AND FLEET (John Henry NELSON and Sydney FLEET), electrical engineers, 38, Fylde Street, Preston, by mutual consent as from January 11th, 1929. Debts received and paid by S. Fleet, who will continue the business in his own name, at 38, Fylde Street, Preston. J. H. Nelson will continue the business under his own name, at 36, Ribble Bank Street, Preston.

SIMPSON BAKER AND CO. (Charles Montague SIMPSON and Arthur Campbell BAKER), electrical suppliers, 2 to 5, Nelson Street, and 32, Newman Street, Marylebone, London, by mutual consent as from December 31st, 1928. Debts received and paid by Simpson Baker and Co., Ltd., which company was incorporated on December 27th, 1928, and will continue the business at the same addresses.

Bankruptcy Proceedings.

MARCHANT, Charles Henry, 42, Ashdown Road, lately 9, South Street, Tarringboth, Worthing, Sussex, electrical engineer. The public examination of this debtor was held on January 16th, at the Court House, Church Street, Brighton. The debtor presented a statement of affairs showing liabilities of £887, against assets of £39, and he stated that he entered into a partnership with another in July, 1926. Each provided £60 capital, the debtor borrowing his share from his father. The business was a failure and the partnership was dissolved in 1927. The partners divided the stock between them, each receiving about £10 worth, and the partner took over the liabilities, amounting to about £5. In June of 1927 the debtor entered into an agreement with another, commencing as wireless and electrical engineers and dealers. Their joint capital was £60, of which the debtor provided two-fifths and his partner the balance. This business was not successful, and the partnership was dissolved in May, 1928, since which time the debtor had continued on his own account, but he had to discontinue after two months' time. He stated that he had removed £150 worth of stock to a store room, intending to return it to his creditors who supplied it, but it was sold by the High Bailiff. The examination was adjourned for closing.

WILSHAW, George Marshall, and SHARPE, George, trading as WILSHAW AND SHARPE, 320, Padiham Road, Burnley, Lancashire, electrical dealers. The public examination herein was held on January 15th at the County Court House, Bankhouse Street, Burnley. According to the statement of affairs returned by the debtors there were liabilities amounting to £763 and a deficiency of £516. Debtors attributed their failure to lack of capital and experimental work in wireless eliminators and loud speakers, which had not proved successful. They stated that they started business in April, 1925, with a capital of about £86, the conditions being that they should share the profits and losses equally. The business was fairly successful until March, 1928, but then the takings had fallen considerably. They stated they were aware of their position in July, 1928. The examination was adjourned.

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HACKBRIDGE
THERMAL RELAY

THE large number of enquiries we have received for these instruments would indicate that their application is not limited to Transformer Service.

They can be used wherever a critical temperature (between 50 and 120 degrees C.) is required to operate an auxiliary or external circuit, and our Research Dept. is prepared to advise and to carry out tests in any particular case.

Engineers are cordially invited to submit problems involving such conditions, and may accept our assurance of co-operation.

THE HACKBRIDGE ELECTRIC CONSTRUCTION COMPANY LTD
WALTON-ON-THAMES : : SURREY

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PATENT RECORD.

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Specifications Accepted.

293 683 RAINBOW LIGHT, INC. Argon-mercury discharge tubes. (9/7/27.)
303 082 H. J. ROUND. Thermionic valves. (23/9/27.)
302 976 RADIO INSTRUMENTS, LTD. AND G. W. HALE. Transformers for high-frequency electric circuits. (23/9/27.)
302 979 L. H. PETER and WESTINGHOUSE BRAKE AND SAXBY SIGNAL CO., LTD. Track-signalling systems for railways and the like. (24/9/27.)
303 040 BRITISH THOMSON-HOUSTON CO., LTD., and H. C. HASTINGS. Control of electrically-operated switches. (26/9/27.)
278 014 S. T. GASKIN. Reception and recording of electrical signals over cables or the like. (27/9/26.)
303 085 J. HOFMANN. Electromagnetic devices operated by alternating or oscillatory currents. (26/9/27.)
303 047 A. REYROLLE AND CO., LTD., and H. C. ATKINS. Balanced electric protective systems. (27/9/27.)
303 048 BRITISH THOMSON-HOUSTON CO., LTD., and H. DREGHORN. Electric motors. (27/9/27.)
303 051 A. REYROLLE AND CO., LTD., J. MIRREY, and A. ALLAN. Electric circuit-breakers or switches. (27/9/27.)
303 086 S. G. S. DICKER (ASSOCIATED TELEPHONE AND TELEGRAPH CO.). Automatic or semi-automatic telephone systems. (27/9/27.)
279 058 ASSOCIATED TELEPHONE AND TELEGRAPH CO. Telephone systems. (18/10/26.)
303 090 A. REYROLLE AND CO., LTD., R. H. BRIERLY, YORKSHIRE SWITCHGEAR AND ENGINEERING CO., LTD., W. H. ISHERWOOD, and R. T. NORTON. Electric fusible cut-outs. (28/9/27.)
303 195 ENGLISH ELECTRIC CO., LTD., A. M. POOLEY, and A. A. HEATH. Means for interlocking doors or lids of chambers or boxes applicable for enclosing electric switchgear and other apparatus. (29/9/27.)
278 746 ASSOCIATED TELEPHONE AND TELEGRAPH CO. Remote-control of electric-power sub-stations. (11/10/26.)
303 221 BRITISH THOMSON-HOUSTON CO., LTD., J. G. WELLINGS, and C. G. MAYO. Electric protective arrangements. (8/10/27.)
303 222 A. IMBERY. Electric furnaces for heat treatment and forging. (10/10/27.)
303 224 J. NEALE. Means for effectively actuating light-sensitive cells during mist or white fog. (12/10/27.)
303 225 J. BATHGATE. Electric junction-box and switch. (14/10/27.)
303 242 W. H. ILLINGWORTH and B. BELL. Electric circuit-breakers. (4/11/27.)
303 247 SIEMENS ELECTRIC LAMPS AND SUPPLIES, LTD., and R. SIVYER. Shade-supporting arrangements for electric lamps. (15/11/27.)
289 762 VEREINIGTE GLUHLAMPEN UND ELEKTRICITATS AKT.-GES. Process for the manufacture of cathodes for electric discharge tubes. (30/4/27.)
303 253 ELECTRICAL IMPROVEMENTS, LTD., and H. B. POYNDER. Thermo-electrically-operated devices for the protection of rotary machines. (29/11/27.)
303 259 F. SMITH. Methods of and apparatus for starting squirrel-cage motors. (2/12/27.)
282 741 BRITISH THOMSON-HOUSTON CO., LTD. Electric furnaces. (29/12/26.)
303 267 RELAY AUTOMATIC TELEPHONE CO., LTD., B. B. JOHNSON, and T. M. INMAN. Junction working between exchanges in telephone systems comprising automatic exchanges. (30/12/27.)
303 301 K. ARMIN. Electric cooking or heating appliance with time-switch device. (12/3/28.)
303 053 A. E. SPENCER, P. H. WALLER, and GENERAL ENGINEERING DEVELOPMENT TRUST, LTD. Electric lighting system. (27/8/27.)
303 312 H. COVILL and R. SUFFLING. Safety device for overhead contact-arms, as applied to tramcars, rail-less electric cars, and the like. (30/3/28.)
303 317 A. E. WHITE (T. R. PALMER). Electric-battery containers. (16/4/28.)
303 320 G. W. JOHNSON (NAAMLOOZE VENNOOTSCHAP W. SMIT EN CO.'S TRANSFORMATORENFABRIEK). Electrical transformers. (23/4/28.)
292 993 BRITISH THOMSON-HOUSTON CO., LTD. Electric signal and control systems. (29/6/27.)
299 762 FELTEN AND GUILLEAUME CARLSWERK AKT.-GES. Submarine cables. (31/10/27.)
294 931 J. E. G. LAHOUSSE. Insulating-material for electric condensers and the like. (1/8/27.)
293 456 BRITISH THOMSON-HOUSTON CO., LTD. Glass-forming machines. (8/7/27.)
303 079 C. R. BURCH, F. E. BANCROFT, and METROPOLITAN-VICKERS ELECTRICAL CO., LTD. Vacuum distillation. (21/9/27.)

Application for Patents.

December 17th.

37 248 BRITISH THOMSON-HOUSTON CO., LTD. Alternating current motors. (22/12/27, U.S.)
37 256 C. CHILOWSKY and A. KOULIKOFF. Measurement of distances by electro-magnetic waves. (15/12/27, France.)
37 193 G. P. COOPER, J. W. HINCHLEY, and J. W. THOMPSON. Bleaching molasses by electrolytic treatment.
37 242 E. H. CROFT and GENERAL ELECTRIC CO., LTD. Motor control systems.
37 250 S. G. S. DICKER (N. V. PHILIPS' GLOEILAMPENFABRIEKEN.) Directing sound.
37 229 J. S. ERICSSON. Electric lighting systems for motor vehicles.
37 264 C. FRENCH. Electric horns.
37 265 C. FRENCH. Loud speakers.
37 642 GENERAL ELECTRIC CO., LTD. Arc lamps.
37 277 IDEAL WERKE AKT.-GES. FUR DRAHTLOSE TELEGRAPHIE. Thermionic tube circuits. (2/7/28, Germany.)
37 245 INTERNATIONAL GENERAL ELECTRIC CO., INC. Dynamo-electric machines. (21/12/27, Germany.)
37 177 W. H. H. MASSY. Television, etc., apparatus.
37 235 F. A. ROBINSON. Holder for thermionic valves.
37 204 R. SCHMITZ. Electric furnaces. (16/12/27, Germany.)

December 18th.

37 327 J. E. ALLAN. Motor control.
37 317 G. A. BIRCH and F. A. MULLEY. Electric light for gramophones.
37 421 BRITISH THOMSON-HOUSTON CO., LTD. Electric switches. (22/12/27, U.S.)
37 422 BRITISH THOMSON-HOUSTON CO., LTD. Furnaces.
37 381, 37 382 A. E. CHAPMAN and J. VIELLE. Electric discharge tubes.
37 315 T. COATES. Electric signal indicator for motor vehicles.
37 428 T. LANDI. Vapour lamps. (23/1/28, France.)
37 373 W. MACKIE AND CO., LTD., and J. ROOK. Dynamo-electric machines.
37 414 MASCHINENFABRIK OERLIKON. Arrangement for converting electric current. (23/12/27, Switzerland.)
37 337 F. MOUSLEY. Mouthpieces for telephones, etc.
37 318 C. PRESSLAND. Adaptor for testing wireless valve sets.
37 438 A. M. TAYLOR. Electrical power transmission.

December 19th.

37 352, 37 353 ASSOCIATED TELEPHONE AND TELEGRAPH CO. Telephone instruments. (20/12/27, Belgium.)
37 534 AUTOMATIC TELEPHONE MANUFACTURING CO., LTD., and T. BLASHILL. Electromagnetic relays.
37 544, 37 557 CLAUDE NEON LIGHTS, INC. Electric discharge tubes. (19/12/27, U.S.)
37 459 S. O. COWPER-COLES. Recording and transmitting sound waves.
37 460 S. O. COWPER-COLES. Electrodeposition of metals.
37 443 J. GRAINGER. Portable wireless receiver sets.
37 580 K. A. HAWLEY. Conductor clamps. (23/12/27, U.S.)
37 475, 37 476 J. H. HEWITT. Operating mechanism for electric condensers, etc.
37 582 E. J. LEVER (TRIX), LTD., and D. A. LYONS. Portable wireless receiving sets.
37 472 W. MCGEE AND SON, LTD., and G. S. YOUNG. Cooling arrangements of dynamo-electric machines.
37 540 G. MAIN. Incandescent electric lamps. (23/12/27, France.)
37 467 METROPOLITAN-VICKERS ELECTRICAL CO., LTD., and E. Y ROBINSON. Vacuum electric tube devices.
37 543 METROPOLITAN-VICKERS ELECTRICAL CO., LTD. Vacuum distillation.
37 576 MULLARD RADIO VALVE CO., LTD., and P. W. S. VALENTINE. Microphones.
37 441 G. H. NEEP and SWITCHGEAR AND COWANS, LTD. Electrical switchgear.
37 561, 37 562 Y. OKAMOTO. Printing telegraphs.
37 539 RECORD ELECTRICAL CO., LTD., and J. W. RECORD. Means for retarding action of electrical apparatus.
37 489 REES MACE MANUFACTURING CO., LTD., and K.S.S. SPENCER. Loud speakers.
37 490 REES MACE MANUFACTURING CO., LTD., and K.S.S. SPENCER. Radio receiving sets.
37 491 REES MACE MANUFACTURING CO., LTD., and K.S.S. SPENCER. Radio circuits.
37 235 F. A. ROBINSON. Holder for thermionic valves.
37 503 J. ROBINSON. Electrical systems for transmission of pictures, etc.
37 586 F. S. S. WATES. Electrical batteries.
37 587 F. S. S. WATES. Electric battery connectors, etc.

December 20th.

37 639 H. F. ANNS. Shades for electric lamps.
37 719 J. H. BAKER and T. S. SKILLMAN. Telephone systems.
37 618 BRITISH INSULATED CABLES LTD., and J. N. CRESSWELL. Sealing devices for electric cables, etc.
37 702 BRITISH THOMSON-HOUSTON CO., LTD. Synchronous inductor frequency changers. (24/12/27, U.S.)
37 703 BRITISH THOMSON-HOUSTON CO., LTD. Governing mechanisms for turbine-driven sets. (24/12/27, U.S.)
37 602 H. F. CARR. Obtaining electrical supply for wireless receivers.
37 694 H. C. CHANNON, H. J. GARNETT, and W. S. SMITH. Manufacture of continuously loaded conductors.
37 695 H. C. CHANNON, J. N. DEAN, and H. J. GARNETT. Submarine cables, etc.
37 680 O. FULTON. Electric reception of pictures, etc.
37 643 GENERAL ELECTRIC CO., LTD., and C. H. NUNN. Changing of transformers.
37 644 GENERAL ELECTRIC CO., LTD., and R. J. KAULA. Electric coupling elements.
37 608 H. HILTON. Electric insulators.

COMING EVENTS.

Friday, January 25th (To-day).

ENGINEERING AND SCIENTIFIC CLUB (WOLVERHAMPTON).—Debate on "Trams *versus* 'Buses." Opened by Mr. A. C. Baker and Mr. C. Owen Silvers.

INSTITUTION OF ELECTRICAL ENGINEERS (IRISH CENTRE).—Gaiety Theatre, Dublin. Faraday Lecture by Mr. Ll. B. Atkinson on "How Electricity Does Things." 4 *p.m.*

PHYSICAL SOCIETY.—Imperial College of Science, Imperial Institute Road, South Kensington. Papers by Prof. G. Vernon Boys on a "Fused Quartz Pendulum Rod for Clocks"; Mr. G. W. Sutton on "A Method for the Determination of the Equivalent Resistance of Air-Condensers at High Frequencies"; and Mr. L. Hartshorn on "The Measurement of the Anode Circuit Impedances and Mutual Conductances of Thermionic Valves." 5 *p.m.*

BIRMINGHAM ELECTRIC CLUB.—Grand Hotel, Colmore Row, Birmingham. Presidential Address. 7 *p.m.*

Monday, January 28th.

ELECTRICAL CONTRACTORS' ASSOCIATION (EALING SUB-BRANCH).—Ordinary meeting.

INSTITUTION OF ELECTRICAL ENGINEERS (WESTERN CENTRE).—Bristol. Faraday Lecture by Mr. Ll. B. Atkinson on "How Electricity Does Things."

INSTITUTION OF ELECTRICAL ENGINEERS.—Institution, Savoy Place, Victoria Embankment, London. Informal meeting. Discussion on "Mains Testing." (Opened by Mr. F. C. Raphael.) 7 *p.m.*

INSTITUTION OF ELECTRICAL ENGINEERS (NORTH-EASTERN CENTRE).—Armstrong College, Newcastle-on-Tyne. Paper by Mr. J. L. Carr on "Recent Developments in Electricity Meters, with particular reference to those for special purposes." 7 *p.m.*

ROYAL SOCIETY OF ARTS.—John Street, Adelphi, London. Cantor Lecture (II) by Dr. C. H. Lander on "The Treatment of Coal." 8 *p.m.*

Tuesday, January 29th.

INSTITUTION OF ELECTRICAL ENGINEERS (TEES-SIDE SUB-CENTRE).—Grand Hotel, Middlesbrough. Annual Dinner.

ELECTRICAL CONTRACTORS' ASSOCIATION (BIRMINGHAM BRANCH).—Ordinary meeting.

INSTITUTION OF ENGINEERING INSPECTION,—Royal Society of Arts, John Street, Adelphi, London. Paper by Mr. B. P. Dudding on "Errors in Testing Bulk Supply by Random Selection." 5.30 *p.m.*

INSTITUTION OF ELECTRICAL ENGINEERS (NORTH MIDLAND CENTRE).—Hotel Metropole, King Street, Leeds. Paper by Messrs. Johnstone Wright and C. W. Marshall on "The Construction of the Grid Transmission System in Great Britain." 7 *p.m.*

SCHOOL OF ENGINEERING AND NAVIGATION.—High Street, Poplar. Lecture II (Course of five lectures) by Mr. H. Brazil, on "Electrical Sub-Stations." 7 *p.m.*

INSTITUTION OF ELECTRICAL ENGINEERS (SCOTTISH CENTRE).—North British Station Hotel, Edinburgh. Informal meeting. Paper by Mr. E. Seddon on "Recent Extensions to Portobello Power Station." 7 *p.m.*

ELECTRICAL ASSOCIATION FOR WOMEN.—E.L.M.A. Lighting Service Bureau, 15, Savoy Street, Strand, London. Lecture by Mr. F. W. Purse on "How Electricity is Generated." 7 *p.m.*

Wednesday, January 30th.

ELECTRICAL ASSOCIATION FOR WOMEN.—46, Kensington Court, London. Socia Sub-Committee special "At Home." 3 *p.m.*

ELECTRICAL CONTRACTORS' ASSOCIATION (BELFAST BRANCH).—5, Bedford Street. Ordinary meeting. 3.30 *p.m.*

ELECTRICAL ASSOCIATION FOR WOMEN (MANCHESTER BRANCH.)—Lighting Service Bureau, 4, Fountain Street. Lecture by Mr. A. P. M. Fleming on "Milestones in the Progress of Electricity." 7.30 *p.m.*

ROYAL SOCIETY OF ARTS.—John Street, Adelphi, London. Paper by Mr. G. Fletcher on "The Shannon Scheme and Its Economic Consequences." 8 *p.m.*

Thursday, January 31st.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle Street, London. Lecture by Sir William Bragg on "The Early Evolution of X-Rays." 5.15 *p.m.*

INSTITUTE OF PATENTEES.—Caxton Hall, Westminster. Lecture by Mr. W. J. Dow on "Inventors, Their Failings and Troubles." 8 *p.m.*

Friday, February 1st.

INSTITUTION OF ELECTRICAL ENGINEERS (METER AND INSTRUMENT SECTION).—Institution, Savoy Place, Victoria Embankment, London. Paper by Mr. J. L. Carr on "Recent Developments in Electricity Meters, with particular reference to those for special purposes." 7 *p.m.*

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THE ELECTRICIAN

Established 1861. The Oldest Weekly Illustrated Journal of

Electrical Engineering, Industry, Science and Finance.

Bouverie House, Fleet Street, London, E.C.4. Telegrams: "Benbrotric, Fleet, London." Telephone: City 0244 (Ten lines).

No. 2644. [No. 3. Vol. CII.] Friday, February 1, 1929. Annual Subscription, 25s. Overseas, 30s.

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Current Topics.

Anticipating Demand.

SINCE attention was drawn, in two recent I.E.E. papers and in a note in these columns, to the importance of economics in engineering—in other words, the economical application of science to engineering problems—signs have not been lacking of a concentration of interest on this fundamentally important matter, which augurs well for the progressive development of the industry. Expansion, particularly of electricity supply plant and networks, has for so long proceeded for the most part on casual lines, with "rule-of-thumb" as the only approximate guide, that it is at first a little difficult to conceive that there can be a more economical way of achieving comparable results. Take, as a broad hypothetical example, an engineer faced with the need to erect a new generating station. He knows of a site which is cheap so far as the land is concerned, and he knows that ample water supplies and railway sidings are in close proximity. It would seem that this was obviously the right spot. But—and there is usually a "but" in these schemes—the portion of the supply area in which intense activity prevails in the erection of new factories and dwellings is situated several miles from the proposed station, and further consideration suggests that future development will continue in the direction of the supply authority's boundary. It may well be that the cost of taking a supply to this outlying portion of the area may be so great as to counterbalance any expected economies envisaged in the original station site, and the possibility of using the same water at a different place, and so extending the existing, or utilising alternative connections with the railway system may be worthy of consideration. Even here, however, little is to be gained by looking at initial cost; the present value of all the annual charges (i.e., interest on capital, maintenance and depreciation) spread over the years of potential use is the only reliable measure, and when such studies take every factor into consideration, and include every possible alternative, it is no difficult matter to arrive at an economically sound conclusion. The basic principle appears so ridiculously simple that it might be wondered why anybody should waste time on efforts to elucidate the obvious. Examination of a concrete example soon shows, however, that an arrangement which judgment considers to be best is frequently not so good when viewed from the strictly economic standpoint. The methods devised by the Post Office for developing telephone areas on economic lines, as explained by Capt. J. G. HINES in his recent I.E.E. paper, are worthy of careful study, and it is interesting to note from an article on a later page of this issue that very similar methods are being used in Sweden for the planning of electricity supply in new districts.

The Dazzle Problem.

IT is difficult to understand why the problem of avoiding glare for motorists' headlights has not yet been tackled in a proper co-ordinated manner. Of swivelling devices, and methods based on the partial obscuration of the light emission of lamps used in headlights, there are literally scores upon the market, and a new development for which remarkable claims are made will shortly make its commercial début. But even if we assume the existence of a perfect motor-car headlight, and, further, that it is quickly adopted by public-spirited road users, this well-intentioned minority will still be at the mercy of the glare fiends, though with the important difference that they will be unable to take retaliatory steps against approaching offenders. As so many safety requirements in the road transport field have been compulsorily imposed after the elapse of a suitable period of notice, it should be perfectly easy for official notice to be given requiring the adoption within a period of, say, six months, of some anti-dazzle headlight of approved pattern. The possibility of giving undue preference to any particular type of appliance would be avoided by the establishment of a "permitted" list similar to that which operates in connection with electric safety lamps for use in mines.

The British Industries Fair.

FROM the advance information we are receiving from day to day, we gather from those firms who are showing in the Electrical Section of the British Industries Fair, at Castle Bromwich, that the exhibits are practically ready for dispatching to the stands. Further, though there are still two weeks to pass before the opening of the Fair, the enthusiasm of the exhibitors is such that the arrangements for showing the various equipments are already decided upon. Those members of the industry who have visited the Fair in previous years—and who has not?—will this year find the stands at Castle Bromwich to be in alignment from end to end as well as from side to side,

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thus permitting direct approach to any particular stand from any position. This arrangement has dispensed with the classified buildings of "A," "B" and "C," and allows of each aisle being lettered and divided into "group" stand numbers, each group number being sub-divided. Another interesting point is that the Electrical Section this year occupies nearly twenty-five per cent. of the whole exhibition. It may also be of interest to those who intend visiting the Fair that there will be a continuous passenger service of petrol-driven cars running the entire distance of the south side of the Fair. The utility of the innovation is unquestioned, but it would have been excellent electrical propaganda to have employed a few electric battery driven vehicles for this purpose. Perhaps it is not even now too late for the change to be made.

Pulverised Fuel Developments.

ANNOUNCEMENTS made by and about the new company which has been formed, with Sir ROBERT HORNE as chairman, to exploit and develop a promising system of burning pulverised fuel for steam raising purposes, serve to renew interest in a perennially controversial subject amongst power-station engineers. The employment of pulverised fuel installations in British central stations has certainly been increasing, but not at anything like the rate that some early enthusiasts predicted. The number and importance of the new stations opened last year in which coal and chain grate stokers were still preferred suggests that a by no means insignificant school of thought in the power-station world is still awaiting the further development of pulverised fuel operation which the formation of this new company may not unreasonably be expected to presage.

The Brown-Lektophone Case.

THE judgment in favour of S. G. BROWN, LTD., in the loudspeaker patent litigation which has been proceeding in the Law Courts for some weeks, will doubtless create something approaching a stir in the radio manufacturing industry. Details of the findings of Mr. JUSTICE TOMLIN are given elsewhere in this issue, and a point of interest outside the legal aspect of the case is found in the fact that in his Lordship's opinion Mr. M. C. HOPKINS confined his specification to instruments which produced vibration by the movement of a stylus over a record. In view of the year of the granting of this patent, namely 1914, we are once again reminded of the apparent close association between the gramophone and radio industries, as opposed to the anticipated competition when broadcasting started in 1922–23, in both America and this country. Since then we have seen increased sales in gramophones as a result of radio; many expensive gramophone-radio combination sets have been put on the market; and the majority of the better-class gramophones incorporate moving-coil loud speakers. The latest development along these lines is the merger between the RADIO CORPORATION OF AMERICA and the VICTOR TALKING MACHINE CO., possibly the two biggest organisations in America in their own classes. Both the radio and gramophone industries may now be regarded as of electrical interest, for the two together will, in the words of Mr. DAVID SARNOFF, give better service to a single art—electrical entertainment.

Marine Electrical Progress.

IT will be apparent to those who have followed the recent developments in electric ship propulsion that after a period of stagnation this important application of electricity on board ship is now showing very distinct signs of liveliness. For auxiliary purposes electricity has very naturally come to be regarded as the standard power producer for most types of modern vessel, and it is gratifying to find that British electrical firms are securing much useful business in this field. The revival of interest in electric propulsion dates from the decision of the P. & O. Line to adopt the turbo-electric drive for the new 19 500 tons "Viceroy of India," shortly to be placed in commission. Still more noteworthy, and of particular interest from the engineering point of view, is the confirmation of the forecast, made in our issue of November 16th last, that the new 60 000 tons White Star liner "Super-Olympic," now on the stocks at Belfast and destined to be the world's largest ship, will be a Diesel-electric ship. Consideration of her mammoth proportions and the type of propulsive machinery to be adopted clearly indicates that in many ways the new vessel will be designed on lines very different from anything that has been done before. Developing something approaching 180 000 S.H.P., she will require to have a large number—probably twenty—Diesel engines. This will mean a 4-shaft arrangement, with a power distribution of 45 000 H.P. per shaft, and splitting this up between, say, six motors per shaft, each motor will be required to develop 7 500 H.P. The Diesel engines are to be arranged on two levels, and this novel layout will entail entirely new designs for many of the features which have been more or less standardised on existing ships. It is hoped later to deal with some of the interesting new problems that will arise in the construction of the "Super-Olympic," but for the moment it is important that the electrical industry should realise that this great ship will rivet the attention of the world on electric propulsion, and will directly influence emulative building. Already there are strong rumours abroad that the Cunard Line will not long delay the ordering of an electric ship of large proportions.

Cabling to Singapore.

RECENT developments in wireless telegraphy have so fired the public interest that cable telegraphy has come to be regarded by the man-in-the-street as an antiquated and obsolescent means of communication. A timely corrective is contained in the announcement of a test carried out on Monday at the London offices of the Eastern Extension Co., of the efficiency of the new direct cable service to Singapore, which makes it possible to send messages a distance of 10 521 miles in 1·2 sec. It is not so long since a message to Singapore took approximately ten hours, and even in recent years half an hour was considered good. Under the new arrangements the message is automatically relayed through eleven other stations, including Gibraltar, Malta, Alexandria, Suez, Port Sudan, Aden, Colombo, and far-distant Penang.

Colour and Its Applications.

THE paper read by Dr. L. C. MARTIN at the last meeting of the Illuminating Engineering Society, dealt mainly with the scientific principles underlying the application of coloured light, and a number of delightful experiments, executed by Mr. C. F. SMITH with the aid of the "mutochrome" apparatus, illustrated the phenomena of colour-harmonies, colour-contrasts, spatial induction, etc. The discussion turned to a great extent on applications of artificial daylight—both in the form desirable for accurate colour-matching and in the modified type of unit for general use. Dr. MARTIN pointed out—what many people are apt to overlook—how great a part the peculiarities of the eye play in the matching of colours. Results may depend very largely on the degree of luminosity and the region of the retina used. For this reason the demands for accuracy of reproduction of "normal daylight" made by dyers and others are apt to be excessive. In any case, extreme accuracy can only be attained when we have decided on our standard of "white light." The provisional standard mentioned by Dr. MARTIN—based on the use of an electric incandescent lamp, under standard conditions, and equipped with a blue solution-filter—seems to be a practical device, and it was interesting to hear that the framing of a standard specification for artificial daylight units is now considered feasible. We gather that there is still some doubt regarding the explanation of the alleged better visual conditions obtained with a modified form of artificial daylight as compared with uncorrected light. There does seem some justification for the belief that this hue is more restful. However, as several speakers pointed out, this form of unit cannot become really popular if the psychological effect is considered "cold."

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ANTICIPATION OF ELECTRICAL LOAD IN RESIDENTIAL AREAS.*

Forecasting Future Load in Terms of Time and Expansion—Studies in a Large Area—Important Economic Factors—Distribution Problems.

By ALFRED EKSTROEM, D.Sc., M.I.E.E.

IT is interesting to note that in England practically the same methods are utilised for developing a fresh telephone area as are used in Sweden for projecting an electricity supply for new districts. I have lately had the opportunity of seeing how much all work of this description in England is facilitated by the existing excellent 25 in. Ordnance Survey maps. Capt. J. M. Donaldson in his paper read before the I.E.E. last month dealt with a very important matter for an electricity supply undertaking, viz., the forecasting of the future electrical load in terms of time and expansion, and also the necessity for a flexible distribution system.

As regards flexibility, I fully agree with his recommendation of an intermediate pressure of 3 300 V, although there may be cases where an increase to 6 600 V might be preferable; at the same time the pressure of 11 000 V might also be economically increased up to 22 000 or 33 000 V.

Capt. Donaldson made a survey of several existing plants in suburban and rural areas and showed a maximum demand at main transforming centres per consumer of 0·578 kW as an average for domestic and power load. If we consider only the domestic part of the load this figure will be reduced to between 0·3 and 0·5 kW. In such a case it can easily be shown what number of units can be supplied to the consumer.

The price per unit of the energy supplied being of fundamental importance, it might be opportune also to quote some figures from a scheme for a large area in England which I have lately had an opportunity of studying thoroughly.

Light and Sundry Domestic Appliances.

The average maximum load per consumer was here taken at 0·5 kW at main transforming centres.

If we assume a load factor of about 17% (1 500 hours utilisation of the maximum demand) it is possible to transmit 0·5 kW × 1 500 hrs. = 750 kWh annually to each consumer.

The first cost for complete distribution plant in this case from the "grid" to the switchgear of the consumer amounted to £22 per consumer requiring a maximum demand of 0·5 kW. The resulting energy price charged at the consumer's terminals, according to his consumption in the instances given below are based on the assumption that a bulk supply is received from the national 33 000 V network at a cost of £3 10s. per kW + 0·23d. per kWh.

With this energy we could heat about 10 gallons of water per day from 50 to 185° F., on the assumption of a thermal storage system with an efficiency of 70%. For a family of 6 persons this amounts to 1½ gallon per person per day, which should well meet the requirements of the average kitchen and scullery.

By introducing automatic thermal storage tanks on the consumers' premises in combination with a suitable control system by the electricity supply undertaking, we would thus be able to give a considerably increased supply with the same distribution plant. Moreover, this increase of about 250% in transmitted energy can be supplied at a very low price. Excluding the necessary "change-circuit" system equipment, there are no increased costs for the distribution plant. The peak load of the power station also is not increased. It might therefore be quite reasonable in this case to sell this energy at a price not exceeding ½d. per kWh.

Cooking.

If we also wish to supply electric cooking on a large scale it is necessary considerably to increase the distribution plant originally designed for the above-mentioned maximum load of 0·5 kW per consumer. Indeed, it must be constructed so as to enable a transmission of an *additional* 1 kW per consumer. Experience has shown that for electric cooking a load factor of about 25% (2 000 hours) is attained.

For an additional maximum demand of 1 kWh per consumer we can thus transmit 1 kW × 2 000 hrs. = 2 000 kWh annually per consumer.

For cooking one generally assumes 1 kWh per person per day. These 2 000 kWh will therefore be sufficient for a family of 6 persons (6 kWh × 360 days = 2 160 kWh).

In the above-mentioned example the increase of the original plant so as to enable an additional maximum demand of 1 kW necessitated an additional cost of £15 per consumer. This resulted in a price of about 1d. per kWh to the consumer, allowing sufficient interest and sinking fund for the additional in vested capital, as well as providing for upkeep, management and energy supplied from the National grid.

In fact, as the peak loads of cooking and lighting, etc., are not quite simultaneous a certain diversity factor will arise, reducing the above-mentioned necessary additional maximum demand of 1 kWh, which will improve the economical result in favour of cooking.

It is obvious that at the same time an increase of the hot water supply is rendered possible by thermal storage arrangements up to twice that stated in the first instance, which will be sufficient for covering the consumption of energy for sinks, lavatory basins and baths at a price not exceeding ½d. per kWh.

By taking into account also the load factor of the industrial demand, obviously the amount of current available for the hot-water supply can also be increased.

TABLE.

Consumer's average consumption in units (kWh) per annum	200	250	300	400	500	600	750
Consumption per person per annum in units (kWh) (1 consumer = 6 persons)	33	42	50*	67	83	100	125
Load factor at main transforming centre in %	13·9	13·9	15·0	15·0	16·2	16·2	17·4
Equivalent hours use at maximum demand	1200	1200	1300	1300	1400	1400	1500
Consumer's part of maximum load at main transforming centre in kW	0·17	0·21	0·23	0·31	0·36	0·43	0·5
At £3/10/0 + 25 % losses	£0/15/6	0/19/4	1/1/5	1/8/7	1/13/2	1/19/9	2/6/6
Consumed units (kWh) at 0·23d. + 25% losses	£0/5/1	0/6/4	0/7/8	0/10/3	0/12/9	0/15/4	0/19/2
Cost for distribution: Interest 8% on invested capital at £22; Sinking Fund 3% ditto; Management, etc., 5% ditto; Total, 16% ditto	£3/10/5	3/10/5	3/10/5	3/10/5	3/10/5	3/10/5	3/10/5
Total cost per consumer	£4/11/0	4/16/1	4/19/6	5/9/3	5/16/4	6/5/8	6/16/0
Consumer's total cost per consumed unit (kWh) in pence	5·5	4·6	4·0	3·3	2·8	2·5	2·2

* Corresponding to an abundant consumption of light only.

The quantity of possible supply in this table is sufficient for a domestic load, including lighting, ironing, vacuum cleaning, and small electrical devices, though it is *not* sufficient for water-heating, cooking and room heating. Moreover, the resulting prices per unit are very moderate for this class of consumption.

Water-Heating.

By increasing the load factor we could, however, dispose of a considerably higher quantity of energy. If we assume an increase of the load factor of 46% (4 000 hours' use) we could transmit an additional quantity of 0·5 kW × 4 000 hrs. = 2 000 kWh annually to each consumer.

Electric Heating of Rooms.

Electric heating of rooms which are used occasionally, or for more specialised purposes which will not increase the peak load of lighting, etc., and cooking make a very desirable con-

* Including points raised in a contribution to the discussion on a paper read by Capt. J. M. Donaldson before the I.E.E. on January 10th, 1929.

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sumption. I may mention the use of radiant heaters in offices and sitting rooms for heating during spring and autumn, in bathrooms for heating just before taking a bath, in bedrooms which in England usually have no permanent heating arrangements, for keeping the persons warm while dressing or undressing, or for warming the bed before going to bed, or for drying the underwear.

In all these cases a remunerative and useful electricity supply of quite exceptional dimensions is possible, favoured by England's mild island-climate and by English habits and hygiene. A charge for electricity for this purpose of up to 1d. per kWh might also be quite reasonable as long as no, or only a slight, increase in plant is called for.

The continuous heating of a house—as in the all-electric house—is a more complicated problem, as this introduces the peak load factor.

During the coldest days in the winter the electrical energy required for this purpose is very considerable, the assumed capacity of the distribution plant (about 1½ kW per consumer) being entirely taken up with domestic use other than room heating. The autumn and spring demand is less, while the summer demand is practically zero. The resulting load factor will be at the very maximum 10% (1 000 hours' use).

A diversity between permanent heating of this kind on the one hand and lighting, etc., and cooking on the other, cannot here be assumed, as many times during the cold season the peak load of these two kinds of consumption must undoubtedly coincide. In this case the heating must therefore of necessity pay its full share of the costs of the increase of the necessary distribution plant as well as of the peak load.

It is, however, obvious that already the costs of energy for a bulk supply from the national grid (assumed at £3 10s. + 0·23d. per kWh) will result in a price of more than 1d. per kWh excluding the costs for increase in the capacity of the distribution plant.

The alternative methods for an economical supply of this kind must therefore be :—

(*a*) Either that another adequate load should arise during the warmer seasons (i.e., refrigeration) which could pay the cost for the transmission plant (interest, sinking fund, management and upkeep) as well as one part of the standing energy cost (£3 10s.) of the bulk supply.

(*b*) Or that thermal storage arrangements should be carried out so that a considerable part of this load could be changed over to the off-peak time.

Conclusions.

From the foregoing comments it will be seen :—

(1) That a suitably dimensioned distribution plant is of fundamental importance for the development of an electricity supply undertaking, as well as for the price for which energy can be supplied.

(2) That a suitable " change-circuit " system may be exceedingly valuable for a domestic hot-water supply. The price of energy for this purpose ought not to exceed ½d. per kWh.

(3) That cooking on a large scale necessitates a considerable increase of the distribution plant over and above that which is generally employed. The additional costs for such an increase, if suitably carried out, will, however, often give a profitable supply at a price of 1d. per kWh, which price might generally be attractive enough to secure this class of consumption.

(4) That a supply of electrical energy for heating of rooms for more occasional or specialised purposes has in England quite exceptionally favourable possibilities to a price up to 1d per kWh, while the permanent electric heating of rooms (i.e the all-electric house) seems to be a question requiring close investigation.

BOOK REVIEWS.

Electric Lines and Nets. By Dr. A. E. KENNELLY. 2nd Edition. (London : McGraw-Hill Publishing Co.) Pp. viii + 426. 25s. net.

Dr. Kennelly has developed in his new book, which is an expansion of his former treatise on artificial electric lines, the application of hyperbolic functions to general network theory, and demonstrates their application to both real and artificial lines. His treatment of network theory is comprehensive, consistent and self-contained. To the mathematically inclined student, more particularly of communication than power transmission engineering, it should make a special appeal and prove a source of inspiration.

The use of hyperbolic functions in long line theory as developed by Dr. Kennelly is now an established part of any advanced electrical engineering curriculum, but it seems a little unfortunate that in extending the method to problems which can be treated by other easily understood methods Dr. Kennelly has not indicated what is to be gained from such extension.

For example, it is difficult to see any advantage in converting the sections of a power network, including the lumped impedances of connected apparatus, each to its particular line angle when it is desired to estimate the performance of the network. In spite of the elegance of Dr. Kennelly's method, the power engineer will probably still prefer to use the vector equations developed from the four terminal impedance theory of La Cour as being more direct and obvious in application.

Although the book purports to include the line theory of polyphase systems it could hardly be put forward as a text book on such matters, since unbalanced polyphase conditions are not treated. Suitable analysis has been developed for this purpose for some years, and a text book statement of it would be very acceptable to power engineers.

The treatment artificial lines receive in the book is again carried out from the communication engineer's standpoint alone and no mention is made of the recent developments in artificial lines for the solution of power network problems.

One can only repeat, that as the application of a particular type of analysis to long line theory the book is an excellent piece of work, but the reader must not think that there are not other aspects of the problem and other equally powerful methods of treatment.

Dr. Kennelly has his own views on terminology and can be excused inventing terms to cover his particular method, but at times he becomes a little wearisome. There seems little need, for instance, to coin the term " cyps " for cycles per second, all the more so as he himself more frequently uses the symbol ~. C. DANNATT.

Handbook of the Procedure and Evidence in Arbitrations. By W. T. CRESSWELL. (London : The Institute of Arbitrators, Inc.) Pp. xvii + 167. 6s. net.

The author has succeeded in producing a good and accurate summary of the law and practice relating to arbitrations at a price which should place it within the reach of everyone interested in the subject. Litigation is now so expensive, and is sometimes so unsatisfactory in its results, that it is not surprising that arbitration is being resorted to in an increasing degree. The technical formalities and the delays involved in legal procedure are making parties loath to commence actions, and in addition it is well known that many disputes, especially those involving the taking of accounts, or where much technical evidence has to be sifted, are more expeditiously and cheaply decided by skilled arbitrators than by a judge and jury, or by a judge alone. The skilled arbitrator is able to assess the value of expert evidence more readily and more accurately than ordinary legal tribunals. It must be remembered that parties can now select their own method of settling disputes, and an experienced arbitrator is usually the best person to decide cases in which much evidence of a technical or commercial character has to be given.

An arbitrator, however skilled he may be on the subject matter of a dispute between parties, must obey the judicial rules laid down for his guidance, and he must also be acquainted with the rules of evidence, etc. Otherwise his award may be liable to be attacked and to be set aside, or to be referred back to him for further consideration. The pitfalls are fairly numerous, and there are even irregularities which may be committed by the most experienced arbitrator, but a perusal of Mr. Cresswell's work should be of great assistance to arbitrators in steering clear of trouble in arbitration proceedings. Mr. Cresswell covers everything required, from the agreement to submit to arbitration to the making and publishing of the award and its form. It is not only arbitrators who will derive assistance from this work, but engineers, architects and business men who may occasionally be interested in settling disputes by arbitration should also find it very helpful.

In future editions of the work we should like to see the appendices giving the text of the Arbitration Act, 1889, and relevant extracts from the Administration of Justice Act, 1920, and from the Supreme Court of Judicature (Consolidation) Act, 1925, as well as certain standard forms or precedents printed in larger type. The number of forms included should also be increased, and in the index of decided cases references should also be given to all the reports in which the cases are reported.

M. O S.

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AN INTERESTING TEST ON A D.C. 3-WIRE SYSTEM.

Combined Lighting Supply at 120 V and Power at 240 V—Arrangement Effects Considerable Reduction in Losses in Neutral Wire and on Entire System.

By VERNON W. PALEN.

RECENTLY I made a test run on a d.c. 3-wire system which netted what was to me some very interesting information.

Such an arrangement makes 120 V available for lighting and 240 V for power, and combines the two, thereby eliminating one wire, and considerably reducing the losses in the neutral wire and on the system as a whole.

There are several ways by which such a system may be derived. One of the first used schemes was to connect two 120 V generators in series as shown in Fig. 1.

With a 240 V generator as the source of energy and a battery of storage cells connected across its terminals with a tap off the midpoint of the battery (see Fig. 2), we have another method of obtaining such a system.

To-day, the generally adopted method of deriving the 3-wire system is by use of a 240 V generator supply with two identical 120 V generators (direct connected through their shafts) connected in series across the line, as in Fig. 3.

A motor-generator set when thus used is sometimes called a compensator. This name originated from the fact that such an arrangement automatically compensates for any difference in the load on the 120 V circuits.

When the load becomes unbalanced on the system, the machine across the lightly loaded side operates as a motor, while the machine across the heavily loaded side operates as a generator.

For simplicity, in Fig. 3, only the armatures are shown in the circuit. In Fig. 4, however, the fields are shown properly "cross-connected" and the various points where current and voltage readings were taken are indicated.

Characteristics of System.

Table I gives a tabulation of all the readings made during the test on this system, and includes conditions ranging from a perfect balance to extreme unbalance. Thus, by a study of the readings obtained, the characteristics of the system may be observed and conclusions may be drawn.

In Figs. 5, 7 and 8 are illustrated particular sets of readings with the magnitude and direction of current indicated at each point.

Since the path of current through a motor's windings is from positive to negative, and in a generator's windings from negative to positive, the direction of current in each case indicates which machine is the motor and which the generator.

An examination of Fig. 5 shows that the machine (A_2) across the lightly loaded side is operating as a motor, while the machine (A_1) across the heavily loaded side is running as a generator. Thus the motor adds load to the lightly loaded side, and the generator helps to supply current to the heavily loaded side. In Fig. 7 the above conditions are reversed, and we see the machine (A_1) operating as a motor and machine (A_2) operating as a generator.

Valuable Economies.

It is in this manner that the load on the two sides of the system is kept balanced, and from experience, the motor-generator set thus used pays for itself through the saving in losses.

Take, for instance, the case shown in Fig. 7. If a four-wire 120-240 V system were used, the losses for unit distance (D) would amount to :—

$(6)^2$ (2d.) + $(16)^2$ (2d.) = 584d. The losses with the scheme in Fig. 8 amount to :—

$(6)^2$d. + $(16)^2$d. + $(10)^2$d = 392d.

TABLE I.

I_1	I_2	I_3	I_4	I_5	I_6	I_7	V_1	V_2	V_3
17	16	16	0	17	0·60	0·60	238	119	119
16·5	16	14	−2	16·5	0·60	0·60	238	119	119
15·5	16	12	−4	15·5	0·602	0·595	238	118	120
14·5	16	10	−6	14·5	0·61	0·59	238	117	121
13·5	16	8	−8	13·5	0·62	0·58	238	115	123
12·5	16	6	−10	12·5	0·63	0·57	238	113	125
9	16	0	−16	9	0·65	0·55	238	109	129
16·5	14	16	+2	16·5	0·60	0·60	238	119	119
15	12	16	+4	15	0·595	0·602	238	120	118
14	10	16	+6	14	0·59	0·61	238	121	117
13·5	8	16	+8	13·5	0·58	0·62	238	123	115
13	6	16	+10	13	0·57	0·63	238	125	113
9·5	0	16	+16	9·5	0·55	0·65	238	129	109

Neglecting the slight losses of the motor-generator set, the difference in losses between the 4-wire and 3-wire systems in this case is 192d, or a saving of 33 per cent. Besides the saving in losses, there is a saving in copper of at least 25 per cent., since one wire is entirely omitted, and since in most cases the neutral wire can be reduced in cross-section.

In Fig. 6, is shown a water analogy of Fig. 5 which may help to illustrate just what happens in the electrical circuit. In this case we deal with turbines and pumps instead of motors and generators, but the water flow through the various pipes

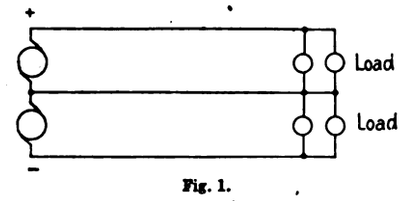

Fig. 1.

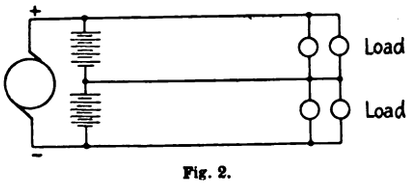

Fig. 2.

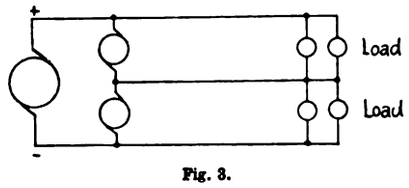

Fig. 3.

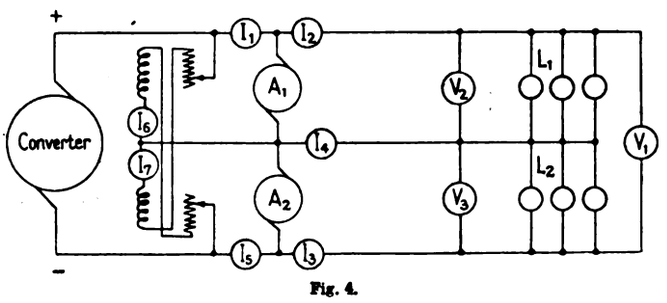

Fig. 4.

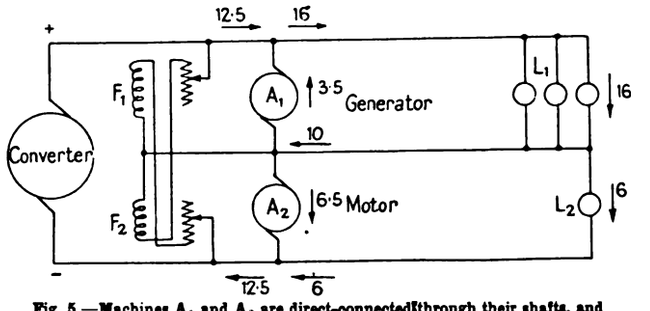

Fig. 5.—Machines A_1 and A_2 are direct-connected through their shafts, and either is capable of operating as motor or generator.

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is perfectly analogous to the flow of electricity in the wires, and the load conditions determine which machine operates as a turbine and which as a pump.

There are several ways in which the fields of the compensator set may be connected. It has been found least satisfactory to connect them directly across their own armatures, as shown in Fig. 7. Since the greatest voltage drop will occur across

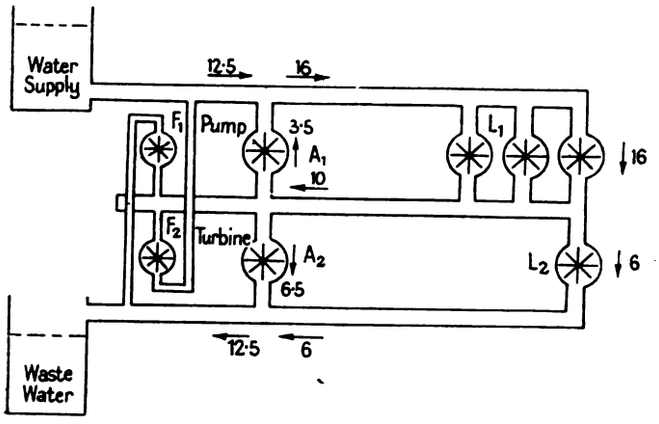

Fig. 6.—Machines A_1 and A_2 are direct-connected through their shafts, and either is capable of operating as turbine or pump.

the terminals of the more heavily loaded machine the field excitation will be reduced proportionately, and since a decrease in excitation means a further decrease in voltage, conditions will tend to become worse.

If, however, the fields are cross-connected as in Fig. 8, the voltage drop across the heavily-loaded side will decrease the excitation (and, therefore, the voltage) of the lightly

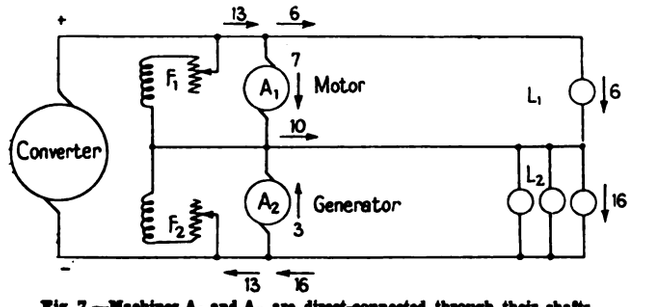

Fig. 7.—Machines A_1 and A_2 are direct-connected through their shafts, and either is capable of operation as motor or generator. Fields are straight-connected across their own armatures.

loaded side. This action tends to maintain a voltage balance between the two sides of the system, or, in other words, tends to maintain the neutral wire as its proper potential.

An examination of the data in Table I will disclose the fact that the values of field current are not constant. This, of course, is due to the variation of voltage on the two sides of the system. So, for instance, when the voltage V_2 dropped, the field current I_7 also dropped. The variation of field current and voltage are very much less than would result if the fields were " straight connected " as in Fig. 7.

Since we are primarily concerned with what takes place in the armature and load circuits, the field current values

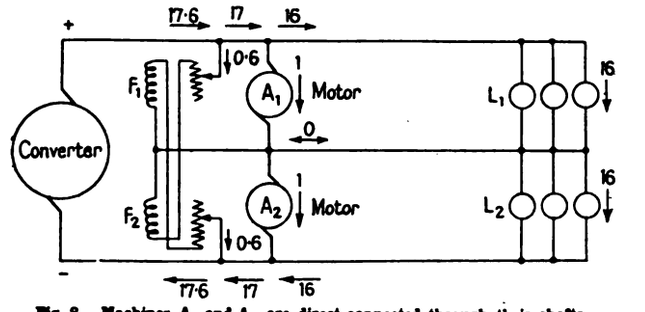

Fig. 8.—Machines A_1 and A_2 are direct-connected through their shafts, and either is capable of operating as motor or generator. Fields are cross-connected to improve voltage balance.

have purposely been omitted from Figs. 5 and 7, since they would only complicate matters and add unnecessary confusion.

An examination of Figs. 5, 7, and 8 will lead to the conclusion that " the greater the load unbalance, the greater the neutral current." Further, " the greater the neutral current, the greater the armature current."

It is, therefore, necessary to have the armatures sufficiently large to carry the maximum neutral current that will flow. With a well-balanced system a relatively small compensator set will handle the situation.

In computing the power consumption in the various parts of the circuit shown in Fig. 4, we may use the following formulæ :—

Power received from the supply :—
$$V_1I_1 + V_2I_7 + V_3I_6$$
Power consumed by the load =
$$V_2I_2 + V_3I_3$$
Power consumed by the compensator set =
$$V_1I_1 + V_2I_7 + V_3I_6 - V_2I_2 - V_3I_3$$

Taking the third set of readings (Table I) as an example :—

Power received from the supply =
(238) (15·5) + (118) (0·595) + (120) (0·602) = 3 832 W.

Power consumed by the load =
(118) (16) + (120) (12) = 3 334 W.

Power consumed by the compensator set =
(238) (15·5) + (118) (0·595) + (120) (0·602) − (118) (16) − (120) (12) = 498 W.

I.E.E. MANCHESTER DINNER.

An Interesting Early Employment of Cotton-Covered Wire Recalled.

A SINGULARLY successful and enjoyable annual dinner was held at the Midland Hotel, Manchester, on January 23rd, by the North Western Centre of the Institution of Electrical Engineers, and over 250 guests and members were present. The chair was occupied by Mr. Harcourt Williams.

In proposing the toast "The Cities and Trade of Manchester and Salford," Major-General Sir PHILIP A. M. NASH said that the trades carried on there were of a varied nature, ranging from dolls' eyes to cloth, barbed wire to steam rollers, and chemicals to artificial stone. He had heard that many years ago Messrs. W. T. Glover and Co. used to cover wire with cotton for ladies' crinolines, and this had grown into the less romantic occupation of making electric cables. The two cities were an important centre of engineering and textiles. It was worthy of note that Manchester had produced such important men as Faraday and Whitworth, and they were proud to have Dr. Ferranti, another outstanding figure, in their midst. The first Edison dynamo was made in Manchester by Mather and Platt in 1883.

Responding, the Lord Mayor of Manchester, Lt.-Col. G. WESTCOTT, said he strongly approved of the regional system of electricity supply. The question of efficiency was one of great importance. Time was when there were many incompetent people in the electrical industry, and there were still a few left. It was one of the objects of the Institution to make it more and more efficient. He recently asked a pupil engineer at the Stewart Street power station what his ambitions were, and whether he was going to push Mr. Lamb out of his job. The prompt reply was " Oh, I hope I shan't stop at that." Twenty-five years ago electricity was in its infancy, and in his opinion it was still in its infancy. The members of the industry had enormous opportunities before them, and it was the duty of the Institution to see that they were fully exploited. Manchester was second to none from an electrical point of view, and this was due to the brains of such men as Dr. Ferranti.

The toast of " The Institution " was proposed by Mr. DOUGLAS MILLER, High Master of Manchester Grammar School, who said that, though his knowledge of the industry was small, it required no inside knowledge to appreciate electricity. He only knew of two critics of electricity, the late R. L. Stevenson, who had a love for the picturesque method of lighting gas lamps, and the gas engineer.

In response, Lt.-Col. K. EDGCUMBE said that the local Centres were really the backbone of the Institution, and other institutions were following their example and forming local centres with happy results. He had often wondered why Lancashire was so precocious, and why " Lancashire thought to-day what London thought to-morrow." It was, however, recently discovered that when the Angles entered this country, the acute Angles settled in Lancashire and the obtuse Angles settled in the other parts of the country.

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NUISANCE AND DAMAGE CAUSED BY ELECTRICITY SUPPLIERS.

Some Interesting Considerations Arising from a Recent Legal Case.

By W ERIC JACKSON, LL.B., Barrister-at-Law.

THE case of Farnworth *v.* The City of Manchester, which came before Mr. Justice Talbot at Manchester last July, and has recently occupied the attention of the Court of Appeal, raised some very interesting points for statutory undertakers and is well worth the closest study, although many of the points were not of very general application. The case well illustrates, however, the complexity of Private Bill legislation, and how, in spite of the efforts to codify the law by means of various general statutes, a consistent and uniform system of law seems well-nigh impossible to attain.

The Manchester Corporation originally obtained powers in 1890, under the Act of 1882, to supply electricity in various districts around Manchester. In 1899, as is well known, the Electric Lighting Clauses Act was passed, defining the clauses and conditions which were to attach to every Private Bill which in future should be granted for the supply of electricity.

In 1914, the Corporation obtained powers to erect a super-generating station. This station, when erected, proved to be a source of nuisance to surrounding occupiers by reason of the fumes created at the station.

Now the Clauses Act of 1899 says that every undertaker shall be liable for nuisance, but the Act of 1882 says nothing as to this. At any rate, the Provisional Order which gave the Manchester Corporation power to supply said nothing about liability for nuisance. Hence, up to 1914, the Corporation could not be sued for any nuisance caused by their supplying electricity, if such nuisance was a necessary and inevitable consequence of their exercising their statutory powers.

But in 1914 they obtained another statutory power, namely, the power to erect the super station. The question was, therefore, whether the clauses of the Act of 1899 (which made undertakers liable for nuisance) applied to the powers of 1914. The Act of 1899 applied to powers to *supply*, whereas the Act of 1914 was not, in the opinion of Mr. Justice Talbot, an Act authorising supply. It was merely an Act to authorise the building of a station. According to his opinion, therefore, the Clauses Act did not apply to the 1914 Act, and therefore the Corporation could not be sued for nuisance, since Parliament had, in authorising the building of a station that might cause nuisance, impliedly authorised its commission.

The Undertakers' Duty.

The principle of law still remains, that undertakers who are still supplying under the old Act of 1882, and Orders made under it, are not liable for nuisance unless in their own particular Order or Act, the liability for nuisance is expressly preserved. This does not mean that the undertaker can go out of his way to commit a nuisance and remain immune from legal action. But any nuisance caused by the ordinary and reasonable user of his statutory powers will not incur any responsibility in damages to persons who complain. But if the user is quite unreasonable and not at all necessary, then to that excessive extent he will be held liable for any trouble he may cause.

There is still, therefore, a duty upon undertakers to utilise reasonably up-to-date methods of generating and of smoke consumption, even though their powers were conferred before 1899. And after 1899, if any undertaker obtains powers to *supply*, then he will most certainly become liable for nuisance in the same way as any ordinary factory owner who has not statutory powers.

The usual sources of claim for nuisance are noise and smoke fumes. The cases generally fall into two classes, namely, those nuisances which cause injury to property, and those which only interfere with the enjoyment of property. Heat and fumes causing injury to goods or plant are in the former class, and noise and smell are in the second class.

The general principle of law is that a man can do what he likes with his own property so long as he does no harm to anyone else. No question of malice or negligence arises, so long as some actual material interference is caused, but material interference with the enjoyment of property is essential to a successful claim. To build a factory in a residential area would not be a nuisance merely because it lowered the tone and amenities of the neighbourhood.

Where, however, actual damage is caused to adjoining property the owners are entitled to damages even though the district is one which is devoted to offensive trades, or where such trades are to be expected. But where the complaint is only on the ground of interference with the adjoining owner's enjoyment of his property, without any actual damage, then the condition of the surrounding district will be taken into account.

As Lord Westbury once said in a famous case: "If a man lives in a street where there are numerous shops, and a shop is opened next door, he has no ground of complaint because, to him individually, there may arise much *discomfort* from the trade carried on in that shop . . . but where the result of that trade is a material *injury to property* then arises a very different consideration."

A "First Comer" Point.

Provided that the Court holds that a nuisance exists, it is ordinarily no defence for the tradesman to say that he was there first, and that the complaining party knew there was a nuisance and came to live near it. The reason for this is that if once an offensive trade became established, it would be impossible for the surrounding property to be used for anything but a similar business. The result would be that the district would be perpetually restricted to a particular use.

Accordingly, in a case where a confectioner had for several years used a pestle and mortar in his kitchen in Wigmore Street, London, W., and then a doctor in Wimpole Street near by built a consulting room in his back garden against the confectioner's kitchen, and the noise from the kitchen was a nuisance to the consulting room, it was held that although the doctor installed himself next to the nuisance, the confectioner was just as much in the wrong, and was ordered by the Court to remove or discontinue using the pestle and mortar.

The right to carry on a nuisance may, however, be acquired by a grant from the landlord of the adjoining property which is affected, or it may be acquired by twenty years' uninterrupted user. It is, however, not always easy to prove the latter; for it is difficult to show by evidence that the nuisance was, twenty years ago, the same as it is to-day.

On the whole, then, electricity undertakers are in this position. If their premises are in an industrial district and no physical damage is caused, no claim can be made. If it is not an industrial area, they may be open to claims for interfering with the amenities of the district, as well as for injury to property. At any moment a new occupier may come into the district and claim damages. All this is, of course, subject to what has been said above as to exemption by Statute. If the Statute or Order does not reserve the liability for nuisance, or if the undertaking is being carried on under powers conferred under the Act of 1882, then no responsibility either for physical injury or interference of enjoyment will rest upon them, provided that the nuisance caused is an ordinary consequence of the reasonable exercise of their Parliamentary powers.

In the Farnworth *v.* Manchester case the fact of nuisance was fully admitted by the undertakers. The sulphur fumes from the station could be clearly seen to devastate the crops on the ground over which they passed. Among other contentions the plaintiff said that the undertakers had not used reasonable means to conduct away the fumes by using a sufficiently high chimney. The Judge, however, on the evidence, found (and the point is therefore not open to appeal) that the suppliers had done all that they reasonably could to evade committing a nuisance. Had the Judge found otherwise, the case would have had quite a different result; for even though the Corporation may have statutory exemption from claims for nuisance, there is still cast upon all undertakers the duty of keeping their offending activities within bounds. A statutory exemption does not allow an electricity supply undertaker to do whatever he likes; it only permits him to carry out in a proper manner the powers given him. If, in so doing, he causes injury to others, then there is no more to be said, except perhaps to commiserate with the unfortunate owner adjoining whose property is damaged without any redress.

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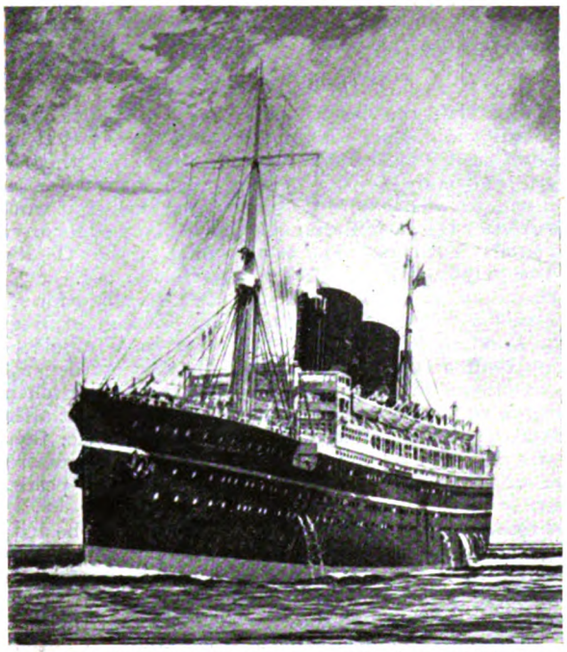
MARINE ELECTRICITY.

The Possibilities of Electric Ferries for Liverpool Considered in the Light of the Great Manœuvring Powers of Marine Electricity—Cost of Electric Ships Compared with Steamers—Electricity as a Fuel Saver.

By A. C. HARDY, B.Sc., A.M.I.M.E. (Author of "Motorshipping," "Merchant Ship Types," etc.)

IT is announced that Liverpool Corporation is shortly to order some new ferries for the busy passenger and freight services across the Mersey. Liverpool is the only port in Great Britain where ferry services are at all active and comparable with those in operation in some of the big American cities—New York, Philadelphia, and San Francisco. All these big American cities are in effect "dual" cities—New York–Brooklyn–Jersey City, Philadelphia–Camden, San Francisco–Oakland, for example. Each part in these "dualities" is separated by water. Liverpool is similarly



The triumph of the electric ship is exemplified in the 19 500 tons "Viceroy of India," the new turbo-electric P. & O. liner, shortly to make her maiden voyage. She is one of the biggest electric ships at present in commission.

separated from Birkenhead, and the Mersey ferries are as familiar and as necessary as the tramways.

It will be interesting to see whether the claims of electricity for propulsion have been, or are being, considered for these new orders. There is a great deal to recommend it—from a point of view of manœuvrability and control. No one can pretend that a reciprocating prime mover—such as a steam engine is—can manœuvre rapidly and with quick changes of rotation as efficiently as a rotary prime mover such as the marine electric motor actually is. The flexibility of pilot house control for such ships, too, is a point which cannot be overlooked.

If only on the grounds of similarity of dimensions and characteristics, it is worth while comparing a New York all-electric ferry built for carrying automobile traffic across the Hudson and a vehicular ferry operating across the Mersey. This latter is a steam driven vessel. The dimensions are comparable as below :—

Type	Route	L	B	D	Power	Speed	Remarks
Auto Ferry	New York	155	37	14·25	580	13 m.p.h.	All-electric
Luggage	Mersey	150	50	15·6	1 200	11 kts.	Steam : side loading.

Manœuvrability for Small Ships

Except in beam, the two are dimensionally very much the same. In each case, the beam recorded is the extreme beam, or beam over guards, and has comparatively little effect upon the propulsive efficiency of the hull proper. As a matter of fact, the New York ferry has a somewhat higher turn of speed than the Liverpool vessel, although her power is much less. The Liverpool ferry in deck plan view is something like an elongated horizontal section through a tub. She is a side loading vessel, moreover, and it is questionable whether this type is as efficient as the American double-ended type with a bridge house at each end. Here, with the pilot perched well up forward, are the ideal conditions for pilot house control.

Manufacturers interested in marine electricity would be well advised to lose no opportunity to place the claims of this type of propulsion prominently before those responsible for the ordering of the new vessels. It would be decidedly worth while for the industry as a whole if even one electrical contract were placed—even at a "give-away" price. The demonstrational value of such a vessel would be enormous because of the superior manœuvring qualities of the electric vessel compared with her steam sisters. After all, they are not dropping all-steam propulsion on the ferries in American waters in favour of electric propulsion merely because of the good salesmanship of the big electrical companies. In New York and San Francisco harbours, they have probably had more practical experience with ferryboat operation for heavy passenger and vehicular traffic than anywhere else in the world.

Floating Tramcars.

Ferryboats are the tramcars of big rivers and estuaries. Surely no one to-day would abandon the flexibility of control that electricity can give for this purpose in favour of a control which would postulate that the drives should give manœuvring signals to a blind man inside the body of the vehicle somewhere. And yet that is what control on the steam-driven ferry is in effect to-day.

The pilot rings a bell; the engineer on watch answers him and . . . executes the order. And this, when as many as one order every 51 sec. is given and executed on some harbour craft. With pilot house control of an electric motor the whole thing is done quickly, quietly, and automatically without any intermediary agency. The present system is merely an obsolescent application of ocean-going practice to cases where it does not apply.

It is to small harbour craft of ferryboat type that electricity is so particularly applicable on grounds of manœvrability alone. Here is a general case of application in fact. Each and every ocean-going electric ship is an entirely special case, the reasons for or against electric propulsion being dependent (1) upon auxiliary and (2) upon service requirements. This has been discussed in previous articles at some length, but is here referred to again, in connection with the latest electric ship contracts for two 20-knot turbo-electric liners for the Ward Lines New York–Havana service.

In brief, these ships are not ships to which electric propulsion shows any big advantage over other types of propulsion, because the auxiliary load, by reason of service conditions, is not a high one, and because it is not a fluctuating one. Considerations of compactness of total machinery space might have had some influence on the owners in their choice, but even here much that is gained with compact turbo-generators is lost to boiler and oil firing space.

American shipbuilding has recently received a much-needed stimulus by legislation in the form of mail and building subsidies and with it has come a kind of fashion, out of all proportion to service considerations, for electrically-propelled liners.

Leaving aside, for the moment, the question of suitability, the characteristics of the new Ward liners are of definite academic interest. The American General Electric Co.'s electric propelling motors of 16 000 S.H.P. will give a speed of about 20 knots to a hull 508 ft. in length overall by 69 ft. 8 in. beam, and having a cargo capacity of 4 155 tons. A total of 377 passengers in first cabin, and 90 tourist third passengers, will be provided for. The vessel will be of twin screw type—8 000 S.H.P. per shaft—and are expected to make the run from New York to Havana in 60 hours, the distance being some 1 166 miles. On the northward run with the Gulf Stream, that friend alike of navigators, historians, geographers, and comedians, the time may even be cut below this, and a speed of 22 knots may be attained.

Details of a technical nature, as to the exact layout of the machinery are meagre, but six Babcock and Wilcox boilers will supply steam to the turbo-generators. The stokehold will be divided, it is announced, into two watertight sections, but no information is available as to whether the bulkhead

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division will be transverse or fore and aft. The contract for the construction has been awarded to the Newport News Shipbuilding and Dry Dock Co., a company already widely experienced in the construction of electric ships by the big electric liners it has built for the International Mercantile Marine Co.'s New York–San Francisco service. The contract price was £870 000 per ship, and figures are available of the bids which were submitted by other shipyards. These form a useful indication of the cost of electric ships in America. Unfortunately, similar figures are very seldom available in this country.

These figures tabulated below also enable an interesting comparison to be made of the times taken to build the ships in various yards, and of the difference in price between turbines of direct drive, and turbo-electric type. It is a noticeable reflection upon the American marine Diesel industry that no quotation was made either for direct Diesel or for Diesel-electric propulsion.

It is difficult to calculate, of course, just how the prices of electric ships, compared with turbine ships, have been regulated by the necessity of attracting work to the shipyards. Presumably, too, the prices quoted are for ships complete with propelling equipment. Judged by European standards, the prices are high, but it must be remembered that the work is being largely financed by Governmental aid.

One fact definitely emerges, however; the cost of the electric ship is not, in proportion to the total cost, so very high above that of the direct turbine ship—in the case of the successful bidder, only some £20 000. In another case, the difference was wiped out, the quotation for either steam or electric ship being exactly the same. Here again, assuming the prices to be for the complete ship, it is possible that the electrical companies, with their keen appreciation of future markets, have probably helped to arrange this. For, once the shipowner realises that he can get an electric ship for very little greater capital outlay than that necessary for a ship of ordinary type, it comes at once within the realms of practical economics and politics.

Marine electrical engineers will unquestionably find the above table useful as a guide to the price of this type of ship. Shipowners will be interested to see, proportionately, of course, for European labour conditions, what the all-electric ship will cost them. It would seem that it is not the expensive proposition we are sometimes led to believe it to be.

COSTS OF STEAM AND ELECTRIC SHIPS COMPARED: TWO 16 000 H.P. MAIL AND PASSENGER LINERS.

Shipyard.	Price per Ship: Turbine. 1 Ship	Turbine. 2 Ships.	Price per Ship: Electric. 1 Ship.	Electric. 2 Ships	Remarks.
	£	£	£	£	
Newport News Co.	850 000	No quotation	870 000	No quotation	Delivery November 1st, 1930.
Federal Shipbuilding and Dry Dock Co.	910 000	879 600	910 000	870 000	Delivery first ship 24 months: second 28mos.
Bethlehem Shipbuilding Corporation ..	904 600	807 600	933 400	908 400	Delivery first ship 22 months: second 24mos.
New York Shipbuilding Co.	909 520	877 820	925 640	896 040	Delivery first ship 18 months: second 21mos.
Sun Shipbuilding and Dry Dock Co. ..	1 049 200	1 034 600	1 050 000	1 035 000	Delivery first ship 22 months: second 27mos.

Economy of Electric Self-Unloading Ship

I have allowed a vein of criticism to run through the above remarks on this latest electric ship order—because the ships are engaged on a service upon which the root reasons for electric propulsion are not applicable. Special requirements of service, other things being equal, should determine the fitting or non-fitting of electric propulsion. The Great Lakes of North America provide some interesting special cases for application of the all-electric ship in the giant self unloading freighters which carry ore and grain from Fort William, Port Arthur, Duluth Superior, and the upper lake ports to the lower lake ports on lake Erie, carrying back coal cargoes in return.

Some of these lake ports are little more than dumps with no unloading apparatus. Because speed of cargo handling is a *sine qua non* in great lakes ship economics it has been found practical to fit many large vessels with self unloading apparatus—endless belts on booms and in trunkways operated by some form of prime mover.

The auxiliary load in such cases is high. In one particular self-unloading vessel of 3 750 tons deadweight capacity, the belt conveyors are driven through gearing at 80 ft. per min. by a 400 H.P. engine. In another bigger ship there are two big steam engines. The application of electricity to such purposes would appear to be quite in line with modern practice, and the fact that coal is so cheap and readily obtainable at lower lake ports, would appear to make an all-electric ship a particularly worth-while proposition.

One such ship, the "Carl D. Bradley," a large ship (615 ft. by 65 ft. by 33 ft.) displacing 21 700 tons at 20 ft. draft, fitted with mechanical stokers, water-tube boilers, superheaters, air preheaters, and a main turbo-generator, has an extremely economical operating record. Under constant steaming conditions, she uses between 1·15 and 1·2 lb. per S.H.P. hour for all purposes, as compared with 1·65 to 2·25 lb. per S.H.P. hour for an ordinary reciprocating engine. The overal-coal consumption for 30 trips in 1927, including all coal used when loading and unloading, was 1·39 lb. per S.H.P. hour. This shows a very considerable economy for the electric ship.

The above remarks will, perhaps, indicate that the electric ship presents many points worth serious consideration. It should be emphasised, however, that the average shipowner is not aware of the possibilities of electric propulsion, nor of its special, rather than general, application. It cannot be said that the electrical industry has gone out of its way to show shipowners what it can offer them.

It is now generally accepted that the big high-powered ship of the future will be an electric ship, and probably a Diesell electric ship, because of the high auxiliary loads, and because of the tremendous fuel economy which cannot be secured by direct drive.

[Previous articles on the subject of Marine Electricity by Mr. Hardy have appeared in our issues of November 16th, 1928, and January 4th, 1929.—ED.]

CORRESPONDENCE.

The Editor welcomes the free expression in these columns of genuine opinion on matters of public interest, although he disclaims responsibility alike for the opinions themselves and the manner of their expression.

"Some Fallacies of Load Factor."

[TO THE EDITOR.]

SIR,—In his article bearing the above title, Mr. E. V. Clark criticises the electricity supply companies quite as severely as he does the municipalities whom Mr. T. D. Martin has justifiably defended in your correspondence columns.

If the latter are mainly interested in statistics, the former are so timid that they are not prepared to face the diminishing returns available from new business and the risks attached to increased output! A company is, therefore, in the position of a taxi-cab driver who, being permitted to arrange his own fares, and estimating the same net profit at 1s. 6d. and 6d. per mile, chooses to charge on the higher scale. By doing so he can spend more time smoking on the cab rank, thus reducing the chance of street accident, and yet enjoy the same income as a more enterprising colleague. He would no doubt defeat his own ends, as his more active rival would tend to make taxi rides more popular and thus secure an ever-increasing share of custom, and hence a larger income for himself. "Whether it is best that a section of the community shall invariably" ride in taxis or pay nothing and walk, "it is outside the province of the engineer to decide."

In the supply of electricity refusal to take the risks inherent in increased turnover is similarly attended by the penalties paid by the business man of short views. The great British industries have not been built up by merely playing for safety. There is, it is true, a position in trade for the man of short views, but it is not one of responsibility for a great industry, such as the supply of electricity.

There is, however, another consideration. An electric supply company has had quasi-monopolistic powers bestowed upon it by Parliament, and has no right to take advantage of a sheltered position to avoid its responsibility for meeting any possible demands for electricity at reasonable prices.

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Moreover, it has been claimed that a company is better able to take business risks than a publicly-owned body, and that consequently it can better fulfil a public service.

If it is not prepared to put this theory into practice it opens the door to Socialism; since we must prefer what best serves our purpose, despite political predilections. Socialism is ostensibly concerned first of all with meeting the public needs, but as good intentions do not necessarily pave the road to Paradise, and the longest way round is often the shortest way home, some of us still hold that a company's "selfishness," when truly enlightened, will prove more efficacious in the long run. Mr. Clark must look for other reasons than business pusillanimity for the lower load factors of company undertakings. The small size of many of them may be one reason. That larger ones take long views is shown by their high load factors (e.g., the Newcastle-upon-Tyne Electric Supply Co.) and by their willingness to incur commercial risks in securing such low-priced business as railway loads and domestic heating and cooking.

Mr. Martin, taking the progressive view, states the case for low prices very clearly, but his conclusion appears to require a corollary. It is unsound to reduce the price of an article either below the figure necessary to encourage its free serviceable use or so low as to destroy the stimulus to devising means for its more efficient use. We are perhaps not very far from the time when municipal undertakings may find themselves tempted to reduce the lighting rate below the economic minimum; since by doing so the appeal to the electorate will be more immediate than the pursuit of a progressive policy in other and less spectacular directions.

It must be admitted that the domestic tariffs quoted by companies do in many cases compare unfavourably with those published by municipalities, but in making a comparison of tariffs it ought to leave us quite cold to hear that one undertaking charges 6d. and another only 4d. per unit for lighting, since the former may be accompanied by a really favourable two-part tariff. The 6d. units might in that case be charged only to consumers who took so little electricity that they barely (if at all) paid their share of the cost of production.

For true comparison, one must evaluate several items:—

1. Availability of supply. Emphasis was placed on this aspect in the Weir Report, but seems to have been forgotten in the "lighting at a penny a unit" stunt of the popular Press. An undertaking which supplies a wide area can obviously make less profit per head than another supplying only an urban population. It must, therefore, either have very widely differing scales of charges in towns and villages or it must charge an average price for the whole of its mixed area higher than that required by the other, in order to earn the same profit. Nevertheless, an undertaking which makes electricity more widely available may justly claim to be fulfilling its duty at least as well as the other, even if its charges are higher.
2. The average price per unit sold for the entire output of the undertaking. This includes, of course, units supplied for large power upon which many consumers depend for their livelihood. The indirect advantage of low rates here may be of more benefit to the householder than a shilling or two in his lighting bill.
3. The average price per unit charged to domestic consumers who have substituted electricity entirely for the household services formerly performed by other means. This would be made practicable in most cases only by:
4. Hire or hire-purchase terms for all current-consuming apparatus, and by:
5. The readiness of the undertaking to give skilled attention in case of failure of apparatus and equally skilled advice in the choice and use of appliances. To give such essential attention and advice is expensive and may warrant a slightly higher rate than that found necessary by some undertakings, company and municipal, who counteract the effect of reasonable rates by a policy of leaving their consumers severely alone.

To return to load factor, Mr. Clark assumes a figure of 0.35d. per unit as the additional cost of night units. As this price is exclusive of capital charges, these cannot be spread over the new load as Mr. Martin suggests. The figure is, of course, intended by Mr. Clark merely as an illustration, but it is so wide of actual conditions as to vitiate his argument.

A large modern station should be able to deliver low-voltage units for a consumption of 2¼ lb. of coal each at 25% load factor. The fuel cost with coal at 12s. 6d. per ton would be 0.15d., of which about 0.035d. would be the stand-by cost. The extra cost is, therefore, only 0.115d. per unit, a figure far below that competitively necessary for any service and leaving ample margin for a greater coal cost or for the increased capital charges due to the greater margin of stand-by required with high load factors. (Incidentally, Mr. Clark might have claimed more in respect of these increased capital charges, but the subject is too wide to enter upon here.)

The surplus is available as a direct contribution towards the general standing charges of the undertaking and can be used, if thought fit, to reduce charges to other classes of consumers. It is interesting to note that one relatively small municipal undertaking in London sells three units a penny for night water heating—a rate that is about as low as it is competitively necessary to go to secure the entire business in the area.

There seems little ground for Mr. Clark's doubt whether the actual cost of supplying off-peak units can be ascertained. The most important factor being coal, "Parson's lines" over reasonable periods (summer and winter) will give all the information required. The cost of increased repairs and maintenance is the only difficult estimate to make from existing data, but the amount is comparatively small, and will be covered by any reasonable allowance for contingencies.

An increase in fuel costs would present no difficulty. It would probably necessitate the same kind of temporary surcharge as the competing coal or coke merchants see fit to impose for household fuel.

Mr. Martin rightly objects to the implication that there is antagonism between load factor and diversity factor, when one is so clearly an element of the latter. But was he not guilty of making the same kind of false antithesis in the *title* of his interesting article, "The Government Scheme *versus* Improved Load Factor"? There is surely nothing repugnant in the Act of 1926 to improvement in local load factors or the other desirable things to which Mr. Martin refers.—I am, etc.,

C. O. Brettelle, M.I.E.E.

32, Victoria Street,
Westminster.

Glass Insulators.

[To the Editor.]

Sir,—In his article on Glass Insulators in your current issue, Mr. North makes certain mis-statements relating to porcelain which cannot be allowed to pass uncorrected.

In the first place, there is no maker of any repute in this or any other country who turns out insulators full of pin holes, and dependent upon the glaze for their insulating qualities. The majority of insulator specifications still contain a clause stating that the material shall be absolutely non-porous and the glaze in no way relied upon for insulation, but this fact is now so well recognised that both the clause and the corresponding porosity test may be described as obsolescent practice.

In the second place, a relation between either the wet or dry flashover voltage (flashover value is somewhat indefinite) and the nature of the insulator glaze is to the best of my knowledge non-existent, identical results being obtained on both glazed and unglazed insulators of the same type within the limits of experimental error. Glaze is put on insulators for precisely the same reason that it is put on dinner plates, viz., to obtain a smooth surface to which dirt will not adhere, but has no other connection with the electrical performance.

That much of the argument on page 102 conveys little meaning to me is perhaps due to my own obtuseness. I should, however, like Mr. North to explain how it is that in spite of the many advantages of glass over porcelain, glass insulators usually fail on the temperature cycle test with a temperature range of about half that which the average porcelain will withstand. The desirability of this test may perhaps be argued, but this has nothing whatever to do with the result.

Finally, I should like to point out that in all the specifications with which I am acquainted, the temperature cycle test appears as a type test, i.e., is performed on selected insulators which are not subsequently put into service. Unless this practice is violated, the service troubles described by Mr. North cannot arise.

I am perfectly aware that glass insulators are widely used on the Continent and have many advantages—notably that of cost—which I do not wish for one moment to decry. Their introduction into Great Britain will not, however, be assisted by mis-statements of the type contained in Mr. North's article.—I am, etc.,

B. L. Goodlet,
Metropolitan-Vickers Electrical Co., Ltd.

Trafford Park, Manchester.

[Several letters are unavoidably held over due to pressure on space.—Ed.]

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HEATING AND COOKING DEVELOPMENTS.

Low Temperature *v.* Radiant Heat Systems—Importance of Efficient Maintenance Service—Some Tariff Considerations.

"ELECTRIC Heating and Cooking Developments" were discussed at the January Salesmanship Conference of the E.D.A. in London. Mr. C. H. RAYNER, who introduced the subject, thought that the low temperature system of heating would supplant the radiant type of electric heater for continuous heating on account of its adaptability, low consumption and the ease with which it can be installed in various lengths in any position.

With regard to electric cooking, it was pointed out that manufacturers had recently made many improvements in both large and small electric cooking apparatus, particularly in hot plates, in the disposition of switches and fuses, enamelling hobs and oven interiors, whilst at the same time, providing a more pleasing and convenient design. As to the controversy regarding the respective merits of open type and closed type of hot plates, the verdict was decidedly in favour of the latter. Discussion, however, was still being carried on in regard to comparisons between top and bottom heat and side heat in the ovens, but in the northern districts where bread baking was carried on in the home, bottom heat appeared to be popular.

Increased Cooker Reliability.

On the score of reliability, it was pointed out, that although there are now 4 500 hired cookers on the Manchester circuit, the total number of breakdowns is less per annum than it was when there were fewer than 2 500 such cookers. As an example of the use of electricity for cooking on a large scale, mention was made of a 100 kW oven which has been in use in Manchester for nearly 3 years, giving complete satisfaction.

On the question of tariffs, Mr. Rayner favoured the two-part tariff for both industrial and domestic purposes. In Manchester, the consumer was offered a domestic "all in" tariff, based on a yearly charge of 20 per cent on the 1914 or equivalent rateable value of the house, plus ½d. per kWh for all current; this had been adopted by more than 8 500 consumers in Manchester. Two examples were given of consumers, one having a fixed charge of £4 5s. per annum, and a consumption of 11 600 kWh, and the other a fixed charge of £3 13s. 8d. and a consumption of 5 881 kWh. The total average price paid by these two consumers was 0.059d. per kWh, and 0.065d. per kWh respectively, no coal or gas being used in the first instance, whilst in the second, no gas was used, and coal only for one fire in the winter.

Finally, in a discussion of the relations between the undertaking and the consumer, emphasis was laid upon the necessity for a thoroughly efficient maintenance service, demonstrations both in the home where necessary and in showrooms, and the usual propaganda to encourage, not only the use of current for additional purposes by existing consumers, but also new consumers. Special emphasis was laid upon the necessity for bringing home to architects and builders the importance of providing sufficient points in new houses, and it was suggested that the E.D.A. should take this matter up with the representative organisations.

DISCUSSION.

Mr. R. GRIERSON, speaking of the necessity for confidence between the consumer and the supply authority, said the rateable value system was valuable in that it was easily understood by the consumer. At the same time, supply authorities frequently acted in a manner which created suspicion in the minds of the consumer and so hindered development. He mentioned one or two instances in which the supply authority had asked for the payment of lump sums ranging from £140 to £350 as a condition of giving an increased supply to premises already taking it, and it was impossible to ascertain upon what basis these amounts had been calculated. Another necessity was the standardisation of the voltage in consumers' premises, because the knowledge that the voltage in one district was different from that in another frequently deterred domestic consumers from purchasing apparatus if there was any likelihood of their moving to another district.

Mr. GREGORY suggested that the standing charges of £3 and £4 mentioned in the examples given in the paper were not sufficiently high to cover the actual costs to the supply undertaking.

Mr. HOWELL expressed the view that there had been very few developments in electrical heating and cooking apparatus in recent years, and asked how many of those engaged in the electrical industry were actually adopting electricity for cooking. He supported the action of supply authorities in some cases in demanding the payment of a lump sum before putting in a supply owing to the conditions of tenancy under which an intending consumer frequently occupied their premises.

Mr. STEELE argued that it was not necessary to have so low a running charge as 0·5d. per kWh, and said that in his own "all electric" house, his average cost was 1·1d. per kWh, and he was satisfied that he was doing his lighting, heating and cooking, etc., more cheaply than would be possible by any other means.

Importance of Tariffs.

Mr. H. W. WATTS, who thought that the development of electric cooking depended upon tariffs, said he was thinking out a three-part tariff, and did not consider it necessary to have so low a running charge as ½d. per kWh. He agreed that it was often difficult to avoid charging a consumer something for putting in a supply.

Mr. BIRKS, who said he represented a small company undertaking receiving a bulk supply, complained that owing to the terms upon which this supply was given, it was impossible to offer sufficiently low terms to encourage consumers to adopt electricity for continuous heating. In the same way it was difficult for him to develop cooking to the extent he would like owing to the load mainly coming on the peak. He suggested as a possible means of solving this problem, in cases such as his own, that the wiring of the cooker should be so arranged that the grill could not be switched on at the same time as one of the hot plates. This would reduce the demand at the time of the peak.

Mr. GARLICK said those who suggested that there had been no improvements in electric cooking and heating apparatus during recent years could hardly have had experience of what had really happened, more particularly as regards electric cooking and boiling by electricity. It was sometimes said that boiling by electricity was slow, but his experience was that this argument was being pushed too far in relation to the facts, and that the speed at which boiling could be carried out was quite reasonably satisfactory to most users. Again, the manufacturers of electric cooking apparatus gave two two years' guarantee, and the importance of that in demonstrating the reliability of the apparatus could not be over-emphasised. He also called attention to the better cooking that can be done electrically, and thought there must be some significance, as regards reliability of the apparatus, in the large maintenance staffs kept by gas undertakings. At any rate, in view of that the electrical industry need not regard it as a crime that electrical cooking and heating apparatus required supervision and maintenance from time to time. What was wanted in regard to electric cooking and heating apparatus was energetic salesmanship and demonstration of its real possibilities.

Lieut.-Col. W. A. VIGNOLES emphasised the point that the conferences were salesmanship conferences, and suggested that rather too much time had been taken up with blaming either the manufacturers of apparatus or the supply authorities for a possible lack of development of electric heating and cooking. What was wanted was some real effort at salesmanship to push the use of electricity for heating and cooking, because electricity would not sell itself. As an instance, he mentioned that on the Holly Lodge Estate where he lived, and where some 200 to 300 houses had been wired in the most modern fashion, there were not more than a dozen electric cookers. When he first went there, the gas company approached him and offered to do everything possible in the way of heating, cooking, etc., and he felt that it was this activity on the part of the gas company in getting apparatus installed which had made it impossible for electricity to be extended in the manner it might have been, had similar activity been shown on the electrical side. Electricity for heating and cooking had so many points in its favour that it only needed some real salesmanship to develop it properly.

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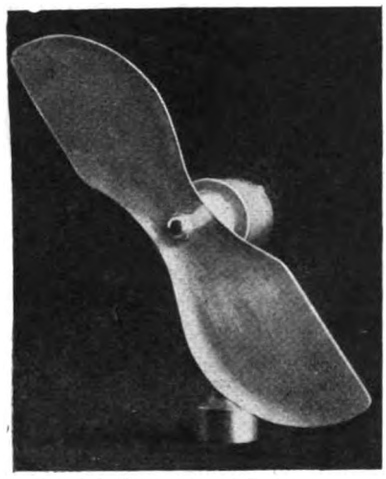
LIGHTING EQUIPMENT.

A Windmill Generating Set—An Emergency Plant.

WE have received from F. A. WILKINSON AND PARTNERS, LTD., of Gretting, near Kettering, Northamptonshire, details of a small windmill-driven generator giving alternating current. The device is fitted with a direct coupled propeller and is designed for directly lighting an additional headlamp on road vehicles. A further use is for lighting clocks, petrol pumps, advertisement signs, etc., and when used for these purposes the machine is fitted with a wind direction vane and tubular support 2 feet long with screwed socket for extension. For use with motor vehicles, the windmill dynamo is fitted on the radiator or the roof of a saloon car.



The windmill generator of F. A. Wilkinson and Partners, Ltd.

In order to meet the emergency of a breakdown in the public supply to public buildings, cinemas, hospitals, etc., the CHLORIDE ELECTRICAL STORAGE CO., LTD., of Clifton Junction, near Manchester, has designed a system, under the trade name of "Keepalite," whereby an instantaneous supply of energy is available for a number of auxiliary lamps fitted at selected points throughout the building. These auxiliary lamps are all connected by special wiring, which may be of the simplest type acceptable to the insurance companies, and are supplied at low pressure from a sealed-in battery, normally in constant connection with the mains, either through a resistance or a rectifier, according to the nature of the supply. A system of "trickle-charging" is also provided. By means of this latter a suitable charging current is trickled through the battery continuously day and night, the current being just sufficient to balance the losses which occur in that particular battery on open circuit. Should anything happen which brings about an interruption of supply, a change-over contactor-switch on the panel throws the battery over to the emergency lights. These are, consequently, instantly and automatically lighted, and remain alight until the main supply is resumed, when the battery is automatically disconnected from the emergency lighting circuit and reconnected to the trickle charging circuit. Should the breakdown be such that the emergency lighting will be required for some hours, it will, not unnaturally, appreciably reduce the charge in the battery, the capacity of which is not as a rule calculated to carry the emergency lights much longer than one hour. Should this happen, and it becomes necessary to recharge the battery promptly, then a higher charging-rate can be obtained by a special switch provided on the panel.

We have received from BERTRAM B. FENN, LTD., of 78/80, Edgware Road, London, W.2, details of a new anti-dazzle automobile lamp, which bears the trade name of "Fenn." It is claimed that one may look into the lamp when in use for an appreciable time before suffering any eye-strain, while at greater distances and slightly at one side the glare is "negligible." The lamp may be said to be made in two sections, each having its own filament. The top part of the bulb is of amber-coloured glass, while that part near to the cap is covered with fine indentations. The effect of these latter is that instead of producing a straight-forward reflection, the bulb offers to oncoming drivers, etc., a modulated reflection in the silver parabolic reflector of the head lamp. The normal driving light is given when the lamp filament contained within the indented section of the bulb is in focus, but by adjusting the lamp so that the upper filament within the amber-coloured section is in focus a yellow tinted light, for illumination when driving in foggy weather, is obtained. These two different adjustments are made by means of the lamp holder. The component is made for all standard voltages and in sizes to fit all existing head lamps.

NEWS IN BRIEF.

BURY St. Edmunds T.C. has adopted an assisted wiring scheme.

Sunderland elementary schools are to be equipped for electric lighting before next winter.

The Chief Constable of Exeter reports that every district in the city now has its police telephone.

Edinburgh point-duty policemen are to be illuminated by means of floodlights sunk below the road.

Ilford Electricity Committee seeks sanction for a loan of £5 000 for wiring installations on hire.

Tenders have been invited for the erection of a telephone exchange and postal sorting office at Oldham.

Holbeach Board of Guardians is to obtain details as to the cost of installing electric light in the workhouse.

The Faraday House Old Students' Association will hold a dance on March 5th, at the Victoria Hall, Southampton Row.

Hired cookers connected to Manchester Corporation's mains during November last numbered 63, making a total of 4 947. Orders received in November numbered 94.

Uxbridge Board of Guardians is to consider the question of installing its own electricity plant, and has instructed Mr. Eves, architect, to make inquiries with that end in view.

A meeting of the Institute of Wireless Technology will take place at the Engineers' Club, Coventry Street, W., on Feb. 11th, when Mr. Arthur W. Thynne will lecture on television.

A junior technical officer, preferably with an electrical engineering degree and experience in design of electrical apparatus, is required in the design section of an Admiralty establishment at Portsmouth.

The party of South African Public School boys who are touring England reached Rugby on Sunday. On Monday they made a tour of the British Thomson Houston Co.'s works, and were entertained at luncheon.

A special course of eight lectures on "Picture Telegraphy," will be given by Mr. E. S. Ritter at the Polytechnic, Regent Street, W., on Wednesdays, commencing January 30th, and continuing until March 27th, omitting March 6th.

Applications are invited for the Professorship of Electrical Engineering at the College of Engineering, Guindy, Madras. Forms from Secretary to High Commissioner for India, Grosvenor Gardens, S.W.1. Last date February 23rd.

West Riding C.C. Health Committee recommends an extension of the buildings and equipment at the Middleton-in-Wharfedale Sanatorium, where ultra-violet ray treatment has been given for some years. The cost is estimated at £1 092.

It has been reported to the Devon Sea Fisheries Committee that the Exe Power Experiment Association, which is proposing to harness the tides in the estuary of the Exe with a view to the generation of electrical energy, has applied to the Ministry of Fisheries for permission to place two pontoons in the estuary in a position slightly different to the one at first suggested. The Committee offers no objection.

The annual report of the Post Office on the London telephone service states that the total number of exchanges at the end of 1928 was 614 183, increase 48 593. Over 26 000 private branch exchanges are in use. One equipped during the year has 500 extension lines, 129 exchange lines, and 15 operating positions for receipt of incoming traffic. The charge for a three-minute call from Great Britain to the first Canadian and American zone has been reduced from £15 to £9.

At a meeting of Glasgow T.C. last week, Mr. McSkimming objected to a contract placed by the Watching and Lighting Committee for insulated cable. He said that while the contracting firm had a British name the work was to be done in Austria. Mr. MacDougall convener of the committee, stated that they were trying to break a ring in this industry. The tenders of the British makers had all been within 2s. of each other. The Committee's minute was approved.

At a meeting of the Insurance Students' Circle in Edinburgh, on January 22nd, Mr. Donald Smeaton Munro, chairman of the Scottish Centre, I.E.E., read a paper on "The Fire Hazards of Wiring." Mr. Munro expressed the view that our insurance companies would do well to follow the example of the American Board of Fire Underwriters and play a greater part in the protection of the public and property by ensuring the employment of qualified firms working to approved rules. The objects, aims, and working of the National Register of Electrical Installation Contractors were explained. The lecture was illustrated by experimental demonstrations designed to show how lack of continuity and defective earthing arrangements may cause outbreaks of fire.

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PERSONAL.

MR. E. J. Strange, electrical engineer, Tunbridge Wells, has been elected unopposed to fill a casual vacancy on the Town Council.

The Mayor of Brighton, Coun. H. J. Galliers, has been elected to the vacant aldermancy created by the death of Ald. H. B. Lewis.

Sleaford Urban Council has increased the salaries of the assistant electrical engineers, Messrs. S. Thorlby and S. R. Smith, by £13 per annum each.

Mr. Herbert S. Goostry, of Wednesbury, has been elected chairman of the Midland Branch of the Electrical Contractors' Association, and Mr. G. R. J. Parkinson, president.

Having been appointed manager of the Norwich Electric Tramways Co., as announced last week, Mr. Frank Buckley has resigned his present position with the Bury Corporation Tramways.

Walsall Town Council has increased the salary of Mr. W. Vane Morland, transport manager, from £875 to £950 per annum, with a further increase up to £1 000 in October next year.

Mr. W. F. Marchant, chairman of the London and Home Counties Electricity Authority, has been elected chairman of the Conference of Joint Electricity Authorities, Advisory Boards and Committees.

The Council of the I.E.E. has made the Eighth award of the Faraday Medal to Signor Guido Semenza, of Milan, in view of the leading part he has taken in the development of the applications of electricity. See page 149.

Mr. H. P. Stokes, transport manager for the Plymouth City Council, has been presented by the Management Committee of the Tramways Social and Benefit Fund with a case of pipes and a tobacco pouch.

The Tramways Committee of the Derby Town Council on January 21st appointed Mr. P. W. Bancroft as deputy tramways manager for a period of six months. At the end of that period the question of the managership will be finally decided upon.

Mr. Stanley Cecil Davies and Miss Elsie Steel, members of the staff of the Hewittic Electric Co., Ltd., have been presented on their marriage with a cabinet of cutlery, a carpet cleaner, a pouffe, and a mahogany oval mirror by their colleagues.

Mr. V. W. Dale, the business manager of the British Electrical Development Association, who was taken ill at Christmas with influenza is, we are glad to say, improving in health. The influenza was followed by pneumonia and empyema and an operation was necessary, but good progress is now being made.

Estate of the gross value of £1 867 was left by the late Mr. Frank Schofield, commercial manager of the Stalybridge, Hyde, Mossley and Dukinfield Joint Tramways and Electricity Board.

M. Henri Lucien Boulanger, of Grenoble, has been appointed deputy director of the International Telegraphic Union, Berne, Switzerland.

Miss B. J. Lanfear, who has resigned from the position of Secretary of the I.M.E.A.

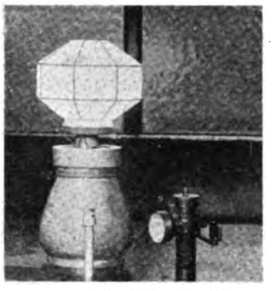
Many of our readers, particularly those connected with the electricity supply industry, will learn with regret of the resignation of Miss B. J. Lanfear from the position of Secretary of the Incorporated Municipal Electrical Association. During the nine years in which she has occupied the post she has worked in co-operation with the honorary secretary, Mr. A. C. Cramb, borough electrical engineer of Croydon. The organisation of the annual conventions of the I.M.E.A., with which Miss Lanfear was so notably associated is remembered by many of the members and visitors as a model of efficient organisation.

Mr. E. W. Hill has been appointed chief engineer of Aron Electricity Meter, Ltd., in succession to Mr. F. A. Nield, who is retiring by medical advice on account of ill-health. Mr. Hill is an old student of Finsbury Technical College (1900–1902) and has for many years been associated with the electricity meter and instrument branch of the industry in this country and abroad, and was recently one of the moving spirits of the late Meter Engineers' Technical Association.

THE EVERLITE LAMP.

A Battery Lamp Unit for which Efficiency and Economy are Claimed.

PROF. DR. ALFRED SCHMID, of Bale University, was recently interviewed by our representative in regard to the Everlite lamp, which was invented by Dr. Schmid, and is to be put on the market by EVERLITE, LTD., a subsidiary of the Metropole Gramophone Co., Ltd., of Metropole House, Finsbury Square, London, E.C.



Examples of the "Everlite" lamp.

Dr. Schmid said the fact that only from 5 to 10% of a dry battery is used up chemically, led him to develop a battery which has a constant discharge curve and can be re-charged, as the refills for the Everlite lamp battery are made in nonhydroscopic capsules which contain solidified extracts. The complete units are airtight and watertight, and, it is claimed, can be used under water. The smaller lamps, such as bicycle and torch types, are being made so that they light both in inverted and horizontal positions. Other types are also to be made, including miners' lamps, boy scouts' lamps and table lamps, and all can be made to operate by means of a switch, if desired. Lamps of 30 to 50 c.p. will be supplied for signalling. Bicycle lamps, we understand, will be on sale in April. An important claim for the new lamp is that it has no "self-consumption." It is stated that it can be left for years and will afterwards give its full output. It is claimed that a room can be lighted by it economically, because the materials used in the capsules can compete favourably in cost with paraffin oil. A 22 c.p. lamp with an 8-hours' output will be one of the types manufactured.

In a report on Dr. Schmid's battery, Mr. R. P. Wilson says he was primarily concerned in satisfying himself that the battery would develop the energy claimed, and that it would maintain a reasonably constant output throughout the period of its operation. Having satisfied himself on these points, he ascertained the nature and the cost of the ingredients used. That the battery will produce the energy and maintain its pressure was demonstrated to him in Bale, but on his return to London he made up a lamp in accordance with the inventor's formulæ and design, and has tested it over a continuous period of six hours. During the whole of this period the voltage was well maintained, and at the end of the six hours the lamp was giving its full illumination. He is satisfied from his test that the manufacture of this lamp, in accordance with Dr. Schmid's specification and complete with the necessary filaments, is a commercial proposition. The ingredients are all such as can be obtained freely on the market. The refills can be stored in any climate without deterioration. The battery used for this test was designed to give an output of 3 A for six hours at 1½ V, but the average output throughout this period was in excess of these figures. The mean current was 3·125 A and the mean voltage 1·69=5¼ W. At the beginning of the test the discharge rate was 5·8 W, or 30% in excess of what it should have been, but in spite of this excessive rate of discharge the output was satisfactorily constant.

ELECTRICITY COMPANIES' OBLIGATIONS.

The London and Home Counties Joint Electricity Authority issued, last week, a report upon the following questions: (*a*) the limitation placed upon the London electricity companies with regard to divisible or retainable profits; (*b*) the obligation imposed upon the London companies to reduce charges for electricity; (*c*) the reserve funds which the companies may keep as prescribed by the Acts referred to. The report states that the questions are not free from difficulties in the interpretation of the Statutes. It is clearly the intention of the scheduled agreements to limit divisible and surplus profits in such a way as to encourage reduced prices to and increased consumption by all classes of electricity users, and to exhaust the revenue of a company by (*a*) meeting proper expenses of generation and distribution; (*b*) providing limited interest, dividend charges and reserve and contingency funds; (*c*) reducing charges for electricity. It is reasonable to believe that the proper application of the Statutes will lead to these results.

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LEGAL INTELLIGENCE.

No Infringement of Loud Speaker Patent by S. G. Brown, Ltd.

IN the Chancery Division on January 23rd Mr. Justice Tomlin delivered his considered judgment in the action by the Lektophone Corporation, of Jersey City, against S. G. Brown, Ltd., of Victoria Road, Willesden Lane, N.W., which was heard during last sittings.

The plaintiffs claimed an injunction restraining infringement of a patent relating to improvements in loud speakers granted in 1914 to Marcus Clarence Hopkins. They complained that in September, 1927, the defendant company sold a "Mascot" loud speaker which they alleged infringed the patent.

The defendant company denied infringement, and said their case was that the patent was invalid on the grounds of common general knowledge, and insufficiency of description in the specification. They counterclaimed for revocation of the patent.

His lordship said that at the date of the patent (1913) sound reproduction had a limited field. The first application in England for a patent for Hopkins' invention was made on July 11th, 1914, and the patent granted was for "improvements in or relating to sound regenerating machines."

In his specification Hopkins was confining himself to the art affecting instruments which produced vibration by the movement of a stylus over a record. He thought Dr. Eccles, the plaintiff's witness, was right in saying that Hopkins didn't appreciate that he could get lower frequencies with a larger diaphragm.

As to what Hopkins claimed in his specification his lordship said he was satisfied that the claims were for a stylus and record machine with a diaphragm reproducer operating without a soundbox, horn or trumpet, but with a tympanum at least 9 inches in diameter having conical and annular portions, the latter being supported by rings at its outer edge.

This view would be sufficient to dispose of the action, as the alleged infringing article was a loud speaker in the modern sense, and was not constructed for use on a record and stylus machine.

The granting of licences by the plaintiffs first began in 1926. He had seen a number of loud speakers said to be made under these licences, and many of them seemed to have little resemblance to Hopkins' diaphragm. Whatever was the tone construction of the specification of the patent he held that there was no infringement by the "Mascot."

The result of the case was that both the action and the counterclaim failed and must be dismissed.

His lordship divided the costs, four-fifths to the defendants and one-fifth to the plaintiffs, and dismissed the counterclaim with costs.

Trade Mark Infringement.

A motion by the Cable Makers' Association against the City Engineers' Supply Co. was mentioned to Mr. Justice Eve in the Chancery Division on January 18th.

Mr. D. H. Corsellis, for the plaintiffs, said it was a motion to restrain infringement of three registered trade marks. Defendants were prepared to treat the motion as the trial of the action and to consent to a perpetual injunction, an order for delivering-up or destruction of the infringing articles and to pay the plaintiffs' costs. There would be no order as to damages.

Counsel for the defendants agreed to this course.

Electricity Schemes Facilitate Settlement.

In the Chancery Division recently Mr. Justice Romer heard an action brought by Mr. Vincent Bambrick, who has a steam laundry at the junction of Reservoir and Diamond roads, at Whitstable, for an injunction to restrain the Whitstable Electric Co., Ltd., from committing a nuisance by vibration and noise. The power station is 50 yards from the laundry. It was complained that plaster was shaken down in the latter, and £75 had been spent on chimney repair and £200 other repairs were needed. The plaintiff feared injury to an employee by escaping steam or explosion, and the defendants replied that if his fabric was damaged it was by his own machinery. They denied both that the soil was London clay, conducive to the transmission of noise and vibration, and that they had taken no steps to abate any possible nuisance.

Mr. Bennett, K.C., and Mr. Wilfred M. Hunt, appeared for the plaintiff, instructed by Messrs. Walter Hills and Shea, Margate, London agents, Messrs. Kingsford, Dorman and Co.; and Mr. Gover, K.C., and Mr. Swords for the defendants, instructed by Mr. H. W. Guthrie, London.

Before all the evidence was heard Mr. Gover suggested that a settlement be arranged. Counsel consulted and Mr. Gover then announced that the electricity schemes now proceeding had facilitated a settlement.

Relay Telephone Patents.

In the Chancery Division, on Monday, Mr. Justice Tomlin granted an extension of the period of a number of patents relating to automatic or semi-automatic telephone exchange systems, for three years from April 23rd, 1929, on the application of the owners, the Relay Automatic Telephone Co., Ltd.

Mr. Trevor Watson, for the company, said that the main reason for the application was loss or damage in the use of the patents due to the war.

Marconi Royalties.

The action, Marconi's Wireless Telegraph Co., Ltd., against Attaix, Ltd., of High Street, Southampton, came before Mr. Justice Astbury, in the Chancery Division on January 22nd on a motion by plaintiffs for judgment in default of defence.

Mr. Trevor Watson for the plaintiffs said the action was brought for an account of certain royalties due to the plaintiffs under an agreement between the parties, an injunction to restrain breach of the agreement and damages. The defendants had entered an appearance in the action but had not put in a defence. There had been negotiations between the parties as the result of which an agreement was entered into in May, 1927. It was alleged that defendants had sold wireless receiving sets and battery eliminators which infringed plaintiffs patents. In the agreement entered into defendants acknowledged their liability to pay to the plaintiffs a royalty of 12s. 6d. per valve holder upon all broadcast valve receiving sets and a royalty of 12s. 6d. on each battery eliminator employing any of the plaintiff's patents and sold by defendants from April, 1925, to the date of the agreement. The defendants further undertook to render to the plaintiffs within seven days of the agreement, a complete royalty statement and account with respect to their liability and not to infringe plaintiff's patents. They had not rendered the account nor paid the royalties due under the agreement apart from £50 paid on account. Counsel accordingly asked for judgment against defendants and an inquiry as to the damages sustained by plaintiffs by reason of the breaches of the undertaking.

His Lordship gave judgment as asked.

Valve Selling Licences.

On a motion on January 25th before Mr. Justice Eve, in the Chancery Division, by the Mullard Radio Valve Co.,Ltd.,against Mr. C. Barnett, of Angel Lane, Stratford, E., Mr. Watmough, for the plaintiffs, said it was sought to restrain the defendants from selling valves in infringement of the plaintiffs' limited license. Defendants consented to an injunction and to the motion being treated as the trial of the action and had agreed to pay £5 damages, which would be handed to a charity, and costs.

His Lordship assented.

Pooled Telephone Patents

Mr. Justice Tomlin, in the Chancery Division, on Monday, heard an application by Standard Telephones and Cables, Lrd., for the extension of the period of seven patents relating to automatic telephone apparatus. The application was based on the loss or damage by reason of the war.

Mr. Trevor Watson, for the company, said the patents belonged to the Western Electric Co., Ltd., now Standard Telephones and Cables, Ltd. There was no opposition. He read an affidavit by the chairman of the company, which stated that soon after the war broke out the company became a controlled establishment, and the practical use of the patents had been postponed for six years because of that fact, and also because of the delay in the reorganisation of the automatic telephone proposals in this country.

The company's system was the rotary system, the features of it being that it was a part system, and it was applicable to systems manufactured by other companies. All the companies engaged in this work had pooled their patents for the use of the General Post Office.

His lordship made an order extending the period of all the patents to February 11th, 1934.

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BUSINESS ITEMS.

THE GENERAL ELECTRIC CO., LTD. has reduced the price of the "Magnet" two-way adaptor.

According to a Customs Circular dated December 14th, 1928, wireless apparatus and accessories may be imported into Roumania without any permit from the Roumanian Postal authorities.

A Danzig firm desires to be put into touch with British firms able to supply 170 tons of copper wire and 4½ tons of bronze wire. Further details from the Department of Overseas Trade, reference A.X. 7 374.

We understand that the first regional station of the B.B.C. will be erected at Brookmans Park, Potters Bar, and an order has been placed with the D.P. BATTERY CO., LTD., Bakewell, for a battery of 115 cells with a capacity of 1 950 Ah.

An interesting church lighting installation has recently been carried out by Messrs. NICHOLSON AND CO., electrical contractors, Milford-on-Sea, under the direction of Mr. W. McIntyre, acting as consulting engineer, at New Milton Church, Hampshire, using G.E.C. floodlights and specially designed reflectors.

Extensive use has been made of electric locomotives in connection with the construction of the new Mersey Tunnel, and orders have been received by the D.P. BATTERY CO., LTD., Bakewell, from Messrs. Wingrove and Rogers and Messrs. Greenwood and Batley, for a total to date of 52 Kathanode batteries for use in this work.

The WOKING ELECTRIC SUPPLY CO., LTD. is taking a prominent part in the Woking Trades Exhibition to be held in the Exhibition Buildings, Oriental Road, Woking, from February 6th to 16th. The General Electric Co., Ltd. is co-operating with the supply company in this connection, and has undertaken to equip a five-roomed electric bungalow, as well as furnishing a number of household appliances for the company's stand.

In connection with the order for the S.E. England Scheme, which, as announced last week, has been placed by the Central Electricity Board with FERRANTI, LTD., we understand that the contract is for 60 000 kVA, 30 000 kVA and 20 000 kVA, 132 kV three-phase units of total capacity 1 100 000 kVA. Ferranti, Ltd., point out that the transformers are the largest to be ordered to date for use in this country, and by working in co-operation with the railway companies concerned they have succeeded in making 60 000 kVA units suitable for transport in oil by rail under normal traffic working conditions.

An unfortunate accident took place on January 19th in the Trafford Park works of the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., to a 33 000 kVA frequency changer. Whilst running at full speed on test, a short circuit in the pit under the machine set fire to a temporary wood air discharge duct. Flames indrawn from the duct by fans at both ends of the machine then set fire to the stator windings, which were seriously damaged in the period of five minutes that elapsed before the rotor, weighing over 70 tons, could be brought to rest. On inspecting the damage it was decided to rebuild the stator, using new laminations, new copper, and new insulation throughout, and although the work is being pushed forward it is estimated that a delay of seven weeks may occur. We are given to understand that the set is notable as being the largest frequency changer yet built in this country. It is a reversible machine designed on the one side for three-phase 25 periods 11 000 V and on the other side for three-phase 50 periods 6 600 V. The normal rating is 33 000 kVA at 500 r.p.m., with a momentary overload capacity of 100%. The set is being built to the order of the London Power Company for the Deptford West station.

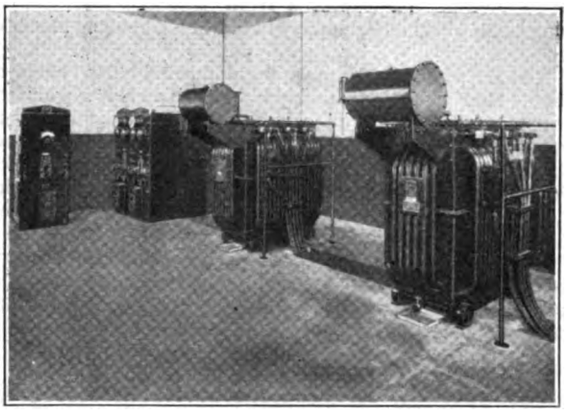
ROYAL WARRANTS OF APPOINTMENT.

Amongst the firms holding warrants of appointments to H.M. King George V are Allan Bros.; the Edison Swan Electric Co., Ltd.; the Grosvenor Electrical Co.; the Hart Accumulator Co., Ltd.; A. P. Lundberg and Sons; Burt, Escaré and Denelle, Ltd.; J. W. Gray and Son; C. A. Vandervell and Co., Ltd.; and Hoovers, Ltd. Amongst the firms holding warrants of appointment to the Queen is Tredegars (1923), Ltd. Firms entitled to style themselves "By appointment to the late King Edward VII," include Belshaw and Co. Firms permitted to style themselves "By appointment to the late Queen Alexandria," include Hassel and Tendt, Copenhagen; while firms holding warrants of appointment to H.R.H. the Prince of Wales include the Edison Swan Electric Co., Ltd.

WORKS ELECTRIFICATION.

Application of Electric Drive to Modern Biscuit Factory.

THE increasing use of electric drives in the factories of large industrial concerns outside the usual run of textile, colliery, iron and steel and similar works, is well illustrated by



View of sub-station showing G.E.C. truck cubicles and two 500 kVA transformers at Reading.

the electrification of Huntley and Palmerss' biscuit factory at Reading. Electric drives are here employed for many purposes, from the initial mixing processes right through to the final stages where, in the case of chocolate biscuits, for example, fractional H.P. motors are employed to wrap them in silver paper. Power for the operation of these motors is taken from the Reading Electrical Supply Co., Ltd., although, in case of emergency, sufficient power can be generated in the company's power house to keep the more important processes in operation. The equipment, manufactured and supplied by the General Electric Co., Ltd., includes two 300 kW motor converters, with starting panels, h.t. truck type cubicle switchboards, l.t. a.c. power and lighting switchboard, d.c. flat back switchboard, and two 500 kVA oil-immersed self-cooled core type transformers.

Power is received from the Reading supply mains at 3 700 V, three-phase, 50 cycles, but provision is made for an alternative source of supply, the incoming feeders from both sources being brought to two cubicles, each equipped with a direct operated oil circuit breaker of 75 000 kVA maximum breaking capacity together with ammeter, voltmeter, frequency meter, reverse power and overload relays, instrument transformer with current limiters and h.t. and l.t. fuses. The two outgoing feeders are taken one to the power house and one to a sub-station. The latter contains two 500 kVA oil immersed self-cooled core type delta star transformers, having a pressure ratio of 3 700/400 V, the h.t. supply to which is controlled by a truck switchboard of two cubicles equipped with direct operated oil circuit breakers. From these transformer secondaries cables are taken to an ironclad industrial draw-out pedestal switchboard also situated in the sub-station. The neutral points of the low tension side of the transformers are brought out to a l.t. lighting switchboard, thus enabling a voltage of 230 to be obtained for lighting purposes. The second outgoing feeder from the h.t. truck cubicle switchboard is taken to two similar trucks installed in the power house, each of which controls the h.t. supply to a 300 kW shunt wound motor converter, running at 1 000 r.p.m. and converting current at 3 500/3 900 V, three-phase, 50 cycles, into 210 V, for feeding a 2-wire d.c. system.

ELECTRICAL WOMEN.

The Manchester and Salford branch of the Electrical Association for Women spent an interesting afternoon at the new showrooms of Salford Corporation Electricity Department on January 15th. The city electrical engineer, Mr. L. Romero, had arranged an attractive programme, the first item of which was an inspection of the showroom. This was followed by an interesting and instructive address by Mr. Kellet on "Waterheating," in turn followed by an animated discussion.

Owing to the popularity of the E.A.W. ball held last year and the number of requests from all over the country for another one to be held this year, the Council of the Association has decided to hold a ball at the Hotel Cecil, London, on April 16th, the same day as the annual luncheon.

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PUBLIC LIGHTING.

Regulations for Electrical Installations in Places of Entertainment.

THE London County Council has published a new book of Regulations and Rules with regard to structural and other requirements in places of public entertainment. These regulations came into force as from January 1st, and the following is an abstract of some of the rules affecting electrical installations.

The I.E.E. regulations may be complied with with the exceptions that the relaxations permitted in their regulations for "extra low pressure" installations shall not apply to such premises and that the I.E.E. regulations for "low pressure" installations must be observed in all cases in which the pressure is below "medium pressure." Batteries with celluloid or other inflammable containers shall not be used. The use of wood for mounting or enclosing electrical apparatus shall be avoided as far as practicable, and where permitted must be of English oak, teak or mahogany. With certain exceptions, twin twisted flexible cords without protection may be used only for pendant lights and portable table lamps.

Stage Lighting.

Local switches will not be required for stage sockets, provided the council is satisfied that the control at the stage boards is sufficient. Auto-transformers must not be used for any purpose. The regulations also point out that when a three-wire or four-wire system is brought into the premises, it shall be divided, unless the council otherwise agrees in writing, at or near the intake into two two-conductor services from which all main circuits other than circuits connected to the outer conductors only, shall be taken. These services shall be kept and spaced apart throughout as may be considered necessary by the council to remove the risk of shock. Wiring must not be run in a ventilating duct, flue or air shaft, or installed in a lift unless it is essential for the operation of the lift. A cable duct must be stopped at any point at which it passes through a fire-resisting wall or floor so as to prevent the passage of fire or smoke from one section of the duct to another. Cable ways must not be formed in the protective covering of structural steel work, and conduit must be efficiently protected against corrosion. Where cables are permitted without conduit or similar protection (e.g., for connections to battens), they should be protected by an asbestic or other non-inflammable covering. This regulation does not apply to cables used in connection with portable apparatus. The use of flexible cord or cable should be avoided wherever practicable and in any case in which such a conductor is permitted it should be as short as possible. Each cord or cable must be fitted with a separate plug connection. Sub-circuits for current-consuming devices other than lamps must not be connected to lighting circuits. Provided that any such device which consumes not more than 500 W may be connected to a separate sub-circuit of a lighting distribution board. Sub-circuits from one source of supply only must be taken into any fitting, and a voltage greater than 250 should not exist between any conductors in any fitting. Multiple core and bunched cables must be suitably insulated and protected. Wiring used in connection with bell, telephone and similar apparatus must be kept away from and should not be installed in the same conduit as wiring used for other purposes. Radiators, convectors and similar devices may not be installed except with the consent of the council in writing. If such a device is installed it must be securely fixed in position, and if liable in any circumstances to reach a high temperature, must be provided with a stout wire guard of close mesh, fixed in position and so arranged that no part of the guard is within six inches of any portion of the device which is at a high temperature. The metal framework and the guard must be earthed. Electric ketties, irons and other appliances may be used only in positions specially approved by the council for the purpose. If the temperature of a non-luminous appliance be liable to exceed 212° F., a pilot lamp must be installed to indicate whether the current is on or off. The pilot lamp final sub-circuit should be separately fused on each pole.

In any premises at which a safety curtain is provided to the proscenium opening electric light may be the only illuminant provided for on the stage and (where such accommodation is provided) in the stage basement, the flies, property rooms and scene stores. The supply services for such illumination must be independent of those for either of the systems required in the auditorium, etc. Wiring and apparatus on the stage side of the proscenium wall must be supplied from an intake situated on the stage side of the proscenium wall and may not be connected to either of the services or installations which supply the auditorium, etc.

Temporary electrical installations may be carried out in accordance with the regulations under the Act of 1878. All temporary installations which are not in accordance with these regulations must, however, be disconnected from the permanent installation immediately after each occasion on which they are used. If, in connection with a particular production at premises provided with a safety curtain to the proscenium opening, it is proposed to use for a period not exceeding one week apparatus or effects which do not form part of the recognised stage installations, but which are in compliance with the regulations, the submission of details is not required if, before the apparatus or effects are used, a certificate be submitted to the council by the licensee describing the apparatus and stating that they have been examined by his electrician and found to be in safe working order.

In premises at which exhibitions or bazaars are to be frequently held, suitable distributing mains must be permanently installed with tappings, each controlled by a double-pole switch and double-pole cut-outs. Distribution boards must be provided as the council may consider necessary. Unless in any special case the council agrees otherwise in writing, the electrical arrangements, whether for lighting or other purposes, in connection with exhibitions or bazaars must be in accordance with these regulations. Provided that if the exhibition or bazaar is to be held for a period of not exceeding one month, wiring described under classes L, S or W, of 87 of the I.E.E. regulations may be used in certain positions if it is installed out of reach of the public and is open to view throughout its length. Lamps and signs installed in connection with exhibitions or bazaars must not be placed in such a position as to obscure or render less conspicuous the notices indicating the exits. Showcases containing lights or electrical appliances must be permanently wired in hard wiring and should be ventilated so as to prevent undue rise of temperature. The framework of any showcase containing running motors or appliances should be constructed of metal or approved hardwood. Electrical wiring or apparatus may not be installed in showcases containing inflammable materials. All lampholders should be kept fitted with lamps. Wiring and apparatus which will be out of use for a period exceeding one month, must be disconnected by the withdrawal of the fuses on both poles Permanently disused wiring and apparatus must be removed.

BRIGHTON'S NEW SWITCHGEAR.

Borough Electrical Engineer's Suggested Arrangement for North Road.

MR. JOHN CHRISTIE, borough electrical engineer, Brighton, has reported to the Lighting Committee that as the new e.h.t. switchgear for the Corporation and the Central Electricity Board at Southwick has been allocated to the Metropolitan-Vickers Electrical Co., Ltd., the best arrangement they could now adopt would be to duplicate the plant for the e.h.t. section at North Road with that which is being installed at Southwick and both ends of the system can be protected by "Translay" relays which both the Central Electricity Board and the Corporation purpose adopting. The Metropolitan-Vickers Electrical Co., Ltd., has made an offer that if the order for this extension is placed with them as an addition to the existing contract which has been placed with them for Southwick, it will supply this at the same price as the Southwick gear, viz., £1 070 per panel, less a reduction of 2½%. As 14 panels are required, the cost will be £14 605 10s. Mr. Christie recommends that an order for this equipment be placed at once. The old equipment at Southwick and North Road can, if re-conditioned and worked in conjunction with reactances, be safely used for the subsidiary circuits controlling the plant at North Road, the outgoing e.h.t. feeders to Hove, the automatic sub-stations, etc.; the Metropolitan-Vickers Electrical Co., Ltd., has quoted £2 985 for these reactances, and an order should be placed with them for their delivery as required. This extension scheme will therefore work out as follows:—E.h.t. switchgear: Metropolitan-Vickers Electrical Co., Ltd., £14 605 10s.; reactances, ditto, £2 985; buildings, about £25 000; contingencies, £1 500; reconditioning switchgear: Metropolitan-Vickers Electrical Co., Ltd., £8 820; alterations and additions to e.h.t. feeders and sub-circuits, about £2 500. The Committee has adopted the report.

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BUSINESS OPENINGS.

Latest Particulars of Electrical Engineering and Wiring Installation Contracts for which Tenders are being Invited at Home and Abroad.

WE give below the latest particulars of contracts for which tenders are invited. The closing date is given, when available.

BLACKBURN CORPORATION.—Electric light installation at the Roe Lee School. Specification, etc., from the Borough Engineer; deposit £1.

CARLISLE CORPORATION.—Supply and erection of 15 000 kW turbo-alternator, and condensing plant. Specification, etc., from Mr. C. W. Salt, city electrical engineer; deposit £2 2s.

EPPING GUARDIANS.—Electric light installation at the Institution. Particulars from the Clerk.

Overhead Lines and Transformers.

CHEADLE AND GATLEY URBAN DISTRICT COUNCIL, February 1st.—High tension overhead line (contract 45); and outdoor type transformers (contract 56). Specifications from Mr. R. W. Willis, 37, High Street, Cheadle, Cheshire; deposit £1 1s. for each contract.

HULL CORPORATION, February 1st.—Electric light wiring and fitting of senior department of Francis Askew School, Hessle Road, Hull. Specification, etc., from the City Architect.

OTLEY URBAN DISTRICT COUNCIL, February 1st.—Electricians' work in connection with erection of 40 houses on Westbourne housing estate. Specifications can be seen and quantities obtained on application to the Council's Surveyor; deposit £1 1s.

COUNTY ARMAGH EDUCATION COMMITTEE, February 2nd.—Electric lighting installation in Lurgan New Technical School. Specifications can be seen at the office of Mr. J. St. J. Phillips, 16, Donegall Square South, Belfast, or the Education Office, Armagh.

WANDSWORTH (LONDON) GUARDIANS, February 2nd.—Reorganisation of engineering plant at Tooting Hospital, Church Lane, Tooting. Plan may be inspected at the offices of the consulting engineer, Mr. W. M. Binny, 39, Carlton Road, East Putney, London, S.W.15.

AMPTHILL GUARDIANS, February 4th.—Electric heating installation, in the board room at the institution. Particulars from the surveyor, Mr. Leonard Foster, Flitwick, Bedford.

BATLEY CORPORATION, February 4th.—Supply of l.t. cable. Forms of tender from the Borough Electrical Engineer, Electricity Works, Batley.

EASTBOURNE CORPORATION, February 4th.—Automatic electrically-operated pumping plant. Specifications from the Borough Engineer; deposit £1 1s.

HALIFAX CORPORATION, February 4th.—Wiring 64 houses at Moor End Road for electric light. Particulars from the borough engineer, Mr. A. C. Tipple, Crossley Street, Halifax; deposit £2 2s.

LEEDS UNIVERSITY, February 4th.—Electric wiring, etc., of Mining Section of the University, Woodhouse Lane, Leeds. Specification from the Registrar of the University; deposit £1 1s.

LONDON COUNTY COUNCIL, February 4th.—Manufacture, and supply at East Greenwich power station of h.t. and l.t. cables, concrete core re-actors, control battery, etc. Specification from General Manager, L.C.C. Tramways, 23, Belvedere Road, S.E.1; deposit £2.

LONDON COUNTY COUNCIL, February 4th.—Wiring and fittings for electric lighting, heating and cooking in one block of dwellings, consisting of some 86 tenements and administrative quarters, on Ossulston Estate, St. Pancras (about 999 wiring points). Specification, etc., from Chief Engineer, Old County Hall, Spring Gardens, S.W.1; deposit £1.

HOLBORN (LONDON) BOROUGH COUNCIL, February 5th.—Twelve months' supply of electric lamps, etc. Specification, etc., from Mr. J. E. Parr, borough surveyor, or Mr. L. Walford, town clerk, Town Hall, High Holborn, W.C.1.

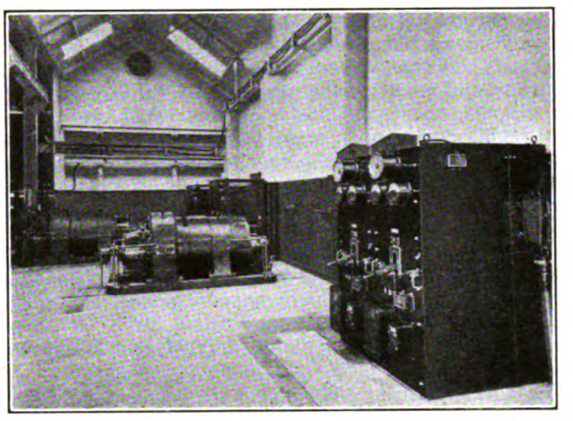
MANCHESTER GUARDIANS, February 5th.—Supply of Philips' portable X-ray plant, complete, 250 V, 50 cycles, to Crumpsall Institution, Crescent Road, Crumpsall, Manchester. Tenders to the Clerk, Union Offices, All Saints', Manchester.

BOOTLE CORPORATION, February 6th.—Supply of electric lamps. Forms of tender from the Borough Engineer.

GRIMSBY CORPORATION, February 6th.—Manufacture, supply, and erection of high-pressure steam pipes and valves, circulating water pipes and valves and water service pipes and valves, for the electricity department. Specification, etc., from Mr. S. R. Windle, Electricity Offices, Moss Road, Grimsby.

HAMMERSMITH (LONDON) BOROUGH COUNCIL, February 6th.—Twelve months' supply of electric lighting sundries, insulated wires, joint boxes, meters, h.t. and l.t. paper insulated cables, etc. Forms of tender, etc., from the Borough Electrical Engineer. Stamped addressed envelope to be sent.

PORTSMOUTH CORPORATION, February 6th.—Twelve months' supply of stores and materials to the tramways department,



A VIEW of the power house at the Reading works of Huntley and Palmers, Ltd., showing two G.E.C. 300 kW motor converters with their starting panels and h.t. switchboard.

including insulating materials, lamps, and motor windings (section Q), overhead line materials (section R), etc. Specification and form of tender from Mr. B. Hall, general manager and engineer.

GLASGOW CORPORATION, February 7th.—Electric lighting installation at Shettleston Baths. Specifications, etc., from the Office of Public Works, 64, Cochrane Street, Glasgow; deposit £3 3s.

LONDON COUNTY COUNCIL, February 7th.—Electric light wiring and fitting at Coroner's Court, Bethnal Green, and Weights and Measures Office and Coroner's Court, Clapham (about 80 wiring points). Specification, etc., from the Chief Engineer, Old County Hall, Spring Gardens, S.W.1; deposit £1 1s.

LEEDS GUARDIANS, February 8th.—Re-installation of electric light wiring in the Children's Block, at the Rothwell Institution. Specification, etc., from Mr. J. H. Ford, Poor Law Offices, 11, South Parade, Leeds. Stamped, addressed envelope to be sent.

LONDON, MIDLAND AND SCOTTISH RAILWAY, NORTHERN COUNTIES COMMITTEE (IRELAND), February 9th.—Twelve months' supply of stores, including telegraph ironwork, wire, electric lamps, porous pots, etc. (tender form No. 26). Forms of tender (6d. each) from Mr. F. J. Martin, Stores Superintendent, York Road Station, Belfast.

Wiring of Housing Estate.

NEWMILNS CORPORATION, February 9th.—Electric wiring, in connection with Council's housing scheme. Specifications from the Burgh Surveyor.

HENDON URBAN DISTRICT COUNCIL, February 11th.—Manufacture and erection of 29 closed circuit code-signalling street fire alarms. Specifications from Mr. A. G. Knight, engineer to the Council; deposit £3 3s.

ETON RURAL DISTRICT COUNCIL, February 12th.—Electrically-driven pumps, etc., at sewage disposal works, Iver, Bucks. Specification, etc., from Mr. A. Gladwell, Denmark House, Windsor Road, Slough; deposit £3 3s.

MANCHESTER CORPORATION, February 12th.—Supply of stores for the tramways department, including parts of tramcar electrical equipments, electrodes, cable, rubber strip, tramcar axles, wheel tyres and centres, etc. Schedules, etc.,

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from the General Manager, Corporation Tramways, 55, Piccadilly, Manchester.

STOKE-ON-TRENT CORPORATION, February 13th.—Twelve months' supply of mains and cables (contract No. 2 904); and a.c. and d.c. meters (No. 2 905); sub-station e.h.t. switchgear (No. 2 906), and static transformers (No. 2 907). Specifications, etc., from the City Electrical Engineer, St. George's Chambers, Kingsway, Stoke-on-Trent; deposit £2 in respect of each contract.

STOKE-ON-TRENT CORPORATION, February 13th.—Overhead wiring and services to 170 new houses on Hanford housing site. Specification, etc., from the City Electrical Engineer, St. George's Chambers, Kingsway, Stoke-on-Trent; deposit £2.

Generating Station Equipment.

SHEFFIELD CORPORATION, February 14th.—Equipment for new generating station at Blackburn Meadows, Sheffield, including turbo-alternator, with condensing, evaporating and steam preheating plant (specification B.M. 67); water-tube boilers, with chimneys, superheaters, stokers (or pulverised fuel firing equipment), economisers, valves, etc. (B.M. 68); wagon tippers, conveyors and elevators (B.M. 70); cooling towers (B.M. 72); and overhead electrically and hand-operated cranes (B.M. 73). Specifications from Mr. S. E. Fedden, general manager and engineer, Electric Supply Department, Commercial Street, Sheffield; deposit, £3 3s. for each.

CENTRAL ELECTRICITY BOARD, February 15th.—Supply and laying of 66 000 V cables in London area, in connection with South East England Electricity Scheme. Specification (S.E.E.-L.C.1) and form of tender from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit, £2 2s.

LEEDS CORPORATION, February 15th.—One year's supply of stores to the electricity department, including castings (section C.), i.r. covered cables, mains boxes and fittings, jointing and insulating materials, fittings and sundries (section N.). Forms of tender, etc., from Mr. C. N. Hefford, manager, 1, Whitehall Road, Leeds. State section for which it is desired to tender.

BELFAST CORPORATION, February 18th.—Twelve months' supply of stores for the electricity department, including electrical accessories (form No. 8), lamps (No. 9), carbon brushes (No. 10), bitite strip, prepared tape and rubber tape for joints and joint box compound (No. 12), c.i. street box frames and covers (No. 14), copper cable connectors and solder (No. 18), electricity meters and instrument transformers (No. 19), m.d. indicators (No. 20), automatic time switches (No. 21), cut-outs (No. 22), transformers (No. 23), cables and joint boxes (No. 24), v.i.r. cables, wires and flexibles (No. 26), etc. Forms of tender, etc., from Mr. F. H. Whysall, city electrical engineer and manager, East Bridge Street, Belfast.

BETHNAL GREEN (LONDON) BOROUGH COUNCIL, February 18th.—Six or 12 months' supply of electric lamps, lanterns, etc. Specifications from the Borough Engineer.

CENTRAL ELECTRICITY BOARD, February 18th.—Supply and erection of 132 000 V overhead transmission lines, in connection with the North-West England and North Wales Electricity Scheme. Specification (No. N.W.E.-P.L. 1) and form of tender from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit, £2 2s.

CENTRAL ELECTRICITY BOARD, February 18th.—Supply and erection of 132 000 V overhead transmission lines, in connection with the Central England Electricity Scheme. Specification (No. C.E.-P.L. 1) and form of tender from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit, £2 2s.

TYNE IMPROVEMENT COMMISSION, February 18th.—One 1½-ton portal, electric, travelling, level luffing crane, for Riverside Quay, Albert Edward Dock, North Shields. Specification, etc., from the Secretary, Bewick Street, Newcastle-on-Tyne; deposit £1 1s.

WEST HAM EDUCATION COMMITTEE, February 18th.—Electric light installation in South Hallsville New School, Agate Street, Tidal Basin. Specifications, etc., from Mr. J. H. Jacques, 61, West Ham Lane, Stratford, London, E.15; deposit £1.

DUMFRIES CORPORATION, February 21st.—Supply and erection of one 1 500 kW turbo-alternator and condensing plant. General conditions, specification and form of tender from Mr. W. S. Johnston, engineer and manager, Electricity Works, Leafield Road, Dumfries; deposit £1 1s.

BEDFORD CORPORATION, February 22nd.—Supply of e.h.t., h.t., and l.t. underground cables (section 1) and incandescent electric lamps (section 2) during year ending March 31st, 1930. Only British manufacturers in the U.K. are invited to tender. Specifications, etc., from the Borough Electrical Engineer, Prebend Street, Bedford.

CENTRAL ELECTRICITY BOARD, February 22nd.—Supply of 132 kV outdoor switchgear, for transforming stations in area of Central England Electricity Scheme. Specification from Sir R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2.

HASTINGS CORPORATION, February 25th.—Electrically-driven pumping plant, of British manufacture, for Kent Street pumping station. Specification, etc., from Mr. G. M. C. Taylor (J. Taylor and Sons), Caxton House, Westminster, S.W.1; deposit £5.

CENTRAL ELECTRICITY BOARD, March 2nd.—Supply and erection of 66 000 V and other transformers in the London area, in connection with the South-East England Electricity Scheme. Specification (No. S.E.E.-L.T.1) and form of tender from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit, £2 2s.

CENTRAL ELECTRICITY BOARD, March 4th.—Supply and erection of 66 000 V switchgear, for South East England Electricity Scheme (London area), and supply and erection of 132 000 V transformers. Specifications from Sir R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2.

CENTRAL ELECTRICITY BOARD, March 4th.—Supply and erection of 132 kV outdoor switchgear, for transforming stations, in the area covered by the North West England and North Wales Electricity Scheme. Specification (N.W.E.-P.S.1) from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit, £2 2s.

CENTRAL ELECTRICITY BOARD, March 4th.—Supply and erection of 132 000 V transformers in connection with the North West England and North Wales Electricity Scheme. Specification (N.W.E.-P.T.1) from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit, £2 2s.

ERITH URBAN DISTRICT COUNCIL, March 4th.—Supply of h.t. and l.t. underground cables, joint boxes and other accessories during 12 months. Particulars and form of tender from the Electrical Engineer, Walnut Tree Road, Erith.

Overseas.

UNLESS otherwise stated, particulars of overseas contracts are to be had from the Department of Overseas Trade (Room 52), 35, Old Queen Street, Westminster, London, S.W.1. *Note.—An asterisk denotes that local representation is, in practice, essential.*

VICTORIAN ELECTRICITY COMMISSION, February 4th.—Supply of 22 000 V switchgear and accessories, for Richmond Terminal Station. (Reference B.X. 4 901.)

VICTORIAN ELECTRICITY COMMISSION, February 4th.—Supply of 11 000 V switchgear, for installation in the Richmond Terminal Station. (Specification No. 29/3.) (Reference B.X. 4 898.)

VICTORIAN ELECTRICITY COMMISSION, February 4th.—Supply of 11 000 V switchgear, in connection with the Yallourn power station extensions. (Specification No. 29/5.) (Reference B.X. 4 897.)

VICTORIAN ELECTRICITY COMMISSION, February 4th.—Supply of pillar insulators, with metal parts, for use on 132 000 V outdoor circuits. (Reference B.X. 4 921.)

COLOMBIAN MINISTRY OF PUBLIC WORKS, February 5th.—Supply of two hand magnetos, with 400 metres of copper wire, capacity 25 detonators each.

INDIAN STORES DEPARTMENT, NEW DELHI, February 5th.—Supply of turbo-alternator, boiler, economiser, switchgear and cables. (Reference B.X. 4 944.)

VICTORIAN RAILWAY COMMISSION, February 6th.—Supply of a.c. line relays (contract 42 491). (Reference B.X. 5 042.)

DUBLIN BOROUGH COMMISSIONERS, February 9th.—Supply of arc lamp pillars. Specification, etc., from the City Electrical Engineer, Fleet Street, Dublin.

EGYPTIAN STATE RAILWAYS, February 9th.—Electrification and equipment of Heluan line, including equipment of power station, overhead transmission lines, track bondn

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motor and trailer coaches, etc. Tenders to General Manager, Cairo Station.

GHENT MUNICIPALITY, February 11th.—Supply of 16 electric portal cranes. (Reference A.X. 7 398.)

NEW SOUTH WALES PUBLIC WORKS DEPARTMENT, February 11th.—Supply, erection and maintenance of hydro-electric generating plant, in connection with Hume reservoir hydro-electric development. (Reference B.X. 4 989.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, February 12th.—Supply of 110 kV switchgear, and controlling equipment, for Waitaki power scheme, section 3. (Reference B.X. 4 848.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, February 12th.—Supply of dry cells, for telephone work. (P. and T. 151/1 205.) (Reference B.X. 4 991.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, February 12th.—Supply of v.i.r. wire (No. P. and T. 151/1 184). (Reference B.X. 4 951.)

JOHANNESBURG MUNICIPALITY, February 14th.—Supply of two single-phase transformers, each of 1 080 kVA (contract 115). (Reference B.X. 5 005.)

LOUGH DERG, PETTIGO, CO. DONEGAL, February 14th.—Supply and erection of two heavy oil engine-driven, continuous current, 10 kW, 220/250 V generating sets (section I); storage battery, on nickel-iron-alkaline system (section II); and d.c. switchboard (section III), for the Venerable Dean Keown. Specifications for each section from Messrs. MacEntee and O'Kelly, 23, Upper O'Connell Street, Dublin; deposit, £2 2s.

SOUTH AFRICAN RAILWAYS AND HARBOURS, February 14th.—Supply of 15-ton electrically-driven portal titan crane (tender No. 1 366). (Reference A.X. 7 272.)

INDIA STORE DEPARTMENT, February 15th.—Supply of 62 248 metallic filament lamps, for train lighting. Form of tender (5s.) from the Director General, Belvedere Road, London, S.E.1.

INDIA STORE DEPARTMENT, February 15th.—Supply of hydro-electric plant, comprising four 12 000 kW water-wheel driven alternator sets, auxiliaries and spares (schedule 4). Forms of tender (5s.) from the Director-General, Belvedere Road, London, S.E.1.

NEW SOUTH WALES DEPARTMENT OF PUBLIC WORKS. Extension of date.—February 18th.—Supply and erection of hydro-electric generating plant for Burrinjuck development. (Reference 4 938.)

NEW ZEALAND POSTS AND TELEGRAPHS, February 19th.—Supply of bronze wire and copper binding wire. (Reference A.X. 7 252.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, February 19th.—Supply of 120 000 galvanised steel spindles for insulators. (Reference B.X. 4 948.)

POSTMASTER GENERAL'S DEPARTMENT, MELBOURNE, February 19th.—Dry cells and wet battery parts (schedule C. 404). Reference B.X. 5 068.)

Pumping Equipment.

CAPE TOWN MUNICIPALITY, February 20th.—Pumping equipment for storm water, etc., for the electricity department (specification 445/28). (Reference A.X. 7 345.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, February 26th.—Supply of induction coils and registers, for telephone work (schedule C. 394). (Reference B.X. 5 031.)

EGYPTIAN MINISTRY OF PUBLIC WORKS, February 28th.—Supply and erection at Sollum of aerial ropeway, with dynamos, telephone and other equipment. Specification (10s. 6d.) from Chief Inspecting Engineer, 41, Tothill Street, London, S.W.1.

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, February 28th.—Supply of six-conductor telephone cordage (No. P. and T. 151/1 234). (Reference B.X. 4 990.)

WHANGAREI (N.Z.) HARBOUR BOARD, February 28th.—Supply of one 15-ton electrically:-operated level luffing gantry crane (contract No. 35). (Reference A.X. 7 263.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, March 5th.—Supply of seven single-phase 5 500 kVA transformers, for Waitaki power scheme, section 4. (Reference B.X. 4 873.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, March 7th.—Supply of hydraulic accumulator, horizontal ram pump, electric motor, motor or belt driven air compressor, starter and control gear.

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, March 12th.—Supply of switchboard cords (P. and T. 151/1 247). (Reference B.X. 5 017.)

CAPE TOWN MUNICIPALITY, March 15th.—Supply of metal-clad switchgear (specification 449/28). (Reference B.X. 5 004.)

CHILEAN MINISTRY OF MARINE, March 15th (extension of date).—Two electric travelling cranes, for Port of Valdivia. (Reference A.X. 7 353.)

VICTORIAN ELECTRICITY COMMISSION, March 18th.—Supply of 1 300 strings of suspension insulators, 600 strings of tensioning insulators, 1 300 conductor suspension clamps, 350 conductor tensioning clamps, 50 semi-anchor clamps for "V" strings of insulators, 200 semi-anchor clamps for single strings of insulators, 475 earth wire suspension clamps and 125 earth wire tensioning clamps. (Reference B.X. 4 997.)

LOURENCO MARQUES PORT AND RAILWAYS BOARD, March 19th.—Supply of three-phase, Diesel-driven 50 kVA generating set, and electrically-driven water pumping set. (Reference B.X. 5 050.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, March 19th.—Supply of 110 000 V transformer, for Mangahao electric power scheme (section 204). (Reference B.X. 4 952.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, March 19th.—Supply of 11 000 V switchgear, for Mangahao power development (section 203). (Reference B.X. 4 953.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, March 26th.—Switchboard cords. (Reference B.X. 5 067.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, March 26th.—Supply of telephones and dials (schedule C. 401). (Reference B.X. 5 023.)

EGYPTIAN MINISTRY OF THE INTERIOR, March 27th.—Supply and installation of electric lighting system for the town of Fashn. (Reference B.X. 5 037.)

Tenders Accepted.

ABERDEEN CORPORATION.—A. M'Kay, supply of electrical fittings for one year.

BRADFORD CORPORATION.—British Insulated Cables, Ltd., supply of 41 tons of copper wire.

ADMIRALTY.—General Electric Co., Ltd., part requirements of Osram gasfilled and vacuum lamps, and Robertson carbon lamps.

DOVER CORPORATION.—Switchgear and Cowans, Ltd., supply of switchgear, £640; Pirelli-General Cable Works, Ltd., supply of 6 600 V feeder cable, £2 232 10s. 7d.

SHEFFIELD CORPORATION.—James Laver and Sons, Ltd., concrete foundations, retaining wall and pipework for new cooling tower at Neepsend generation station, £3 523 12s. 10d.

WESTMINSTER GUARDIANS.—Bellis and Morcom, Ltd., installation of generating plant at St. Stephen's Hospital, £1 347; General Electric Co., Ltd., for alterations of existing switchboards, £171.

INDIAN STORES DEPARTMENT.—Callender's Cable and Construction Co., Ltd., wire, Rs. 4 826; General Electric Trading Co., steel poles, Rs. 1 696; Duncan, Stratton and Co., motor-driven drilling and tapping machine, Rs. 6 310, and electrically-driven, double railway wheel lathe, Rs. 67 650.

GLASGOW CORPORATION.—Ferranti, Ltd., supply of 12 kVA portable a.c. testing equipment, £168; Alex Robertson, electrical installation at Scotstoun for 510 houses, £2 361 8s. 4d.; D. Henderson, electrical installation at Gairbraid for 366 houses, £1 618 14s. 2d.; Alex. Stephen and Sons, Ltd., supply of a 50 H.P. motor, £143. (All recommended.)

BRIGHTON CORPORATION.—Le Grand, Sutcliffe and Gell, Ltd., boring work in connection with extension of condensing system at Southwick power station, £75 for 100 ft. in three borings, and 10s. per foot for any excess over 100 feet; Tudor Accumulator Co., Ltd., new battery at North Road sub-station, £6 811 16s.; Ferranti, Ltd., supply of two 200 kVA transformers, £277 10s.

LIVERPOOL CORPORATION.—General Electric Co., Ltd., supply of six 500 kVA transformers, for £224 each; Rimmer Bros., re-construction work at Lodge Lane sub-station, £4,088; Titan Trackwork Co., Ltd., supply of cranked steel tramway rail fishplates as follows:—100 pairs ⅛ in., at 18s. 6d. per pair; 100 pairs ¼ in., at 19s. per pair; 100 pairs ⅜ in., at 20s. per pair; 100 pairs ½ in., at 20s. per pair; 50 pairs ⅝ in., at 20s. per pair.

SUSPENSION INSULATORS.

In Mr. C. S. Garland's article on "Suspension Insulators for H.-T. Transmission Lines," published on page 109 of our January 25th issue, Fig. 3 was inadvertently described as a "Motor" insulator. The figure illustrated will, of course, be recognised as an insulator of the pin type.

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ELECTRICITY SUPPLY.

Electricity at Forres—Charges at Pontefract—Hollywood Secures Electricity Order—Carlisle Plant Extension—Fulham will not Entertain J. E. A. Proposals—Supply to Film Studios—Marylebone's Extension Project.

OBJECTION has been raised at Odiham, Hants, to the proposal by Aldershot Gas, Water and District Lighting Co. to erect overhead electric cables in the High Street.

At a recent meeting of Forres T.C. it was reported that a committee had been negotiating with a London company for establishing electricity supply in the burgh.

Eton U.D.C. does not assent to the provisions in the London and Home Counties' Electricity Authority's Bill to transfer the purchase rights of councils to the Joint Electrical Authority.

Glossop Corporation has received an Order of the Ministry of Transport fixing the maximum charge for electricity in the borough at 8d. per kWh, and an agreement has been entered into with the Urban Electric Supply covering other points.

The Electricity Commissioners have fixed February 13th, for holding their inquiry into the joint petition of the Pontefract Chamber of Commerce and Town Council for a compulsory revision of the maximum charges for electricity in the borough imposed by the Yorkshire (West Riding) Tramways Co.

Walsall Electricity Committee is to extend mains to supply 40 houses which are being erected by the Corporation at Well Lane.—The Committee is to extend mains at a cost of £700, to supply 48 houses in course of erection by the R.D.C. at Aldridge and Pelsall.—The Committee recommends that, in order to give a supply in the Little Aston area, mains be extended at a cost of £3 100.

Holeywood U.D.C. has obtained a Special Order authorising its electricity supply scheme, and a supply is to be obtained from Belfast Corporation's system, by tapping the line which will be erected to supply Bangor. The distribution will be by means of underground cables in the main thoroughfares and by overhead lines in other streets. The current supplied will be three-phase, 50 periods, at 220 V for lighting and 380 V for power.

The Electricity Commissioners have intimated that they are prepared to give consent to the extension of Carlisle Corporation's generating station by the installation of one 15 000 kW turbo-alternator with three 30 000 lb. boilers and auxiliaries. They have been in communication with the Central Electricity Board as to the procedure in connection with the extension of selected stations, and the Board will shortly give a direction to the Corporation in respect of the above-mentioned extension.

Fulham (London) B.C. is recommended by the Electricity and Lighting Committee to inform the London and Home Counties Joint Electricity Authority that the Council intends to maintain direct relations with the Central Electricity Board in regard to the extension and alteration of its generating station and its subsequent operation under the South East England Scheme, and that the Council cannot, therefore, authorise any discussion with representatives of the Joint Authority as to the acquisition of the station by the Authority.

On the suggestion of Mr. C. I. Shuttleworth, acting city electrical engineer, Hull Electricity Committee has decided to increase the insurance of the electricity works and sub-stations against fire from £600 000 to £850 000. The insurance of boilers and fittings against breakdown is compulsory, and the insurance of other plant against breakdown is optional. With regard to the question of continuing the latter, in view of the considerable premium and the restrictions and limitations in policies, a report is to be obtained from the City Electrical Engineer.

An agreement has been made for the supply by Brighton electricity department to the proposed film studios at Whitehawk Valley at 0·625 per kWh, plus a further 0·025d. per kWh for every 1s. increase in price of coal over 20s. 6d. per ton, corresponding decreases to be made for each decrease of 1s. below 20s. 6d. per ton, the consumers to guarantee revenue of £3 000 for the first 18 months after connection and £3 000 per annum for following four years. An unrestricted supply is to be available during Saturdays and Sundays throughout the year, but on other days in December and January no demand is to be made between 4 p.m. and 6 p.m. beyond, say, 50 kW for ordinary lighting.

The Borough Electrical Engineer of St. Pancras (London), has been in negotiation with the London, Midland and Scottish Railway Co. with reference to a supply of electricity to Euston station. The amount required would be about 350 kW, and the load factor would be not less than 30 per phase. At present there is an agreement for a similar supply to King's Cross Station, and it is proposed that the charge for the Euston supply shall be the same, viz., £3 16s. per kW and ¾d. per kWh up to one million kWh, and beyond this ½d. per kWh, with a coal clause. The company's maximum demand would be 600 kW, representing a minimum consumption 1 576 800 kWh per annum for seven years, at the end of which the agreement could be determined by notice. The revenue would be about £4 496 per annum. The Electricity Committee has approved the terms.

The Electricity Commissioners have notified Bristol Corporation that they are prepared to grant an Order for the extension of area of supply for all the parishes proposed to be included, except Bitton, Hanham Abbots, Oldland and Siston in the rural district of Warmley. In respect of these last-mentioned parishes, Warmley R.D.C. has applied for an Order, and the Commissioners propose to grant it to the R.D.C. They propose to grant protective provisions to a non-statutory company operating in the parishes of Almondsbury and Olveston, and, as the Electricity Committee is of opinion that it is desirable that the area which would in certain events be allotted to this non-statutory company should be within the area of supply of the Corporation, it has provisionally agreed to purchase the goodwill of the undertaking, plant, etc., for £3 700.

Marylebone (London) Electric Supply Committee recommends that the Electricity Commissioners be informed that, so far as the immediate future is concerned, the Council prefers to contemplate plant extensions rather than additional bulk supplies, that the Council approve of the installation of two 20 000 kW turbo alternators, with the requisite boiler plant, etc., at a cost of £471 900; the scrapping of three existing 2 000 kW d.c. Parsons sets with auxiliaries, and two boiler feed pumps; the sale of scrapping of one of the existing 3 000 kW Oerlikon turbo-alternators, with auxiliaries, and the expenditure of £115 652, subject to obtaining consent, upon trenching, provision of ducts and re-instatement (£32 347), e.h.t. cables, drawing in and jointing (£47 544), switchgear at generating station, sub-stations and transformer stations (£26 291), and transformer groups (£9 470).

Godstone R.D.C. recently decided to oppose the application of East Grinstead U.D.C. for a Fringe Order to supply, in parts, the parishes of Lingfield and Godstone, on the ground that the Sevenoaks and District Electricity Co. had agreed to schedule the districts concerned, as a compulsory area. East Grinstead Council, which had applied to the Commissioners for an Order to supply to 39 premises at Baldwin's Hill and Felbridge, in the Godstone rural area, submitted that the consent of Godstone R.D.C. had been unreasonably withheld. A sub-committee of the latter council reported that the company's system would be alternating current, whereas it appeared that there would be unnecessary expense in changing consumers' apparatus if the U.D.C. obtained an Order to supply on the d.c. system, and the company's ring main transmission system would be imperilled. The Council decided at its last meeting to continue its opposition.

Stoke-on-Trent Electricity Committee has decided that where premises are electrically lighted and wired with separate circuits, in accordance with specification issued by the department, supply shall be given for domestic heating and cooking at 1d. per kWh. Electric baking ovens are to be supplied at ¾d. per kWh, provided that such supply is not taken during winter peak load hours, or that, if taken during winter peak load hours, the load factor is not to be less than 20%.—The electric kiln at the Burslem works of Doulton and Co., Ltd., which was started on October 13th, has given entire satisfaction. Mr. C. H. Yeaman, city electrical engineer, reports that the load factors for the four electric kilns already in use are from 85·56% to 94·2%.—Correspondence with the Imperial Sun-Ray Centres (Hanley) in regard to the supply of electricity has been submitted to the Electricity Committee, and it has been decided that, subject to a minimum payment being made of £50 per annum, supply be given at 2½d. per kWh for sun-ray apparatus, provided the consumers take general lighting and heating at tariff rates.

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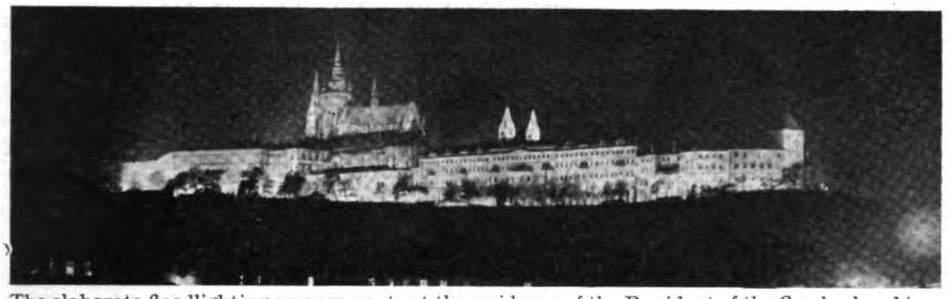
ELECTRICAL NEWS OF THE WEEK IN PICTURES.



The elaborate floodlighting arrangements at the residence of the President of the Czechoslovakian Republic, at Prague. The majority of other Government buildings are also equipped for decorative electric lighting, and this is brought into use on every suitable occasion.

Signor G. Semenza, who has been awarded the Faraday Medal of the I.E.E. (P. 141.)

The new offices of the S.W.S. Electric Power Co., at Mucklows Hill, which was visited by the Birmingham Branch of the Electrical Association for Women last week. Among those present were Lady Brooks, president of the Branch, Mrs. R. A. Chattock, Mrs. Beale, and Mrs. A. L. Hayes, secretary of the Branch.

A group taken at the Plaza Theatre, London, including, among others, Sir John Gatti, Lieut.-Colonel W. Ashley and Sir John Snell, on the occasion of the showing of the E.D.A. film "Rural Electrification" on Monday. The "story" was photographed in this country and takes about an hour to show.

Hastings Electricity Committee recommends that the voltage of the incoming supply from the proposed main grid be fixed at 11 000 V as recommended by the borough electrical engineer.—The Committee has arranged for the extension of the cables to Battle U.D.C. sewage pumping station for driving new pumps which are about to be installed.—The Committee seeks sanction for loans for services, £2 500; mains and overhead lines, £1 000; and transformers, £500, for the extended area of supply.

Mr. W. Redman, electrical engineer to Shipley U.D.C. has submitted an alternative lighting scheme prepared at the request of the Highways Committee. The scheme provides for 242 two-lamp points, each lamp being of 300 c.p. On the Bradford and Keighley Road the lighting points would be fixed on alternate tramway poles on each side of the road. On roads where tramway poles are on only one side of the road, one lighting point would be fixed on each pole. The Electricity Committee has informed the Highways Committee that the charge for the alternative scheme would be £5 per lamp per annum for maintenance, and 1½d. per kWh for current consumed.

Mr. John Christie, borough electrical engineer, reports to Brighton Lighting Committee that it is necessary to augment the capacity of the Portslade and Southwick sub-station. He suggests that the least efficient unit should this year be replaced by a 1 000 kW Bruce Peeble-La Cour motor converter, and that a second unit of similar capacity be installed at a later date. The cost of this new unit complete, including erection, will be £4 609, plus temporary h.t. switchgear, £330; l.t. switchgear, instruments, etc., £350; h.t. and l.t. cabling for connecting up, £150; alterations to foundations, etc., £350, and labour, etc, £200. The Committee has authorised the engineer to obtain offers for necessary plant, etc.

The Stewartry County Council, at a meeting on January 22nd, agreed to lodge an opposing petition to the electricity scheme of the Galloway Water-Power Co. In view of the fact that the scheme is entirely dependent on the natural resources of the Stewartry, the Council desires to secure more favourable terms than the grid, and that a supply should be made available at any of the power stations, and also at convenient points on the Company's own transmission lines throughout the county at the same pressure at which the company supplies electricity to the main transmission lines of the Electricity Board. It was stated at the meeting referred to, that the effect of the scheme would be that, in ten years, salmon in the River Dee would die out completely. Major Wellwood Maxwell, one of the promoters of the scheme, stated that on an average rate at present in force, of 8s. per £1, the scheme would yield an annual revenue to the county of £8 000.

At a recent meeting of electors Preston Corporation's Parliamentary Bill to construct a weir across the River Ribble was considered. Ald. Astley-Bell said the Council had a programme consisting of a 50 000 kW additional set in 1934–35, and a further 50 000 kW set in 1938–39. If they ran continuously their existing four 15 000 kW sets they would require four million gallons of water per hour. Under the proposed scheme, water would be impounded for a distance of three miles. The weir would be of ferro-concrete, with sluice gates, and the cost would be £75 000. The minimum flow of the river was 5 500 000 gallons per hour. Each generator needed over 1 000 000 gallons per hour, and they were faced with the necessity of augmenting this supply. The Central Board wanted the plant increased from four 12 000 kW sets to four 15 000 kW sets. Eventually they would need 11 500 000 gallons of water per hour. The proposal to promote the bill was carried.

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ELECTRIC TRACTION.

Southern Railway Development Programme for the Current Year.

THE construction of an electric railway between the Republic of San Marino and Rimini (Italy) has commenced.

Preston T.C. has decided that hardening treatment be carried out on two miles of single tramway track, at a cost of £1 500.

Southend Corporation is applying for a Provisional Order authorising the running of electric trolley vehicles.

Exeter Corporation has approved the extension of the tramways from the Penhoe Road boundary to the boundary at Whipton, at a cost of £20 750.

Nottingham Corporation has decided to apply for sanction to a loan of £21 750 for the rearrangement of the tramway track necessitated by the new lay-out of the Great Market Place.

The net earnings on the New South Wales Government Railways and Tramways for the year ended June 30th, 1928, were £4 273 185, an increase of £837 505, of which the tramway net earnings were £619 205, increase £300 941.

Colne T.C. has been informed by the National Joint Industrial Council for the Tramways Industry that it has been agreed that wages of men employed on one-man trams and buses shall receive a 10% increase on their normal rates of pay.

The question of the terms of a new lease for the operation of the Prestwick tramways by the Salford tramways department has been considered by the Minister of Transport who has decided that he could not press Salford Corporation to renew the lease on terms more favourable to Prestwick than those offered.

An L.C.C. Tramway Test.

London County Council is about to test on the Camberwell and Catford route of the tramways, which includes Dog Kennel Hill and Denmark Hill, two cars which are being constructed at the Charlton works. Only four-wheeled cars have hitherto been employed on this route, but the new cars, which have been specially designed for steep gradients, are of the double bogie, eight-wheeled type.

Manchester Tramway Committee is to erect a transformer house at the Hyde Road depot, in connection with the car works extension. The Committee has had an interview with representatives of the Wythenshawe Estate Special Committee with reference to the question of transport facilities between the Wythenshawe Estate and the City. The Tramways Committee was in favour of the provision of a 100 ft. road in extension of Princess Road, from Barlow Moor Road to the Stockport-Altrincham road, and the construction therein of a reserved (sleeper track) tramway.

It is announced that the extensive electrification scheme on the central section of the Southern Railway, which has involved the conversion of the old overhead system to the third rail d.c. system, at a cost of £3 750 000, is due for completion next Month. The total mileage of electrified line on the Southern Railway will then amount to 875 track miles, the total cost being £11 500 000. The final stage of the scheme covers the lines between Victoria and Epsom via Mitcham Junction; London Bridge, Effingham Junction, and Dorking North via Mitcham Junction; Holborn Viaduct and Wimbledon via Herne Hill, Tulse Hill, Tooting Junction, and Haydons Road; and the section of line between Beckenham Junction and Crystal Palace, which will permit the Victoria to Crystal Palace services to be extended to Beckenham Junction and further extensions are under consideration.

At a recent meeting of the Council of the London Municipal Society a resolution was passed urging upon the Government the necessity of giving facilities for the speedy passage of the Bills dealing with the proposed London traffic scheme in order that new and urgently needed transport services may be provided, the congestion of the streets relieved, cheaper fares and better labour conditions secured, and an opportunity afforded for giving work to the unemployed by the construction of new tube railways and other important improvements.—A resolution was passed at a recent meeting convened by Deptford B.C. (attended by representatives of Battersea, Bermondsey, Deptford, Poplar, Shoreditch, Stepney and Woolwich Councils), "strongly protesting against the proposed surrender by the L.C.C. of the existing public control of the tramways," and asking the councils represented at the meeting to oppose by petition the legislation on the subject to be promoted in the present Session of Parliament.

THE SOCIAL SIDE.

THE London office staff of Bakelite, Ltd., held their first dance on January 19th, at the Temple Restaurant, Victoria Embankment.

Blackpool Electricity and Tramways Employees' Institute last week held one of the most successful whist drives and dances ever held. Over 2 000 persons paid for admission. The Mayor and Mayoress distributed the prizes.

Downes and Davies, electrical dealers, 1/3, Stanley Street, Liverpool, contributed ten guineas to the Liverpool Goodfellows Fund. The directors and staff of Pulford Bros., Ltd., 106/110, Whitechapel, Liverpool, contributed £5.

The fourth annual dinner of the staff of Lincoln Corporation electricity department was held on January 4th, under the presidency of the assistant electrical engineer, Mr. Arthur Letts. The toast of "The Undertaking" was proposed by the city electrical engineer, Mr. Stanley Clegg. During the evening, the chairman of the Electricity Committee, Alderman W. S. White, presented an inscribed clock to Mrs. Wicks in recognition of her services at the St. Swithin's power station.

The test room staff of the Westinghouse Brake and Saxby Signal Co. held a smoking concert this year instead of its annual social. The concert was held on January 18th at the Railway Hotel, Chippenham. Mr. W. M. Martin presided in the absence of Mr. L. V. Gardiner, who is recovering from a motor accident. Mr. F. C. Brittain, works manager, was present, and the company enjoyed an excellent programme of musical and vocal items arranged by the committee. A feature of the evening was a "never-ending" song in Hindustani rendered by Mr. Murari Lal Mehandru.

The fifth annual works social given by the directors of Heyes and Co., Ltd., Water-Heyes Electrical Works, Wigan, was held at Miss Churchill's Rooms, on January 19th. Among those present were Mrs. W. A. Heyes (Mr. W. A. Heyes, the governing director, being unavoidably absent through illness), Miss Heyes, Messrs. A. V. Heyes (director), J. W. Cartwright (works manager), and J. C. Muir (secretary). The evening commenced with whist, after which prizes were distributed by Mrs. Heyes. Supper and dancing, with items of entertainment by Mr. Elsworth, terminated a most enjoyable evening.

The annual dinner of the directors, staff, and employees of the Eagle Engineering Co., Warwick, which was held recently reflected in happy manner the good relations which have always existed between the employees and employers. Mr. H. Palmer, managing director of the company, attended and was accompanied by Mr. Guy Champ, manager of the radio department, Mr. Colin H. Gardner, technical consultant of that department, Mr. Semple, Western Area representative, and Mr. Marriott, London manager of the radio department. An attractive musical programme was provided by the company's radio engineers by means of a new electrical reproducing equipment, working independently of the mains, which is said to provide music at a volume sufficient to enable 800 people to dance to it. This equipment may be placed on the market in the near future. In addition, a musical programme was provided by the Romnay Dance Band, consisting entirely of members of the staff.

The S.W.S. Social.

The annual dinner of employees of the Shropshire, Worcestershire, and Staffordshire Electric Power Co. was held at Dudley Town Hall on January 19th, about 400 being present. The gathering was presided over by Mr. T. F. Boothby, chief generating engineer, and amongst other officials present were the chief engineer and manager of the company, Mr. J. T. H. Legge, department chiefs and district representatives. The visitors included the Mayor of Dudley and Mr. R. Matthias (general manager of the Midland United Newspapers, Ltd.). During the dinner music was provided by loud-speaking equipment through which gramophone records were amplified—this apparatus being the property of the company's publicity department. The toast of "The Company" was proposed by Mr. S. A. Woodhall, who coupled with it the name of the chief engineer and manager, Mr. Legge. Responding, Mr. Legge said it seemed only a year or so ago since he attended a similar dinner which was held at Smethwick. That was in the younger days of the company and there were then about forty people present. Following the toasts, an enjoyable concert was given by the "Merry Optimists," a well-known Kidderminster Concert Party, while Mr. G. Mountford, an employee, contributed songs.

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COMPANY NEWS.

Manufacturing Holdings Show General Improvement—Electricity Supply Descriptions Harden—Cable and Wireless Stocks Both Higher—Another Important Merger—Statutory Report of Everlite, Ltd.—Company Reports—New Companies Registered.

GENERAL Electric shares have been in demand this week, the quotation being about 7s. above that when we last wrote. Crompton-Parkinson 2nd preference have improved from 18s. 3d. to 19s. and British Thomson-Houston preference from 23s. to 23s. 3d. In the lighting section Shropshire, Worcester and Staffs "B" have risen 1s. 3d. to 36s. 9d., and Yorkshire Power preference are 6d. better at 24s. 6d. County of London shares have improved 1s. 6d., and Kensington and Knightsbridge 6d. Cable stocks show a small improvement, Eastern stock rising 5 points. Marconi's Wireless and Marine are both higher.

Last Annl. Divd. %	Description.	This Week.	Last Week.	1912 to 1927. Highest.	Lowest.
	Electricity Supply.				
(d)	Brompton & Kensington Ord. ..	27/-	27/-	45/-	23/9
4	Central Elec. Sup. 4% Deb. ..	93	93	100	67
(a)	Charing Cross Elec. Ord. (£1) ..	26/-	26/-	60/-	10/-
4½	" " " 4½% C.P. (£1)	17/6	17/6	19/6	10/-
(e)	Chelsea Elec. Sup. Ord.	27/-	27/-	39/6	10/-
10	City of Lond. Elec. L'ting Ord. ..	31/10½	31/10½	52/10½	20/3
6	" " " " 6% C.P. ..	23/-	23/-	40/-	15/6
7½	County Lon. Elec. Sup. Ord. ..	49/6	48/-	68/6	14/6
6	" " " " 6% C.P. ..	23/-	23/-	24/9	15/3
(g)	Kensington & K'bridge Ord. (£1) ..	27/-	26/6	104/6	3/-
(b)	Lon. Elec. Sup. Ord. (£1)	26/-	26/-	38/3	5/-
9	Metro. Elec. Sup. Ord.	46/3	47/6	43/-	8/-
4½	" " " 4½% C.P. ..	17/6	17/6	18/6	9/6
7½	N'castle & Dis. Elec. Ltg. Ord. ..	30/-	30/-	22/6	7/9
6	N'castle-upon-Tyne Elec. Sup. Ord.	26/10½	26/10½	26/-	11/6
6	N. Metro. Elec. 6% C.P.	23/-	23/-	23/9	10/1½
6	Notting Hill 6% C.P. (£10) ..	10½	10½	10½	6/13/9
(d)	St. James & P.M. Ord. (£1) ..	27/6	27/6	62/-	22/-
1/4½	Shrops. Worcs. & Staffs. Power B. Or.	36/9	35/-	23/-	20/9
(f)	W'minster Elec. Sup. Ord. (£1) ..	27/-	27/-	52/-	18/-
4½	" " " 4½% C.P. (£1)	17/6	17/6	21/6	13/-
8	Yorks. Elec. Power Ord.	36/6	36/6	32/9	12/6
6	" " " 6% C.P. ..	24/6	24/-	25/-	14/3
	Railways and Tramways.				
8	Brit. Elec. Trac. Pfd. Ord. Stk. ..	126	124	152½	24
6	" " " 6% Pf. Stk...	127½	127½	129½	53
4	Cent. Lon. Ry. Ord. Stk. (asstd.) ..	73	72½	89½	40½
4	" " " 4% Deb.	81	81	103	56½
4	City & S. Lon. 4% Perp. Deb. ..	79½	79½	102½	50
4	Lon. Elec. Rly. Cons. Ord. Stk. ..	75½	75½	73½	10
4	" " " " 4% Pf. Stk.	75	75	84/2/6	43
4	" " " " 4% Deb. ..	81	81	98½	52
5	Lon. & Sub. Trac. A. Deb. ..	97½	97½	89	65
4	Lon. Un. Trams, 1st Deb.	61	61	82	30
4½	Met. Elec. Trams, 4½% Deb. ..	70	70	101½	49
5	" " " 5% Deb... ..	67½	67½	102/17/6	53
3	Met. Rly. Cons. Ord. Stk.	67	67	84½	19
3½	" " " 3½% Pf. Stk. ..	65	65	88½	40½
3½	" " " 3½% Deb. ..	72	72	92½	51
4	Met. Dis. Rly. Ord. Stk.	80½	80	66½	12½
4½	" " " 4½% 1st Pref. ..	82½	82½	91	45
6	" " " 6% Perp. Deb. ..	116½	116½	146/12/6	80
4	S. Met. Elec. Trams, 4% Deb. ..	70	70	73½	48½
5	Underground Electric Rlys. Ord.	27/6	27/-	5/3	2/1½
—	Yorks. (W.R.) Trams, Ord. ..	5/-	5/-	27/-	1/-
4½	" " " 1st Deb. ..	59	59	87	52
	Electrical Manufacturing.				
7	Brit. Elec. Transformer 7% C.P. ..	15/-	15/-	22/1½	11/6
15	Brit. Insulated Cables Ord. ..	91/3	91/3	86/3	26/6
6	" " " 6% C.P. ..	22/6*	22/6	25/6	14/6
7	British Thomson-Houston Pref. ..	23/3	23/-	24/6	19/7
7	" " " 7% Deb.	104½	104½	109½	92/-
10	Brush Electrical Ord.	28/9	28/9	29/9	10/-
13	Callender's Cable Ord.	85/-	85/-	86/-	22/-
6½	" " " 6½% C.P. ..	25/-	25/-	26/7	3/-
7½	" " " 7½% B. Pref. ..	27/6	27/6	27/6	16/6
8	Crompton-Parkinson 8% Cum. Pf.	25/7½	25/7½	25/-	9/10
6	" " " 6% Cum. 2nd Pf.	19/-	18/3	18/-	8/-
7½	Edison Swan Elec. Ord. (1st Pref. ..	25/7½	25/7½	26/-	5/-
5	" " " 1st Deb Stk...	86½	86½	—	—
7½	Elec. Construction Ord.	26/10½	26/10½	25/9	6/7
7	" " " 7% C.P. ..	22/6	22/6	25/3‡	16/-
—	English Elec. Ord.	8/9	8/9	29/3	7/3
6	" " " 6% C.P. ..	10/-	10/-	22/1½	10/6
7	Ericsson Telephones 7% Pref. ..	18/9	19/-	22/9‡	12/7
35	Ever Ready (Gt. Britain) Ord. ..	31/6	31/6	93/9	18/6
6	Ferranti 6% Pref.	19/-	19/-	19/4½	16/9
7	" 7% 2nd Pref.	19/-	19/-	19/3	13/9
10	General Elec. Ord.	66/3	59/4½	59/-	13/6
‡25	W. T. Henley's Ord.	117/6	117/6	108/9	23/3
12½	Johnson & Phillips Ord.	36/3	36/3	67/11	14/6
7½	Lon. Elec. Wire & Smith's Pref. ..	23/9	23/9	27/6	17/6
7½	Siemens Bros. & Co. Ord.	30/-	30/-	36/6	12/3
10	Telegraph Const. Ord. (£12) ..	25	25	56/2/6	19
	Telegraph.				
3½	Anglo-Am. Tele. Ord. Stk... ..	61½*	64½	68½	40
10	Eastern Ord. Stk.	22½	267½	213½	113/2/6
3½	" 3½% Pref. Stk.	68½	68½	84/17/6	49
4	" 4% Deb.	79½	79½	103½	60
10	Eastern Extension Ord. (£10) ..	27½	26½	21½	10/12/6
22	Gt. Northern Telegraph (£10) ..	34	34½	42/12/6	19
10	Indo-European (£25)	54½	51½	47½	25
20	Marconi's Wireless T. Ord. ..	78/9	77/6	9/16/3	20/9
12½	" Int. Mar.	72/6	70/-	5/11/3	14/11
20	Western Tel. Ord. (£1)	27½	26½	23	11/3/6

(a) 1s. 7.8d. per share. (b) £8 8s. 6·66d. per cent. (c) 1s. 6·949d. per share.
(d) 1s. 8·706d. per share. (e) 1s. 9·3d. (f) 1s. 0.912d. (g) 1s. 7·223d.
* Ex dividend. ‡ Including 1s. bonus.

RADIO CORPORATION.—Pft. for 1928, $18 983 000, against $7 110 170 for 1927. No. div. has yet been paid on common stk.

PAIGNTON ELECTRIC LIGHT AND POWER CO., LTD.—Mr. J. N. Philip, of Torquay, recently announced that up to Jan. 31 he was prepared to pay 41/3 p. sh.-cum.-div. for shs. in this co., and that during last week he had already purchased 5 000 shs., paying from 32/- p. sh.

AMERICAN RADIO-GRAMOPHONE COMBINE.—In connection with the Victor Talking Machine-Radio Corporation merger, holders of common stk. of former co. are asked to deposit their certificates by Mar. 4 with New York depository; or with Messrs. Seligman Bros., London.

VORARL BERGER ILLWERKE AKTIENGESELLESHAFT.—The "Financial Times" states that over 80% of the recent. issue of £2 000 000 of this co.'s 6% 30-year Sterling bonds has been left with the underwriters. Co. was incorporated in Austria for the production of electric power.

Sir Benjamin Longbottom who is on the board of Laurence Scott and Electromotors, Ltd.

MELBOURNE ELECTRIC SUPPLY CO., LTD.—Trading acct. for year ended Aug. 31, 1928, shows blce. £313 809, agst. £283 033. After providing £300 000, the sum determined upon by the Victorian Electricity Commission as payable under Act No. 3 377, there remained £124 308, plus £21 284 transferred from res. and £25 int. received. After placing £24 000 to taxation res. and providing £40 000 for div. on pref. shs., fin. div. of 5% actual on con. ord. stk. is recommended, making, as in previous year, 10%, British tax free. Fwd. £1 156.

WEST LONDON AND PROVINCIAL ELECTRIC AND GENERAL TRUST, LTD.—Directors announce that further sales of co.'s hldg. in Chiswick Electric Supply have been effected, resulting in substantial addition to cap. res. In order to capitalise £36 000 of res. fund directors propose to increase cap. to £390 000 by creation of 18 000 £5 shs. and apply that amt. in paying up £2 p. sh. on the new cap., which will be offered to existing hldrs. in proportion of one new sh. for each £10 of ord. stk. at £3 p. sh. New cap. will be split into £4 5% cum. pref. and £1 ord. and subsequently converted into stk.

EVERLITE, LTD.—Statutory rept. states that total shs. allotted are 2 000 000 of 1s. ea., of which 350 000 have been allotted as fully paid, as part consideratn. for purchase of inventn., patents and applicatns. and remaing. 1 650 000 shs. have been alloted wholly for cash as follows:—405 000 shs. at 2s. 6d. ea., 1 245 000 at 1s. ea. Total amt. received in respect of shs. issued wholly for cash, £112 875. Paymts. to Jan. 23 are as follows:—In connectn. with acquistn. of inventn. trade name, etc., including cash consideratn. (£30 000) payable to vendors, £34 635; prelim. exs. £1 017; excess of paymts. over receipts on trading acct., £71; cash £77 151—total £112 875. Prelim. exes. estimated at £3 500.

TRACTION AND GENERAL INVESTMENT TRUST.—Rev. for 1928, after deducting exes., was £74 432, agst. £59 980, plus £31 921, agst. £29 770. Intm. divs. of 2½% on pref. and 6% on ord. were paid, less tax, on July 31, 1928, with div. of 1s. 11d. p. sh., less tax, on 25 623 new shs., leaving £83 549. To res. £10 000 (same as last year) fin. divs. 2½% on pref. and 10% on ord. less tax. Fwd. £35 798. Premium from Feb. issue to ord. hldrs. of £83 260, after writing off exes. has been transferred to res. As from July 1 last new shs. were converted into £128 115 5% cum. pref. and £76 869 ord., rankg. *pari passu* with existg. stks. Directors also issued further £208 000 4½% deb. stk. Ord. div. for previous year was 15%.

DUBLIN UNITED TRAMWAYS CO., LTD.—Directors recommend, subject to fin. audit, paymt. of div. on pref. stk. at rate of 6% p.a., less tax, for half-year, and fin. div. on ord. stk. at rate of 5% p. a., less tax, for same period, makg. with the

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3% intm. div. paid in Aug., total div. of 4% for year 1928. Directors have also decided to set aside for renewals to track £50 000; for mtge. and deb. redempn., £15 000; and for renewal of overhead lines and cables, £7 000; and to carry fwd. £13 785. Last year divs. were 6% on pref. stk., 6% on ord. stk., making 4½% for year; set aside in the track renewals, £50 000; mortgages and deb. redeptn., £15 000; fwd., £13 368. Although distributn. on ord. stk. for year is reduced from 4½ to 4%, £7 000 is set aside for renewal of overhead lines and cables, while carry fwd. slightly increased.

The amalgamation of LAURENCE, SCOTT AND CO., LTD., Norwich, and ELECTROMOTORS, LTD., Openshaw, Manchester, under the proposed title of LAURENCE, SCOTT AND ELECTROMOTORS, LTD., is, we understand, in process of completion. Laurence, Scott and Co., Ltd., established in 1883, have a wide range of manufactures embracing large generating units and motors, and they have for many years specialised in marine electrical equipment. Electromotors, Ltd., were established in 1899, and manufacture d.c. and a.c. machines up to 150 H.P. Like their future associates they also have a specialised range of motors for driving ships' auxiliaries. The Board of directors includes Mr. C. Wilson (chairman) and Mr. W. H. Scott (founder) of Laurence Scott and Co., Ltd., and Sir Benjamin Longbottom, of Electromotors, Ltd.

BRAZILIAN TRACTION, LIGHT AND POWER CO., LTD.—Purchase of nearly all ord. shs. of City of Santos Improvements Co., Ltd., has recently been completed. The latter co. owns and operates the services of light and power distribution and tramway and omnibus transport in Santos and Sao Vincente, Brazil. Acquisition of shs. of Santos Co. calls for an expenditure of approximately $14 000 000 and, in addition to this, rapid expansn. of other enterprises controlled by Brazilian Traction Co. call for considerable cap. expenditure in near future. Further large power units are shortly to be installed, one of 40 000 H.P. at the Parahyba plant in the Rio district, which has already been ordered, and one of probably 60 000 H.P. at the Serra plant in Sao Paulo district. Also other services of the co.'s subsidiaries call for a large amt. of additional cap. outlay to meet growth of business. The Board has decided to offer to hldrs. of ord. shs. additional ord. shs. of no par value, on basis of one sh. of additnal. stk. for each seven shares held, at $40 p. sh. At a recent mtg. of the Board a qtrly. div. of 50 cents p. sh. was declared on ord. shs., payable Mar. 1, 1929.

New Companies.

S. W. HOWES AND CO., LTD.—Cap., £5 000. Electrical engineers, etc. A director: L. T. Howes, 399, Gravelly Lane, Erdington, Birmingham.

RICH AND PATTISON (LEEDS), LTD.—Cap., £500. Factors of electrical fittings, wireless goods, etc. A first director: H. P. Rich, 323, Pershore Road, Edgbaston, Birmingham, factor.

ZENDIX ELECTRIC CO., LTD.—Cap., £100. Manufacturers of Zendix electrical brush and other electrical appliances, and to acquire trade mark "Zendix." Reg. office: 93, Mortimer Street, London, W.1.

H. J. ELECTRICAL SERVICES, LTD.—Cap., £1 000. To acquire business of electrical service agent and automobile electrical specialist carried on by F. Hargreaves at 2, Bedford Street North, Halifax.

ARTHUR J. HERON AND SONS, LTD.—Cap., £3 000. To acquire business of heating, lighting, ventilating and electrical engineer, etc., carried on by A. J. Heron at 108, Derby Street, Moss Side, Manchester, as "Arthur J. Heron, M.Inst.P."

REGENT STUDIOS, LTD.—Cap., £100. To acquire business of lampshade manufacturers, artists, electrical engineers and contractors formerly carried on by L. Bristow and E. Bristow at Pollen Street, Westminster, etc. Reg. office: 5, Maddox Street, London, W.1.

BRITISH POWER AND LIGHT CORPORATION, LTD.—Cap., £100. To promote companies, syndicates and partnerships of all kinds, particularly those to carry on businesses of electrical and general engineers and manufacturers and maintainers of plant for generation, accumulation, transmission and supply of electrical energy, etc. Solicitors: Herbert Smith and Co., 62, London Wall, London, E.C.2.

MUNICIPAL FINANCE.

Points from the Past Year's Accounts of Electricity Undertakings.

THE total revenue for the year 1927–8 of the 26 undertakings included in the following table and the 217 in the tables which appeared in our issues of August 17th, September 14th, October 26th, and November 30th, 1928, was £30 447 616. The gross profit on the year's working of the 243 undertakings was £14 341 517, and the aggregate sales of electricity amounted to 4 773 141 953 kWh, while 97 undertakings out of the total number have contributed, out of the year's profit or from reserve, an aggregate of £528 120 to the relief of rates. In many cases the costs include items of a capital nature, and net profits have been reduced as the result of reduction of charges for current.

Authority.	Total Revenue. £	Gross Profit. £	Net Profit or deficit. £	(*a*) Working Costs per kWh sold.	Total Cost per kWh (inc. capital charges).	Electricity sold (kWh).	Increase (+) or Decrease (−) in kWh sold.	Maximum Simultaneous Load in kW.	(*h*) Load Factor.	Radiators and Cookers Connected (total) in kW except where otherwise stated.	Other Domestic Appliances connected (total) kW.	Contributed in Aid of Rates.
Ashford U.D.C.	12 541	2 711	− 1 521	1·222d.	2·067d.	1 631 348	See footnote (*c*)	780	23·85	See footnote (*b*)	See footnote (*b*)	—
Ashton-in-Makerfield U.D.C.	1 604	842	+ 75	2·560d.	5·140d.	71 478	See footnote (*c*)	100	8·14	27	See footnote (*d*)	—
(*f*) Ayrshire Elect. Bd. ..	231 015	143 233	− 15 578	0·560d.	1·581d.	37 312 534	+ 3 930 111	18 700	28·62	—	—	—
Bangor T.C.	15 104	5 256	+ 1 344	2·770d.	3·870d.	850 600	+ 97 599	566	24·70	480	20	543
Bethesda U.D.C. ..	1 346	715	+ 159	3·879d.	7·297d.	39 041	—	46	11·50	See footnote (*b*)	See footnote (*b*)	—
Bridlington T.C.	28 472	16 404	+ 3 366	1·930d.	2·406d	1 531 610	+ 193 632	1 022	22·21	—	—	—
Bromley T.C.	53 951	34 787	+ 21 726	1·970d.	3·314d.	2 331 601	—	1 759	18·73	—	—	—
Cleethorpes U.D.C. ..	5 012	1 323	+ 463	4·030d.	4·690d.	219 359	+ 91 498	208	12·41	—	—	—
Dorchester T.C.	8 586	4 188	+ 620	3·210d.	5·813d.	328 955	+ 46 075	325	14·68	—	—	—
Darwen T.C.	35 796	13 981	+ 6 862	1·082d.	1·447d.	4 839 438	+ 730 181	2,410	26·66	(*e*) 1 380	See footnote (*e*)	2 000
Dundalk T.C.	16 247	6 347	+ 321	2·120d.	3·410d.	1 121 102	+ 23 992	754	21·94	—	—	—
Epsom U.D.C.	24 182	5 870	− 831	2·570d.	3·510d.	1 710 592	+ 597 676	1 000	19·00	2 732	450	—
Falkirk T.C.	39 278	12 397	+ 222	1·160d.	1·660d.	5 542 499	+ 360 717	3 100	24·00	See footnote (*b*)	See footnote (*b*)	3 210
Hereford C.C.	34 530	15 590	+ 4 232	0·743d.	1·494d.	4 864 384	+ 545 972	4 000	29·98	—	—	—
Heston and Isleworth U.D.C.	60 844	27 602	+ 13 112	1·800d.	2·415d.	4 417 511	—	2 772	23·54	—	—	—
(*f*) Kirkwall T.C. ..	3 446	1 708	− 100	4·130d.	8·460d.	100 650	+ 18 235	100	16·76	40	60	—
Newark T.C.	4 908	1 553	− 214	1 570d.	2·397d.	513 036	—	223	27·98	—	—	—
North Berwick T.C. ..	3 589	1 192	− 241	5·300d.	8·800d.	108 579	+ 21 459	85	15·00	See footnote (*b*)	See footnote (*b*)	—
Poplar (London) B.C. ..	231 296	88 312	+ 1 900	0·943d.	1·510d.	36 372 747	+ 1 103 264	17 370	26·42	—	—	—
Reigate T.C.	29 344	18 290	+ 2 642	1·540d.	3·722d.	1 720 845	—	1 173	21·03	—	—	—
Saffron Walden T.C. ..	2 190	1 089	− 243	3·300d.	8·800d.	66 638	+ 13 955	75	10·14	See footnote (*b*)	See footnote (*b*)	—
Skelton and Brotton U.D.C.	5 124	1 734	+ 562	2·700d.	3·635d.	300 925	+ 19 873	180	24·23	—	—	—
Swinton U.D.C.	17 162	5 418	+ 2 189	1·393d.	1·864d.	1 645 248	+ 352 660	985	23·36	1 248	580	378
Tanfield U.D.C.	5 896	2 902	+ 86	2·700d.	4·200d.	201 214	+ 53 186	122	25·85	100	—	—
Wigan T.C.	91 851	44 242	+ 11 371	0·990d.	1·720d.	11 550 547	− 1 661 676	5 200	25·28	(*e*) 3 884	See footnote (*e*)	9 000
Worksop U.D.C.	26 976	9 727	+ 2 269	2·050d.	3·040d.	1 689 540	+ 97 113	1 017	18·91	—	—	(*g*) 1000

(*a*) Usually include management, repairs and maintenance, rates and taxes, and special charges. (*b*) Not available. (*c*) Year ended March, 1928, was first complete year of working. (*d*) Included in lighting. (*e*) Including other domestic electric appliances. (*f*) Year ended May 15th, 1928. (*g*) Transferred to capital account £1 172 13s. 10d. (*h*) Net deficiency on rural undertaking, £3 314. (*i*) Excluding bulk supply.

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COMMERCIAL INFORMATION.

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debt. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

BERRY'S ACCUMULATORS, 41, Bolton Road, Irlam-o'-th'-Heights, engineers. £30 16s. 10d. December 4th.

FUCHSIAPHONE INSTALLATION, 11, Mill Street, Middleton, Manchester, electrical, etc., engineers. £18 5s. 3d. December 3rd.

T. J. HORN, 221, Banbury Road, Oxford, wireless dealer. £27 5s. 2d. December 18th.

NEW STANDARD WIRELESS VALVE CO., LTD., High Street, Bollington, wireless valve manufacturers. £21 14s. 2d. December 13th.

ROBINSON, (D.) AND CO., 76, Higher Temple Street, Chorlton-on-Medlock, electrical engineers. £22 16s. 6d. December 14th.

RUTHERFORD, (A.) Plowman's Yard, Church End, Finchley, electrical engineer. £14 6s. 6d. December 20th.

Receivership.

COMMERCIAL TELEPHONE AND ELECTRICAL CO., LTD. C. J. Hocking, builder, of 35, Great Queen Street, Holborn, W.C., was appointed receiver on January 10th, 1929, under powers contained in debentures dated April 30th, 1924. J. H. Rook, solicitor, ceased to act as receiver and manager for the debenture holder on the above date.

Private Meetings, etc.

[*Inclusion under this heading does not necessarily imply failure, Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

HUTTON, Lawford Carr, trading as THE SPORTS AND RADIO STORES, Queens Parade, New Southgate, N.11. The above debtor executed a deed of assignment for the benefit of his creditors in September, 1926. Under this deed Mr. Charles Latham, of the Wireless and Radio Trades Guardian Association, Ltd., of 78, New Oxford Street, London, W.C.1, acted as trustee, and the business has since been carried on under his supervision and is still being continued. Dividends have been distributed from time to time, and it is now stated that a final dividend of 5s. in the £ is being paid, making 20s. in the £ in all. The greatest satisfaction has been expressed on this satisfactory realisation of the estate.

GLOVER, Mrs. Dora, trading as D. JOHNSON, electrical and wireless dealer, 71, King Street, Wallasey, Cheshire. The creditors interested herein were called together recently at the offices of Mr. Parkin S. Booth, accountant and auditor, Exchange Chambers, Bixteth Street, Liverpool. A statement of affairs was presented which disclosed ranking liabilities of £999 14s. 2d., made up of trade creditors, £534; cash claims, £295; and partly secured creditors, £170. The latter was the bank, who claimed £969 19s. 8d., but they held a charge on property valued at £800. In addition, there was a fully secured creditor for £198, who held security valued at a similar amount. The assets were estimated to realise £485, from which had to be deducted £35 for preferential claims, leaving net assets of £450, or a deficiency of £550. It was reported that when she started the present business debtor had £185 in cash, and a stock of electric sundries valued at £100. During the year to January 31st, 1926, the turnover was £3 562, with a net loss of £76, whilst in the following 12 months there was a net loss of £732 on sales of £3 870. In the succeeding year the turnover fell to £3 168, but the net loss was reduced to £215, and in that year friendly loans totalling £520 were brought in. During the 11 months to December 31st last the sales were £2 629, with a net loss of £546.

A resolution was passed in favour of the matter being dealt with under a deed of assignment executed with Mr. Booth as trustee, and a committee consisting of the representatives of Baxendale and Co., Ltd., Chloride Electrical Storage Co., and Rowe Bros. and Co., Ltd.

JONES, Percy, and MERCER, James Henry, trading as NORTHERN WHOLESALE ELECTRICAL SUPPLY, 266 and 268, Holloway Road, London, N7, electrical and hardware dealers. A meeting of the creditors of the above was held on January 24th at the offices of Sunderland, Mountstephen and Co., C.A., 15, Eastcheap, E.C. Mr. Sunderland submitted a statement of affairs which showed liabilities of £902, and assets were estimated to realise £1 248, less £148 for preferential claims, leaving net assets of £1 100, or a surplus of £198. The assets included stock, £953; fixtures and fittings, £78, expected to produce £40; and good book debts, £247. Mr. Sunderland added that there were three suing creditors, and as one was in a position to levy execution, a deed of assignment had been taken in order to protect the assets. He added that the business was commenced last March by the present partners. Mr. Jones then found £1 000 in cash, whilst Mr. Mercer introduced a connection which was valued at £700. The premises were taken on a lease for 21 years at a rental of £250 per annum. A premium of £250 was given for the lease, on which no value had been placed at the moment, although something might be obtained for it. Mr. Mercer had previously been in the same line of business, but Mr. Jones was in another trade, and during the time of the partnership had been in other employment. Full records had not been kept, and the usual trading figures could not be presented. Mr. Jones possessed separate assets, and if the partnership estate did not produce sufficient to pay 20s. in the £, then Mr. Jones' private estate would be liable.

London Gazette, etc.

Bankruptcy Information.

HUDSON, Fred James, late 44, Heath Road, Bradford, now at 63, Thurnscoe Road, Bradford, electrical engineer. Receiving order, January 21st. Debtor's petition.

JACOB, William Thomas, 14, Meyrick Street, Pembroke Dock, Pembroke, wireless engineer. Receiving order, January 26th. Debtor's petition.

Notice of Intended Dividends.

COLLIER, Thomas Frederick, 64, Union Street, West, lately carrying on business at 116, Union Street West, Oldham, electrician. Last day for receiving proofs, February 9th. Trustee: J. D. Turner, Byrom Street, Manchester, official receiver.

DAVIES, John Arthur, Church Street, Blaenau Festiniog, Merioneth, electrical contractor. Last day for receiving proofs, February 8th. Trustee: I. D. Hooson, Official Receiver, St. Peter's Churchyard, The Cross, Chester.

TEMPLE, Edward, and BURKETT, Jane Eva, Mrs., 105, Canterbury Street, South Shields, wireless dealers and electrical contractors, trading as THE WESTOE ELECTRICAL COMPANY. Last day for receiving proofs, February 13th. Trustee, A. J. Gray, 48, Pilgrim Street, Newcastle-upon-Tyne.

Partnership Dissolved.

CURRIE AND HANCHETT (Gordon HANCHETT and George CURRIE), electrical contractors, 5 and 7, Altrincham Street, London Road, Manchester, by mutual consent as from November 30th, 1928, so far as regards G. Hanchett, who retires from the firm. Debts received and paid by G. Currie, who will continue the business under his own name.

Application for Discharge.

WOOD, Norman Hurst, 32, Highbury Avenue, Thornton Heath, Surrey, lately at 38, St. Charles Square, North Kensington, W.10, electrical engineer. Hearing, February 21st, 10.30 a.m. County Court, Scarbrook Road, Croydon.

Bankruptcy Proceedings.

GOVETT, Charles Kenneth, trading as KENNETH GOVETT AND CO., 179, Albany Road, Cardiff, electrical contractor. The first meeting of creditors of this debtor was held recently at Cardiff. The debtor attributed his failure to illness of himself and bad trade. A statement of affairs was presented to the meeting which showed liabilities amounting to £412 against assets of £12, or a deficiency of £400. The case remained in the hands of the Official Receiver as trustee of the estate.

METAL AND CHEMICAL PRICES.

TUESDAY, January 29th

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£78 5 0	£1 10 0	—
Electro Wirebars	,,	£80 0 0	£1 5 0	—
H.C. Wires, basis	per lb.	11⅛d.	⅛d.	—
Sheet	,,	11⅛d.	⅛d.	—
Phosphor Bronze—				
Wire (Telephone) basis ..	per lb.	1s. 2½d.	½d.	—
Brass 60/40—				
Rod, basis	per lb.	8½d.	—	—
Sheet ,, ...	,,	10⅝d.	—	—
Wire ,, ...	,,	10⅝d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£3 8 6	—	—
Galvanised Steel Wire, basis 8 S.W.G.	,,	£14 15 0	—	—
Lead Pig—				
English	per ton	£23 10 0	—	—
Foreign or Colonial	,,	£22 5 0	—	—
Tin—				
Ingot	per ton	£222 5 0	—	—
Wire, basis	per lb.	2 11	—	—
Aluminium Ingots	per ton	£95 0 0	—	—
Spelter	,,	£26 7 6	5 0	—
Mercury	per bottle	£22 8 6	—	—

Sulphur—Flowers, Ton £12 0 0 *Copper Sulphate*—Ton £25 to £25 10 0
,, Roll, ,, £10 15 0 *Boric Acid* (Crystals) ,, £30
Sulphuric Acid (Pyrites, 168°) Ton £6 15 0 *Sodium Chlorate*—Per lb. 2½d.
Sodium Bichromate—Per lb. 3½d.
Rubber—Para fine, 11½d.; plantation, 1st latex, 10¼d.

*** The metal prices are supplied by British Insulated Cables, Ltd., and the rubber prices by W. T. Henley's Telegraph Works Co., Ltd.

LEAD MARKET REPORT.

The market has again been dull and uninteresting, and according to James Forster and Co. the small fluctuations seen were due to professional operations. Prices last week opened 5s. per ton higher, but this advance was lost.

Closing prices on January 25th were £22 1s. 3d. for January and February, £22 2s. 6d. for March, and £22 3s. 9d. for April, or unchanged on the week.

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PATENT RECORD.

The following information is prepared from the Illustrated Official Journal (Patents) by permission of the Controller of H.M. Stationery Office. Printed copies of full Patent Specifications, when accepted, may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at 1s. each.

Specifications Accepted.

303 534 Siemens-Schuckertwerke Akt.-Ges., O. Krell, and H. Gerdien. Electric arc-lamps. (5/8/27.)
303 391 G. Heptonstall and W. Shaw. Electrical distribution boards and structures. (22/9/27.)
303 427 British Thomson-Houston Co., Ltd., and E. D. Regis. Electric switchgear. (29/9/27.)
303 458 British Thomson-Houston Co., Ltd., and E. D. Regis. Electric switchgear. (30/9/27.)
278 705 Electrical Research Products, Inc. Composite signalling-conductors. (6/10/26.)
303 434 Hotpoint Electric Appliance Co., Ltd., E. R. Clarke, and W. J. Sims. Coil winding machines. (3/10/27.)
303 460 J. Y. Johnson (I.G. Farbenindustrie Akt.-Ges.). Method of and apparatus for rendering alternating-current differential wattmeter independent of frequency when employed as resistance meter. (3/10/27.)
303 462 J. Bathgate. Electric combined control switches for automobile lighting, signalling, and horn-sounding. (4/10/27.)
303 541 F. W. Twort. Electrical transformers or couplers. (4/10/27.)
303 465 Relay Automatic Telephone Co., Ltd., and B. B. Johnson. Electric signalling-devices. (4/10/27.)
303 550 Standard Telephones and Cables, Ltd. (Western Electric Co., Inc.). Electrical contact devices. (5/10/27.)
303 551 Standard Telephones and Cables, Ltd. (Western Electric Co., Inc.). Composite sets for telephone and telegraph lines. (5/10/27.)
303 552 Standard Telephones and Cables, Ltd., and E. P. G. Wright. Automatic telephone systems. (5/10/27.)
303 553 Igranic Electric Co., Ltd., and G. Holdway. Variable-inductance devices. (5/10/27.)
303 555 L. T. Payne. Electric inspection-lamps for motor-vehicle use. (5/10/27.)
303 556 A. B. Coleman. Wall or like clips for pipes, conduits, cables, and the like. (6/10/27.)
303 558 A. Reyrolle and Co., Ltd. and R. Willoughby. Load-discriminating systems for electric circuit-breakers. (6/10/27.)
303 561 W. E. Beatty (Bell Telephone Laboratories, Inc.). Composite electric conductors. (6/10/27.)
278 731 M. Singelmann. Rectifiers for alternating-currents. (6/10/27.)
303 563 A. Reyrolle and Co., Ltd., and J. R. Smith. Contacts for electric switches and circuit-breakers. (7/10/27.)
303 571 A. Reyrolle and Co., Ltd., and H. Leben. Electric protective arrangements. (10/10/27.)
303 575 Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. Semi-automatic telephone systems. (10/10/27.)
303 578 K. Kaisser. Starting-device for electromotors equipped with a clutch. (12/10/27.)
303 580 M-O Valve Co., Ltd., and J. W. Wigan. Thermionic valves. (13/10/27.)
303 586 S. G. S. Dicker (N. V. Philips' Gloeilampenfabrieken). Wireless receiving sets. (15/10/27.)
303 587 S. G. S. Dicker (N. V. Philips' Gloeilampenfabrieken). Wireless receiving sets adapted for continuous or alternating current feeding as desired. (15/10/27.)
280 187 Z. B. Begg. Combined electric turn-switch and wall-plug. (3/11/26.)
279 883 M. Surjaninoff. Electric induction furnaces. (30/10/26.)
303 597 H. H. Berry. Electric heating elements. (28/10/27.)
303 603 Igranic Electric Co., Ltd., and A. H. Curtis. Remote-control apparatus. (4/11/27.)
303 606 R. A. F. Jackson and J. D. Place. Electrical heating-units. (8/11/27.)
303 608 Edison Swan Electric Co., Ltd., and L. H. Soundy. Wireless receiving-circuits. (9/11/27.)
303 617 General Electric Co., Ltd., and H. G. McClean. Electric motor control systems. (21/11/27.)
303 620 E. L. Dunand. Supporting-means for electric lamp shades. (23/11/27.)
303 628 Sun-Vi-Lite, Ltd., and R. J. Rawlings. Electric arc lamps. (2/12/27.)
282 765 F. Bornhardt. Stereoscopic Röntgen-ray fluoroscopy. (27/12/26.)
290 619 F. Bornhardt. Stereoscopic Röntgen-ray fluoroscopy. (18/5/27.)
303 666 Metallbank und Metallurgische Ges. Akt.-Ges. and J. Zagorski. Electric conductor of solid cross-section and smooth surface. (30/1/28.)
303 681 L. F. Douglass. Thermionic valve-amplifying circuits. (20/2/28.)
303 682 F. J. Stuart. Automatic switches for battery ignition engines. (22/2/28.)
286 607 C. J. A. Lange and L. J. E. Forest. Arrangement for detecting direction of propagation of current, particularly applicable to switching in telephone installations. (5/3/27.)
303 689 F. Berg. Insulator of the pintle type for live wires. (9/3/28.)
303 690 W. R. Edwards and R. Edwards and Co., Ltd. Boxes or containers for electrical accumulators. (13/3/28.)
287 916 Aktiebolaget Bergslagens Gemensamma Kraftforvaltning. Disconnecting switches for overhead electric lines. (29/3/27.)
292 152 H. Andre. Electric conductors of high negative temperature coefficient. (17/6/27.)
291 372 G. de Gasenko. Incandescent electric lamps having means for giving different degrees of luminous intensity. (31/5/27.)
292 906 J. P. Pegg and H. G. Roddy. Means for utilizing tidal and wave energy. (24/4/28.)

Applications for Patents.

December 20th.

37 701 International General Electric Co., Inc. Arc extinguishing chambers. (24/12/27, Germany.)
37 684 J. Mellersh-Jackson (Siemens and Halske A.G.). Electric meters, etc.
37 711 G. A. Mathieu. Radio telephone systems, etc.
37 699 Patent-Trenhand-Ges fur Elektrische Gluhlampen. Electric luminous tubes. (20/12/27, Germany.)
37 718 F. N. Scaife and Standard Telephones and Cables, Ltd. Variable electric condensers.
37 661 Scintilla A.G. Electric starters for engines. (15/3/98, Germany.)
37 654 Siemens and Halske A.G. Signalling and telephone systems.
37 716, 37 717. T. S. Skillman and Standard Telephones and Cables, Ltd. Telephone systems.
37 692 S. B. Smith and G. M. Wright. Picture, etc., telegraph apparatus.
37 649, 37 650 G. E. Spero. Loud speakers, etc.
37 651 G. E. Spero. Radio receiving sets.
37 652 G. E. Spero. Control switches.
37 624, 37 625 Standard Telephones and Cables, Ltd., and E. P. G. Wright. Telephone systems.
37 642 J. Stanley. Arc lamps.

December 21st.

37 733 T. Angus. Wringing machines, etc.
37 800 Brandes, Ltd. (Federal Telegraph Co.). Signal transmitting system.
37 780 British Thomson-Houston Co., Ltd., and T. Hands. Electric switchgear.
37 840 R. T. Clarke. Installations for generation of electric energy.
37 771 B. B. Fenn. Electric lamp holder, etc.
37 767 J. V. Foll and Muirhead and Co., Ltd. Telegraphic communication systems.
37 782 International General Electric Co., Ltd. Electric protective devices. (28/12/27, Germany.)
37 727 A. T. Koch. Safety control, etc., for electric ignition systems.
37 747 L. V. McKenzie. Electrically operated air suction pumps.
37 880 Maschinenfabrik Oerlikon. Arrangement for converts d.c. into a.c. (31/12/27, Switzerland.)
37 845 A. W. Larsky and C. D. Rowley. Irradiation of liquids, etc.
37 724 C. L. Morton. Operation of danger lights on tramcars, etc.
37 815 F. Newton. Field magnets for dynamos.
37 812 A. Preen. Radio receiving sets.
37 831 Siemens Schuckertwerke A.G. Arrangement for exciting synchronous machines. (23/12/27, Germany.)
37 764 M. C. Spencer. Means for operating polyphase motors.
37 738 Western Electric Co., Ltd. (Bell Telephone Laboratories, Inc.). Television systems.
37 850 J. C. Wood. Electric water heater.
37 732 W. C. Haynes. Electrical branding devices.

December 22nd.

38 004 M. von Ardenne. Terminal repeater device for reproduction of sound. (22/12/27, Germany.)
37 948 C. M. R. Balbi and H. T. Harrison. Light operated electric switches.
37 929 British Thomson-Houston Co., Ltd. (W. D. Coolidge). Electric discharge devices.
37 971 A. Carpmael (Telefunken Ges fur Drahtlose Telegraphie). Picture, etc., telegraph systems.
37 930 Cie Francaise pour l'Exploitation des Procédés Thomson-Houston. Sound reproducing apparatus. (22/12/27, France.)
37 965 S. C. Davey, A. E. Honey, and J. Stone and Co., Ltd. Electric switches.
37 911, 37 912, 37 913 V. C. From, A. W. Larsky, and C. D. Rowley. Electric lamps.
37 921 General Electric Co., Ltd., and W. Wilson. Electrical protective devices.
37 958 Grierson, Ltd., and R. Grierson. Electrical heating of buildings.
37 923 H. E. Humphries and Siemens Bros. and Co., Ltd. Selecting switches for automatic telephone systems, etc.
37 896 H. Plauson. Production of X-rays.
37 897 H. Plauson. Production of light.
37 898 H. Plauson. Cathode ray tubes.
37 947 Standard Telephones and Cables, Ltd. (Western Electric Co.). Radio-telephone, etc., systems.

December 24th.

38 079 Diamco Akt.-Ges. fur Gluhlicht and W. Saulmann. Dry batteries.
38 100 E. Citovitch. Electrochemical processes. (24/12/27, Germany.)
38 126 V. H. M. A. Dangerfield. Apparatus for generating actinic rays.
38 091 A. Einstein and L. Szilard. Electrodynamic movement of fluid metals. (27/12/27, Germany.)
38 127 G. E. A. Pohu. Thermionic valve circuit arrangements.
38 092 F. B. Woolford. Electric furnaces.

COMING EVENTS.

Friday, February 1st (To-day).

Institution of Electrical Engineers (Meter and Instrument Section).—Institution, Savoy Place, Victoria Embankment, London. Paper by Mr. J. L. Carr on "Recent Developments in Electricity Meters, with particular reference to those for special purposes." 7 *p.m.*

Monday, February 4th.

Institution of Electrical Engineers.—Institution, Savoy Place, Victoria Embankment, London. Informal meeting. Discussion on "Earthing and the Safety of the Public." (Opened by Mr. W. R. Rawlings.) 7 *p.m.*

Sheffield Illumination Society.—Lecture Hall, Y.M.C.A., Fargate. Lecture by Mr. R. G. Williams on "Colour Lighting." 7.30 *p.m.*

Royal Society of Arts.—John Street, Adelphi, London. Cantor Lecture III, by Dr. C. H. Lander on "The Treatment of Coal." 8 *p.m.*

Tuesday, February 5th.

Electrical Contractors' Association (Bournemouth Branch).—Ordinary meeting.

Electrical Contractors' Association (Derby Branch).—Ordinary meeting. 5 *p.m.*

Institution of Electrical Engineers (East Midland Sub-Centre).—University College, Nottingham. Paper by Mr. W. B. Woodhouse on "Overhead Electric Lines." (To be presented by Mr. E. T. Painton and illustrated by a cinematograph film.) 6.45 *p.m.*

School of Engineering and Navigation.—High Street, Poplar. Third lecture (course of five lectures) by Mr. H. Brazil on "Electrical Sub-Stations." 7 *p.m.*

Association of Supervising Electrical Engineers.—Junior Institution of Engineers, 39, Victoria Street, London. Illustrated lecture on "Beam Wireless," by Lieut.-Colonel A. G. Lee. 7.15 *p.m.*

Institution of Electrical Engineers (Dundee Sub-Centre).—Lamb's Restaurant, Reform Street. Discussion on "Earthed *versus* Insulated Systems." 7.30 *p.m.*

Institution of Electrical Engineers (North-Western Centre).—17, Albert Square, Manchester. Paper by Messrs. Johnstone Wright and C. W. Marshall on "The Construction of the Grid Transmission System in Great Britain." 7 *p.m.*

Electrical Society of Glasgow.—30, Gordon Street. Paper by Mr. W. D. Brassington on "Consumer, Contractor, and Supply Engineer." 7.30 *p.m.*

Wednesday, February 6th.

Electrical Contractors' Association (Bath Sub-Branch).—Ordinary meeting.

Electrical Contractors' Association (Cardiff Branch).—Ordinary meeting. 2.30 *p.m.*

Polytechnic (School of Electrical Engineering).—307–309, Regent Street, London. Second lecture (course of eight lectures) by Mr. E. S. Ritter on "Picture Telegraphy." 5 *p.m.*

Institution of Electrical Engineers (Wireless Section).—Institution Savoy Place, Victoria Embankment, London. Paper by Messrs. B. Hodgson, L. S. Harley and O. S. Pratt on "The Development of the Oxide-Coated Filament. 6 *p.m.*

Thursday, February 7th.

Electrical Contractors' Association (Newcastle Branch).—Ordinary meeting. 11 *a.m.*

Electrical Association for Women (Manchester Branch).—Visit to Barton Power Station of the Manchester Corporation Electricity Department. 2.30 *p.m.*

Electrical Association for Women.—Visit to the Soho School of Cookery, 20, Soho Square, London. Lecture-Demonstration on "A Five-Course Dinner," by Miss Mabel Collins. 3 *p.m.*

Electrical Contractors' Association (Bristol Branch).—Ordinary meeting. 3.15 *p.m.*

Royal Institution of Great Britain.—21, Albemarle Street, London. Lecture by Sir W. Bragg on "The Early History of X-Rays." 5.15 *p.m.*

Institution of Electrical Engineers.—Hotel Cecil, Strand, London. Annual Dinner. 7 *for* 7.30 *p.m.*

Friday, February 8th.

Engineering and Scientific Club.—Paper by Mr. L. Southerns on "Sound Waves and Musical Tones."

Institution of Electrical Engineers (London Students' Section).—Institution, Savoy Place, Victoria Embankment, London. Paper by Mr. H. H. Taylour on "Electric Welding." 6.15 *p.m.*

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THE ELECTRICIAN

Established 1861. The Oldest Weekly Illustrated Journal of

Electrical Engineering, Industry, Science and Finance.

Bouverie House, Fleet Street, London, E.C.4. *Telegrams: "Benbrotric, Fleet, London."*
Telephone: 0244 (Ten lines).

Closed on Saturdays in accordance with the "Five-Day Week" plan adopted by Benn Brothers, Ltd., and its associated organisations.

No. 2645. [No. 6. Vol. CII.] Friday, February 8, 1929. Annual Subscription, 25s. Overseas, 30s.

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Current Topics.

Credit Policy Defended.

ALTHOUGH the speeches of the chairmen at the annual meetings of the big joint stock banks are always read with interest, their utterances this year are of particular importance in their bearing on the main plaint in the last B.E.A.M.A. "Trade Survey." In this document, as our readers will recall, the credit policy of the banks was blamed for bringing this country "down to a state where industrialists are losing hope of ever being able to improve their conditions of production, and of earning satisfactory margins of profit." Almost with one mind the bankers have taken up the complaint, and, in speeches mainly devoted to the relations between banking and industry, have, on the whole, made a most effective reply to the charges. The experience we have had of credit manipulation in the past should act as a warning against similar essays in the future, but it is still insufficiently realised that a real return to national prosperity can only be made along the lines of financial stability. Mr. TENNANT put the matter very clearly when he pointed out that while banks should make no artificial restriction on credit, the adoption of an opposite policy would neither stimulate demand nor increase production and employment. Production can of course be stimulated by credit, but trade expansion depends on effective demand for the goods produced. In Mr. TENNANT'S own words, "Credit can help at the psychological moment, and those who control credit must always be ready and watching for the opportunity to help. But the initial impetus must come from the side of trade and industry. The function of banking is to be always ready to cater for an increased demand for commodities and an enhanced manufacturing activity by expanding the supply of credit *pari passu* with such developments. If the expansion takes place before the signs of an approaching increase in demand herald the need for an increase in production, the well-known evils of inflation are let loose."

Pictures Across the Sea.

ALTHOUGH a service of picture transmission by wireless has been in use across the Atlantic for nearly three years, the new system of facsimile transmission developed by MARCONI'S WIRELESS TELEGRAPH CO., and which was demonstrated by them at the Somerton "beam" station, on Sunday, is none the less remarkable. With this system it is possible to transmit two images, each measuring 8 in. by 10 in., in less than 20 minutes; while the apparatus is so designed that one picture after another may be transmitted without the necessity of shutting down; thereby reducing considerably both time and costs in running up motors and synchronising both ends of the service for each separate picture. The system depends upon the translation of the blacks and whites of a picture into electrical impulses, as do all other picture transmission systems, but the manner in which the conversion is fed into the "beam" transmitter is one developed by Mr. G. M. WRIGHT, who has been in charge of the research in connection with the system. The fact that this form of transmission may be regarded as the latest issue of electrical engineering makes it all the more remarkable that the highly sensitive receiving apparatus required to complete the service is largely dependent upon the application of a phenomenon discovered by KERR in 1875, namely, a Kerr cell. It is claimed that messages transmitted by the system are received with absolute accuracy, and that handwriting and the reproduction of anything that can be written or drawn on paper are also possible subjects of transmission. Our first acquaintance with this system was some two years ago, when the MARCONI CO. was thinking of distances in yards and obtaining results considerably less definite than those now possible over 3 000 odd miles. The progress made in so short a time is nothing short of remarkable, and is indicative of the enthusiasm which has been brought to bear on the problems involved in the field of electrical research.

Faraday Centenary Celebrations.

IT is gratifying to note that the tentative proposals to celebrate, in September, 1931, the centenary of MICHAEL FARADAY'S great discovery of electro-magnetic induction have resulted in the establishment of machinery to celebrate the occasion in a manner worthy of its importance. In view of the world-wide developments founded on one single discovery among the many made by this great Englishman, it is desirable that the celebrations should be international in their scope, and it is pleasing to note the existence of means whereby this can be achieved. The year 1931 will be notable for several scientific centenaries, including those of the establishment of the British Associa-

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tion for the Advancement of Science, and of the birth of JAMES CLERK MAXWELL. The arrangements now under contemplation will probably concentrate the various celebrations around the date of the Faraday Centenary, and thus ensure a large attendance of interested people from all parts of the civilised world.

Early Swan Lamps Wanted.

IT was an interesting coincidence that, on January 17th last, Mr. E. S. EVANS should have delivered a Swan Jubilee Lecture in the very building in which the late SIR JOSEPH SWAN gave his first lecture on the incandescent lamp on January 17th, 1879. Still more remarkable was the fact, revealed by the Curator of the Sunderland Museum, in proposing a vote of thanks to Mr. EVANS, that although Sunderland was the birthplace of the incandescent electric lamp, it has no historical exhibits, and except for a photograph of SWAN there is nothing in Sunderland to commemorate his great discovery. Sunderland is, however, anxious to remedy the omission, and Mr. CHARLTON DEAS, the Curator of the Sunderland Museum, would be grateful if readers of THE ELECTRICIAN who possess examples of early Swan lamps will either give or make a long loan of an exhibit to the Museum.

Export Trade and the B.I.F.

WITH the approach of the British Industries Fair special interest is found in a recent "Commerce Report" dealing with the electrical export trade of the United States. This report, which is based upon the export figures for November last, shows that during the month under review refrigeration sets up to 1-ton capacity made the largest gain, with radio apparatus next in importance; substantial gains were also registered in interior and exterior lighting fixtures, heating and cooking devices, batteries and parts for motors. The total value of electrical goods exported during the eleven months' period of 1928 amounted to approximately £20 000 000, representing an increase of over £1 600 000 when compared with the same period of the previous year. Our own total of electrical exports for the same eleven months of 1928 amounted to £16 898 185, from which figures it will be gathered that the United States is not leading by the very wide margin that many would have us believe. The British Industries Fair affords an opportunity for intensive export propaganda, and manufacturers should not only be content to exhibit their goods, explain their merits and so on, but they should sell them with such enthusiasm that buyers, potential and actual, will themselves become unconscious propagandists for British electrical goods. The United States is valued largely by what it says about itself; Britain is valued to a large extent by its silence and what other people say about it. Let us drop this modesty and reliance on those Union Jacks in the four corners of the world to sell our goods. Let us rather make as much of ourselves as the United States, let us remind the world—for there is no need to tell it—that our goods are best. The British Industries Fair gives us that chance, let us make the most of it.

Industrial Designs.

ON many occasions we have emphasised the need, which many manufacturers of domestic electrical equipment do not yet seem to have realised, for getting away from traditional designs. Electric fires and cookers in particular have already suffered through being designed to look too much like gas appliances. In lighting fittings design similar conservatism was rife while designing was left to men who were essentially engineers. The collaboration of people with sound training in architecture and other decorative arts is having a notable effect on the design of lighting equipment, and opportunities exist for obtaining similar stimuli for other classes of electrical goods. One notable opportunity is to be found in the annual Competition of Industrial Designs which is organised by the Royal Society of Arts, and in which manufacturers and others offer prizes for acceptable designs to special requirements. In the 1929 Competition, details of which are now available, the electrical industry is only represented by an individual company offering a prize for a design for a showcard to advertise a wiring system. The gas industry, however, is offering 50 guineas for a design for a fireplace for a room and a gas fire of original design for use in connection therewith. A similar requirement for an electric fire—without a fireplace—would probably have attracted some interesting suggestions.

Rural Electrification.

THE film depicting rural electrification in practice in the Chester area which has been produced by the E.D.A., is quite the best of its kind that we have yet seen. The photography is good, and the ground has been covered in a way which should give to the general public the clearest possible idea of the advantages that electricity can bring to a rural area. Pictorially the film should command a showing on many cinema screens, but before this is done, the captions require some "gingering-up" if they are to be appreciated by the average cinema-goer. In one part of the film, for example, the audience reads the terse intimation that the apparatus before its eyes is "A Sub-station"; a few feet further on it sees a similar arrangement of apparatus, and is told that it is "Another Sub-station." Something much more "snappy" and informative is obviously required.

Outdoor Meters.

AN innovation in American domestic distribution practice which may be tried in this country consists of the installation of domestic meters with sheet steel boxes of weatherproof construction affixed to the exterior of consumers' premises. The boxes have a glass window aperture to permit inspection by the meter reader, and though the cost of these boxes is from 12s. to 15s. each, the supply authority responsible for the innovation claims that the expense is justified by the time saved in freeing employees from the necessity of making repeated calls to read meters, and by the elimination of the necessity for entering the consumers' premises and taking readings in inaccessible positions. As the percentage of "no-reads" in some districts is put as high as 10 per cent. of the domestic consumers, the saving in time under the new system should be considerable.

Extension of the Dancing Craze.

THE post-war craze for dancing is so widespread in human communities that we are not so surprised as might otherwise have been the case, to hear that the craze is extending to what have been considered inanimate objects. The dancing cable is the latest manifestation of the craze, and our American contemporary, the "Electrical World," has published a detailed symposium of experiences of the capers cut by conductors on a number of overhead systems. Under certain conditions conductors jump up and down the full length of spans, and though the dancing cables generally cause little physical damage the movement often sets up "shorts" and puts the lines out of service. No definite explanation of the phenomenon is offered, but it is thought to be due to sudden changes in temperature or to uneven loading setting up resonant effects which develop maximum amplitudes at certain points; as the amplitude of the vibration in resonance is a small fraction of an inch, while that of the dancing is several feet, this explanation is open to doubt. From the instances given, the action may occur on any type of construction with any type of insulator support or cables. The most natural theory is that the wires get into a swing and that the structures or cross arms sway backwards and forwards, accentuating the action to build up the dancing. Another theory is that conditions may be such that an upward movement of the air starts this action. It would be interesting to learn whether similar cases of dancing or whipping of cables have been observed in this country, and if so what remedy has been adopted.

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STEEL CONDUCTORS FOR POWER LINES.

Choice of Material—Conductivity of Low Grade Steel—Minimum Permissible Sizes—Relative Values for All Conductor Metals.

By WILLIAM T. TAYLOR, M.Inst.C.E., M.I.E.E.

ON 50 cycle a.c. lines the magnetic qualities of the steel as well as the current load are matters of concern; therefore, the d.c. conductivity is not the correct basis on which to calculate losses or to compare the different metals used for line conductors. As regards the conductor metal, the cheaper grade of steel wire or cable generally has the lower d.c. conductivity (higher d.c. resistance), but a relatively lower a.c. resistance. Medium priced grades of steel are often found to be best for a.c. lines, i.e., a low-grade steel has usually better conductivity than one of high-grade steel.

For a given size of steel conductor the relative d.c. resistance-drop may be quite small as compared with the a.c. resistance-drop; and, for a given size and spacing of steel conductors, the external reactance-drop may be quite small, as compared with the internal reactance-drop. We thus see the great necessity for a close study of steel conductor grading.

not unreasonable if steel conductor lines are to come into being. In 1907 the writer erected a steel conductor two-phase line for a purely induction motor load, and the regulation was so bad that the line had to be partly replaced by copper.

According to regulations, an aluminium conductor of minimum permissible size must have the copper equivalent of 0·0201 sq. in., or $1{\cdot}64 \times 0{\cdot}0201 = 0{\cdot}033$ sq. in. for equal resistance (d.c.).

The question that would now seem to be at isue is: what minimum size of commercial galvanised steel conductor is permissible? It can hardly be based on the equivalent d.c. resistance, such as copper (or aluminium, which is relatively higher than copper due to the greater skin effect) because the most favourable grade of steel conductor is but 16% of that of copper, and, because the internal inductive reactance may reach very serious proportions. Therefore, where and on

TABLE I.—VALUES FOR THE SAME CURRENT DENSITY.

Conditions.	Single-phase. Two-wire.	Single-phase. Three-wire.*	Three-phase. Three-wire.	Three-phase. Four-wire.*
Relative Voltage.	E	E E	E E	$\sqrt{3}E$ $\sqrt{3}E$ E
Relative kW transmitted per amp.	1·0	2·0	1·732	3·0
Relative total weight of conductor	1·0	1·5	1·5	2·0
Weight per kW transmitted ..	1·0	0·75	0·866	0·666
Relative percentage loss	1·0	0·5	0·866	0·5

* Balanced load. Neutral conductor is of the same cross section as the outers.

Compared with copper conductors, the d.c. conductivities of commercial steel conductors vary from about 8 to 16%—remarkably pure iron has a d.c. conductivity of around 16% of that of commercial copper.

In 1906 the writer found that, due largely to excessive internal inductive reactance, it was not possible at ordinary a.c. voltages to burn off line faults. So far back as 1905 the writer erected and operated various overhead lines (chiefly 15 000 V lines), consisting of galvanised steel conductors throughout, the more usual size of steel conductors employed being around 0·033 sq. in. (0·205 in. diam.) *solid*. These lines radiated from main 66 000 V sub-stations to mining districts in the mountains, where severe lightning storms were frequent.

Compared with copper lines they gave less trouble from transformer burn-outs and from insulator breakages due to lightning, and gave less disturbances from short-circuits and other current surges emanating from the distribution transformer houses or from the lines. As regards voltage regulation, for normal operating conditions this was found to be quite satisfactory. The most serious operating objection was that of clearing a fault coming in from the line, as compared with a copper a.c. line or a steel d.c. line.

Largely to overcome this objection a ring loop-in system was constructed. This was also found necessary for the purpose of facilitating rapid location of a faulty section of the line. Where copper construction was used, in most cases, the writer made a practice of entering or leaving the sub-station or transformer site with one or more span lengths of galvanised steel conductor to serve the purpose of lightning and excess current protection.

A Disadvantage.

One of the principal disadvantages of steel conductors is their relatively short life, and, in a rust-forming country like this, it should be decided on with great care. The current must be kept relatively low because of the I^2R and XI excesses. For a three-phase four-wire 100 kW line, it is usually desirable to keep the maximum line-current around 10 A; it is preferable to operate a line of such kW at 11 000 V, because of the probable growth of load, etc. To allow of rural expansion it is evident that some relaxation must be made in the maximum permissible variation of voltage—6 to 8% up or down is what terms shall we base the minimum size of commercial grades of galvanised steel conductors?

Skin Effect.

For a.c. lines the high resistance of steel conductors is in large measure due to skin effect, and in some cases the effective resistance may be almost doubled, due to skin effect. A steel conductor may have about eight times as much resistance to d.c. as a copper conductor of the same size, and about seven times as much resistance for the same weight. Therefore, where steel conductor costs less than one-seventh as much as copper per lb., it would be more economical to use it, assuming the same conditions; however, the relative strength, longer spans, and other matters, may favour the steel conductor. For instance, we may safely use $\frac{1}{16}$ in. or $\frac{1}{4}$ in. ice loading, and *not* $\frac{1}{8}$ in. ice loading, because the heating due to current flow will be concentrated on the outer layer of the steel conductor; so that we should not allow the same ice loading for steel conductors as for copper or aluminium.

Of all the different factors involved, for a given length of line, the current in amperes is one of the most important affecting voltage drop, which latter is apparently the greater of the obstacles to the more extensive use of steel conductors. Hence, we must first make use of that system allowing of the greatest kW load per ampere transmitted.

This favours the *three-phase four-wire* system, which will transmit the greatest kW load, and requires the least total relative weight of conductor per kW transmitted, for equal voltage to earth, than other a.c. systems. And, the cheaper the line conductor, the less likely we shall be concerned with the weight-cost but the more we may be concerned with a smallest line current for a given kW transmitted; also, the more important may become the question of total line loss.

It is one thing delivering three times more power, and it is another thing when this can be done for one-half of the line loss. Hence the necessity of knowing that the best system is the three-phase four-wire, and the *second* best is the single-phase three-wire, for steel and other conductor lines.

The relative values given in Table I (above) apply to all classes of conductor metals, but more particularly to the copper line; the a.c. power loss for a steel conductor is, of course, made up of the d.c. resistance, the skin effect resistance loss, and the hysteresis loss.

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PERMANENT MAGNET MOVING COIL AMMETERS AND VOLTMETERS.

Synopsis of a Detailed Report of an Investigation, undertaken by the B.S.I.R.A., on "Critical Examination of Characteristics of British and Foreign Permanent Magnet Moving Coil Ammeters and Voltmeters of Switchboard Pattern."

THE manufacture of permanent magnet moving coil switchboard instruments has a sufficiently long history for the general lines of design to have become almost universal. It must be recognised, however, that in order to obtain certain characteristics several different methods can be adopted, and that in the design of electrical instruments it is necessary to make compromises at almost every point in order to secure a general "balance" which will ensure satisfactory operation, length of service, adequate sensitivity, and all the other properties looked for in such an instrument. As is to be expected, different designers hold different views as to the best means of obtaining the required balance in the instruments they are designing, and as a result much difference is found in the details of their various designs. Many of the differences are of little importance, but others are of sufficient importance to affect appreciably the behaviour of the different instruments.

Many users of electrical instruments have definite preferences for instruments of one make or another, and occasionally this preference is associated in the mind of the users with some particular detail of design in the instrument preferred. Not infrequently, however, such preferences have no specific foundation, and, moreover, the preferences expressed by one user may be in direct conflict with those expressed by another.

In many instances the preferences expressed are for instruments of foreign manufacture, and they are frequently supported by a statement alleging some general superiority of the instruments preferred. Such statements are scarcely to be taken seriously, and in any case they cannot be dealt with in a scientific manner. If, however, definite reasons are put forward, it is possible to secure evidence regarding these, to investigate this evidence, and to decide whether or not it provided adequate support for the preference expressed.

Opinions of Users.

It is the constant endeavour of instrument makers of the first rank to maintain and improve the general quality of their instruments. It must be assumed, therefore, that in the instruments at present obtainable, all improvements which have been considered practicable by the individual makers are already embodied. In other words, each instrument maker has made the instrument which, in his opinion, best meets the average requirements of his market. If, therefore, preferences are expressed for certain instruments by a user, such preferences imply that, in his opinion, the manufacturers of those instruments are ahead of other manufacturers, as regards skill in designing or perfection of manufacturing methods and organisation. It may be, however, that the opinion held by the user is simply due to the better advertising and selling methods of the manufacturer whose instruments are preferred.

The members of the British Scientific Instrument Research Association interested in the manufacture of switchboard instruments were not prepared to accept or admit the position of inferiority implied by the preferences occasionally expressed for certain foreign instruments, and it was arranged that the Association should endeavour to get trustworthy evidence as to the relative merits of the instruments made by the best-known British and foreign manufacturers. The instruments selected to be investigated were the moving coil ammeters and voltmeters of the types commonly used as switchboard instruments.

Information based on prolonged experience with comparable instruments made by different manufacturers is not easy to obtain. If such information were available it would be of value in the appraising of different instruments; in certain respects, however, it would not be sufficiently complete in itself to allow of a perfectly fair comparison being made. There is a certain amount of published information available relating to construction and design, and much of this is of considerable interest; it has not been found possible, however, to obtain sufficient published information to allow of comparisons being made between instruments of similar types, of up-to-date pattern, made by different manufacturers.

For these reasons it was decided that the Association should itself examine a number of strictly comparable instruments of the current patterns made by different manufacturers. The types of instruments selected were the ordinary "dial type" switchboard ammeters and voltmeters, of six inches to eight inches diameter, and instruments of these types were obtained from the best-known British, American and Continental sources. In all, instruments from twelve different manufacturers were examined, the number of different instruments, not including duplicates of modified designs, being twenty-three. These instruments have been critically and impartially examined, both as regards behaviour and construction, and a general account of this examination, and of the conclusions arrived at, is given below. In this account it has been thought desirable to include some consideration of certain details of design, since some of the conclusions drawn refer to technical points, and such conclusions might not be convincing unless the evidence on which they are based were indicated.

Rapidity of Indication.

The instruments examined differed widely in the extent to which the movement of the pointer was damped, as the result of which there was a wide variation in the time taken for the pointers to come to rest after a current, sufficient to produce a deflection of about 90% of the full deflection, had been switched on through the instrument. In some of the instruments the damping was so small that with such a current the pointer moved over the scale in its first swing and struck violently against the stop at the upper end of the scale. In one or two instances, also, there was a tendency of the movement to stick at the upper end of the scale after the first swing. In other instruments the pointer oscillated several times over a considerable portion of the scale before finally coming to rest.

For a variety of reasons, which need hardly be discussed here, it would appear desirable that the damping should be almost, but not quite, critical, i.e., that the damping should be such as would allow the pointer to swing slightly beyond the position it will finally take up, and to return fairly quickly to (and actually through) that position, after which the movement should be imperceptible.

Certain of the instruments, both of British and foreign manufacture, were admirably proportioned in this respect. Other instruments required slight modifications before their damping was brought up to the amount needed to give the type of swing just described. As an experiment, two of these, both of British make, were modified by their makers in order to demonstrate that it is quite a simple matter to alter the proportion in such a way as to bring the damping to any desired value.

Of the instruments examined, about 60% were accurate to within 1% at ordinary temperatures, 30% had errors between 1% and 2%, 8% had errors between 2% and 3%, and one instrument had an error of over 9%.

The general level of accuracy of the British instruments was at least as high as that of the foreign instruments.

Correction for Temperature.

Most of the voltmeters were fairly accurately corrected for temperature variation, as is to be expected, provided a good type of resistance wire is used for the series resistances.

The ammeters were not, in general, provided with compensating coils, but the variation of sensitivity, over a range from 10 deg. to 50 deg. C. was not usually greater than 3%. For some of the instruments the variation of sensitivity (over the range taken) was greatest at the lower temperature; for most of them, however, the variation between 10 deg. C. and 30 deg. C. was only a small fraction, in some cases not more than one-tenth, of the total variation between 10 deg. C. and 50 deg. C. Three ammeters, two made by British manufacturers and one by a foreign firm, were fitted with compensating coils. In one of the British instruments the com-

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pensation was practically perfect from 10 deg. C. to 50 deg. C., the sensitivity of the instrument being constant to within one or two parts in one thousand over this range of temperature. In both of the other instruments the compensation was good between 10 deg. C. and 25 deg. C., but was less perfect between 25 deg. C. and 50 deg. C., falling off comparatively rapidly at the higher temperatures.

A certain degree of compensation can be provided without the use of compensating coils, by a proper choice of the materials used in the moving coil circuit, control springs, shunt, etc. As examples of the high degree of compensation obtainable in this way, it may be mentioned that in one of the "uncompensated" foreign instruments the variation in sensitivity corresponded almost exactly to that found in the compensated instrument of foreign manufacture already referred to. Another uncompensated instrument, a British one, showed a temperature variation between 12 deg. C. and 30 deg. C., rather less than twice that of the compensated foreign instrument, the total variation in the uncompensated British instrument between 12 deg. C. and 50 deg. C., being only one-third of that of the compensated foreign instrument.

Internal Construction.

As regards the construction of the various instruments, a few points of difference may be touched on, however, as indicating the great variation met with in the instruments examined.

(*a*) *Zero Adjustments.* In some of the instruments no zero adjustment of any kind was fitted, while in several others the fitting provided was very light and flimsy. In less than half the instruments was the zero adjustment really robust and provided with bearing surfaces sufficiently large to ensure mechanical steadiness and ample electrical contact.

It would, perhaps, be unfair to say that the British instruments are superior to the best of the foreign instruments in this respect, but it is worth mentioning that zero adjustments were fitted in all the British instruments, though the adjustment fitted by one British manufacturer cannot be operated without opening the front of the instrument case. In over half of these instruments the zero adjustments are designed in ways to which no exception could be taken; the zero adjustment fitted by one British instrument maker in particular is singularly robust and efficient without being at all heavy or clumsy.

(*b*) *Coil Mounting.* In many instruments the coil was supported between bridge-pieces mounted on the pole-pieces in such a way that the movement could not be removed from between the pole-pieces without dismantling it. In other instruments the whole movement was held in a frame, either pressed or die-cast, which could be slipped from between the pole-pieces after one or two screws and connections had been loosened. The latter form of construction, which is adopted by most of the manufacturers whose instruments were examined, would appear for many reasons to possess advantages over the former.

In the instruments made by one foreign manufacturer the frame which carried the coil was of a very flimsy construction and was held in position between the pole-pieces by shellac; this instrument was rather unusually constructed in almost all respects.

In most of the instruments the coil was supported *between* pivots. Some manufacturers, however, fit the pivots on the *inside* of the coil-former, and the jewels on which the pivots are supported are mounted on the cylindrical core. There is little to choose between these two methods of suspension. The external pivots provided, perhaps, an increased stability of the coil, but in all the instruments the distance betwen the jewels was sufficiently large to provide ample stability of the movement.

In the instruments made by two British manufacturers the jewels were mounted on resilient supports, though this practice was not followed in any of the other instruments examined. Two instruments, neither of which was provided with resilient supports for the jewels, were found to be damaged when the instruments were opened. In one of these the ends of the pivots were flattened, showing that the pivots had been overloaded, either due to mechanical shock or to the jewels having been screwed in too far during assembly. In the other, one jewel hole was broken right through at the bottom, and the pivot itself had suffered damage.

The practice of fitting resilient supports to the jewels affords considerable protection to the movement against risk of damage due to vibration and mechanical shock, and the instruments made by the two British manufacturers who follow this practice have a distinct superiority over the other instruments in this respect.

(*c*) *Connections.* In the majority of the instruments all the internal connections were either soldered or were made between bright metal contact pieces, with contact areas of ample size, tightly screwed together. In most of the ammeters all screwed or rubbing contacts were bridged with copper connections soldered at both ends, the bridging connections being made flexible at those points where it was necessary to provide for any relative movement between the two surfaces in contact. This was not universal, however, and in one ammeter in particular two screwed contacts were not bridged, and, moreover, the contacts were made by screwing a very small metal tag down on to a black-finished metal strip, the screw itself having a quite small head.

In some of the voltmeters the series resistances were wound on porcelain bobbins, and in others they were wound on flat pieces of mica, porcelain, compressed fibre, or bakelite. In some also, the resistances were divided so as to provide equal resistance on each side of the moving coil, while in others the whole of the resistance was put between the coil and one terminal of the instrument; the coil being connected direct to the other terminal.

There is little to choose between the two types of resistance, or between the two methods of arranging the resistances. Any stray field in the air gap due to the current flowing through the resistance coils can be made very small by suitably disposing the coils. This stray field will, in any case, be proportional to the current flowing through the instrument, and will not, therefore, impair the accuracy of the instrument in any way, since it will be taken into account when the instrument is being calibrated, before or during the ruling of the scale. As regards radiation of heat from the series resistances, this will be so largely affected by the construction of the case that any slight difference in favour of either type need not be considered.

In most of the ammeters there was apparently no provision for temperature correction, but in two or three of them the movement was shunted by a coil, or coils, and also a small series resistance coil was fitted. This arrangement provides to some extent against variation of sensitivity with temperature. The temperature correction of the instruments has already been given.

Coil and Former.

The movements in the different instruments differ very considerably in weight. In some instances great attention has evidently been paid to reducing the weight of the moving system to as low a value as possible consistent with retaining the requisite rigidity, the formers being made of thin aluminium and the number of turns on the coil being cut down to a minimum. In others this matter had apparently not been considered as of paramount importance, as copper formers were used and the coils were wound with a fairly large number of turns. In general, however, these movements were not unduly heavy, though the type of construction adopted in one instrument, a foreign one, was such as to make the movement extremely heavy without any corresponding gain either in rigidity or sensitivity.

Some manufacturers wind the voltmeter and ammeter coils with copper wire, others use aluminium wire for the voltmeter and copper wire for the ammeter, while a small number use aluminium wire for both types of instrument. The preference shown for the use of copper wire in the ammeter coils is probably due to the fact that copper wire presents no difficulties in soldering. With aluminium wire it would appear that manufacturers experience some difficulty in getting satisfactory soldered joints since, except in the instruments made by one particular manufacturer, clamped connections were used for making contact with the ends of the coil if this was made of aluminium wire. In the two instruments in which this practice was not followed, a soft solder was used for making the connections to the ends of the aluminium wire with which the coil was wound.

In some instruments the former was soldered to one end of the coil, but in the majority both ends of the coil were insulated from the former, the ends being taken up to insulated pivot holders mounted at opposite ends of the coil.

In most of the instruments the number of turns of wire in the coil was kept down to a fairly small number. In only one or two instances was the number of turns sufficiently large to make more than one layer, in the ammeter, or two layers (of thinner wire) in the voltmeter.

(*To be continued*).

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THE MANUFACTURE OF BARIUM OXIDE FILAMENTS.*

The Barium-Vapour Method of Coating—Four Processes Described—Commercial Use of Oxide Mixtures—Controlling Thickness of Emissive Coating.

By B. HODSON, O.B.E., B.Sc., Ph.D., L. S. HARTLEY, B.Sc.(Eng.), A.M.I.E.E., and O. S. PRATT, B.A.

WITH the barium-vapour method of filament coating, barium filaments or barium oxide filaments can both be readily made. The authors have made valves with barium filaments to see how they compared with the barium oxide filaments in common use. When the usual tests were applied to these valves, no difference could be detected between them

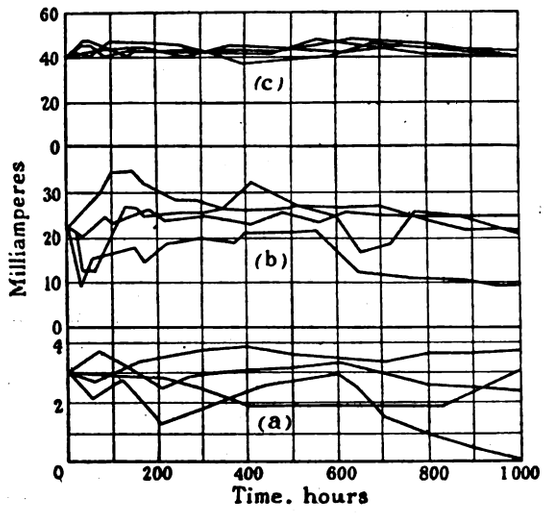

Fig. 1.—Variation of saturation current from various oxide-coated cathodes with life.

and the valves of commerce, except that the barium valves hardly retain their barium long enough to take measurements, whilst, on the other hand, an oxide-coated filament valve shows but little change in thousands of hours.

Thus direct support is given to the theory that barium and barium oxide valves appear to have similar properties; and that the oxide is essential as a support or carrier for the barium, which would otherwise vaporise.

The manufacture can be carried out in one of four ways, namely:—

1. The melting or fusing of a barium compound to the core wire.
2. The application to the wire of a resinous or paraffin paste containing a barium compound.
3. The evaporation of a solution of a barium salt which is painted on the wire.
4. Deposition on the filament of barium from vapour.

In the melting method the core wire, which may be platinum or nickel, is drawn through the fused salt bath. The nitrate of barium is often used. This process tends to make filaments rough in appearance, with loosely adherent coating, and the authors believe that it is not now in very common use.

The Paste Process.

The paste process is more common. In this process great care is taken to obtain very small particles of the barium carbonate usually used. The carbonate is ground in a mill for from 24 to 48 hours, and then the finer particles of this ground mass are selected. The separation is carried out in a way familiar to those who have separated abrasive powders such as emery. The paste is made up with paraffin or resin, kept in a molten condition and allowed to stand. The bigger particles sink first to the bottom, and the upper portion which contains only the finer particles in suspension is used.

This is again mixed to make a uniform paste, and is applied to the heated filament wire so that a portion of it adheres. The wire is then heated more strongly to evaporate, with a minimum of carbonisation, the paraffin or resinous carrier.

Finally, the core is heated to about 1 000 deg. C. to sinter the emitting substance to the wire, and to convert the carbonate to oxide. This process is repeated several times.

A process of this nature is used by the Western Electric Co. (Standard Telephones and Cables, Ltd.) and a more detailed description can be seen in their patent specifications. This process may be carried out by hand, or automatically in a series of ovens and pasting pots. With the use of such a machine, 80 metres of filament wire may be prepared per hour.

The resulting filaments are greyish in colour and slightly rough in texture, but if well done the coating is regular along the length of the filament. If the layer is too thick, it tends to crack, giving the appearance of a number of cylinders threaded on a wire.

The Core Metal.

The core metal is usually platinum or nickel, molybdenum or tungsten being rarely used owing to the risk of burning them during the necessary heat treatment. In the patent specification concerning such filaments it is usually asserted that platinates or resinates are formed; whether this be so or not, in all probability the emission process occurs as outlined by the authors, that is, the barium oxide, present either as barium oxide or in combination as a platinate, is electrolysed, and free barium is formed on the surface.

With both the first and second methods the filament is a barium oxide filament, and must be protected, before pumping, from the action of carbon dioxide and water vapour.

The third method, using solutions of salts, is still in use, and is probably the oldest of all. With this process as now used, the wire is dipped in the solution, taken out and heated in carbon dioxide gas. This is repeated perhaps 50 or 100 times, and finally a layer of carbonate is formed. This layer is almost insoluble in water. With this method the wire must be scrupulously clean before the coating is begun and the heating carefully carried out, otherwise a "pearl-string filament" is obtained.

A filament made by this method is not vitiated by contact with the atmosphere.

The fourth method is the only one in use in which the oxide coating is formed *in vacuo*. In this method the core wire is oxidised before the evacuation of the bulb; for example, tungsten may be used as a core and oxidised in lengths before assembly on the valve-foot, or oxidised on the valve-foot after the assembly has been completed. On the side of the anode towards the filament a piece of barium metal is fixed.

When a good vacuum has been obtained, the anode is heated, usually by high-frequency induction, and the attached metal evaporates. This metallic vapour surrounds the filament, which is kept at a dull red heat, whereupon the tungstic oxide is reduced and barium oxide is formed upon the filament.

Another means of producing the barium vapour is to use barium azide solution, which is painted on the anode and used instead of barium metal. On evaporation, crystals of barium azide are left upon the anode, which is subsequently heated *in vacuo*. Barium azide is a compound of barium and nitrogen, decomposing at about 225 deg. C. into metallic barium and nitrogen. The barium itself acts as a "getter" after this decomposition, but it is usual also to employ magnesium to produce a silvery mirror in the bulb instead of the brown or black mirror produced by barium alone.

With the first three methods the pumping takes a considerable time. The porous nature of the fused, pasted, or evaporated coatings makes it necessary to exercise some considerable care in this part of the process. The filament is heated to 900 or 1 000 deg. C. without anode voltage, and the pumps take away the gas evolved.

After this stage the anode may be heated either by induced high-frequency currents or by bombardment. There is usually sufficient emission at this stage to bombard the anode, especially as the gas still in the bulb enables the

* Extracts from a paper on "The Development of the Oxide-Coated Filament," read before the Institution of Electrical Engineers on February 6th.

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current to attain large values by ionisation. Activation commences as the vacuum improves; and as the filament improves in emissivity it can be run progressively cooler before the valve is sealed off. Completion of the process by ageing can be carried out in the usual way, by heating the filament to its normal running temperature and applying a positive voltage to the anode.

With valves made by the barium-vapour process the anode is heated in the same way, and during this process the formation of the filament proceeds much more rapidly than with the other three methods. This is probably due to the fact that a supply of free barium is already there, and the ageing process is not always necessary.

A phenomenon which should be mentioned here is the formation of " bright spots." If the coating is not of uniform thickness, those parts where the surface is more remote from the core are cooler than the more thinly coated parts. This causes greater emission from the thinner parts, and thus the " hot spots " described by Arnold in 1920 are produced.

This disadvantage is present in all types of barium oxide filaments, and is perhaps the reason why such filaments have not so far been used in valves intended for operation at very high anode voltages.

An attempt has been made to remedy this defect by adding calcium oxide and strontium oxide to the barium oxide, and so making the emitting layer of a composite nature.

Filaments coated with a mixture of oxides are already in commercial use. The Western Electric filament is coated with barium oxide and strontium oxide, and the filament of the Round valve with barium oxide and calcium oxide. It is stated that the use of mixtures of these three oxides and the adoption of thin layers minimise the knot or pearl-string formation which is so liable to cause this " hot-spot " action.

With filaments made by the vapour process the thickness of the layer of emissive coating is under control. Measurements of this type of filament made by the authors have shown it to be a few hundreds of molecules thick. This measurement presents some difficulty, but it has been made by utilising the known solubility of barium sulphate, and also by the amount of oxygen available for the oxidation of the barium.

Filaments made by the vapour process show reasonably constant emission over long periods of life. With those made by the paste method, especially when thin cores are used, the variation from valve to valve is greater. Fig. 1, given by Dr. H. Simon, illustrates this: the filaments *c* are made by the vapour process, whilst those marked *a* and *b* are made by a paste process.

With valves made by the barium-vapour process, the authors have not been able to detect any change in the amount of barium present in a filament after 1 000 hours' life by the direct estimation method mentioned above, and measurements of the total emission of similar filaments show little change in the emission. Life curves of some of these valves are very similar to the Simon curves marked *c*.

MAINS TESTING.

At an informal meeting of the Institution of Electrical Engineers on January 28th, Mr. F. C. Raphael opened a discussion on " Mains Testing." Mr. Raphael thought the I.E.E. regulations for leakage tolerances were rather indulgent for many networks, and he showed how these tolerances permitted a very appreciable current to pass under certain conditions. For three-wire d.c. networks he advocated a high resistance voltmeter between each bus-bar and earth to indicate the remarkable rise in voltage when a main has a bad leakage.

Mr. A. H. BENNETT asked whether there was any value whatever in the continuously taken insulation tests. Tests at frequent intervals were sufficient, but on the d.c. part of a system he would change over the outers to earth lines periodically. Mr. R. GRIERSON pointed out to those who advocated abolishing the limiting resistances that without them the balancers of a three-wire system would have to take the earth wire potential, whatever it might rise to. He was sure the earthing of the mid-wire through limiting resistances was the lesser evil. Mr. A. G. HILLING thought the secret of success was to fuse a network properly and to keep the limiting resistances as low as possible. He felt that the resistance should be 0·2 Ω instead of the 2·0 Ω allowed by the regulations. Messrs. P. F. Allan, J. R. Bedford, E. Brown, W. A. Erlebach, A. F. Harmer, A. G. Kemsley, F. C. Knowles, H. J. Neill, J. Spiley and A. Watson also spoke.

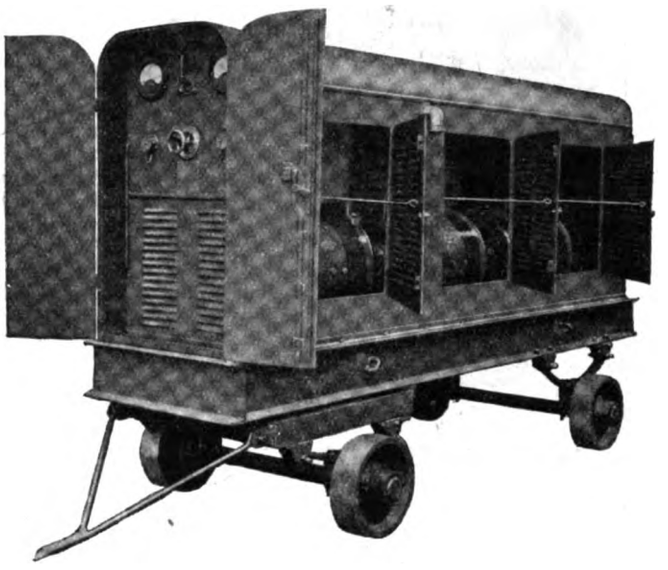
ELECTRIC WELDING.

Recent Advances in Manufacture of Portable Equipments.

As it has now become an accepted fact that electric arc welding machines, both stationary and portable, are as essential in a workshop as any other machine tool, the following description will no doubt be of general interest to engineers concerned in constructional and maintenance work. The machine illustrated represents a great advance in portable welding equipment, and embodies the latest developments.

One of these sets has recently been supplied to the Bengal and Nagpur Railway Co., who entrusted this order to Alloy Welding Processes, Ltd., of London. The contract is for the supply of a motor generator electric arc welding plant for two operators.

The machine which is under construction for the Bengal and Nagpur Railway is to be fitted with the manufacturers' latest



" B.P." type dynamos, which are self-stabilising, drooping characteristic machines giving the arc voltage at their terminals. The special features of the " A.W.P." generator are that no separate series resistances, reactors or transformers are required, neither is separate excitation considered necessary.

Portable machines of any kind may have to be used out in the open, especially in connection with railway work, and, as will be seen from the photograph reproduced herewith, this problem has been dealt with in a very efficient manner. The substantial steel cover, with its wide removable inspection doors at the sides, the protecting doors to the switchboard, the recessed control panel and the flush mounting switchgear have been well thought out to afford the maximum possible protection under adverse weather conditions.

Such refinements as laminated springs, wide steel wheels, fitted with roller bearings and swivelling fore-carriage, are points that will be appreciated by those who have to handle such a plant outside the workshops, where the surface over which the equipment is being moved might not be so hard or smooth as could be desired.

As is usual with electrical machinery destined for India, the dynamo had to be liberally rated and have special insulation.

It will be realised that the risk of breakdown and the maintenance cost will be reduced by the elimination of series resistances, reactors, transformers, diverter switches, separate exciters, contractors, solenoids, etc., which have been swept away in designing this new welding generator.

LONDON ELECTRICITY PRICES.

The London and Home Counties Joint Electricity Authority has just published a statement of charges made for lighting, power, heating, and cooking supplies by electricity supply undertakings in the London and Home Counties Electricity District as at January 1st, 1929. The undertakings are grouped alphabetically, and the statement is divided into three sections, i.e., lighting, power, and heating and cooking. Copies of this publication are to be had from the offices of the Authority (5, Millbank, Westminster, S.W.1), price 1s.

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VERTICAL SWITCHGEAR MANUFACTURE.

Reducing Manufacturing Costs on Smaller Type Metal-clad Units—Standardised and Interchangeable Parts—Elimination of Cast Iron as Constructional Material.

AN interesting development in vertical type switchgear is announced by Messrs. Ferguson Pailin, Ltd., well-known for their pioneer work in the development of the vertical drop down principle of isolation as applied to heavy rupturing capacity e.h.t. metal-clad switchgear, who have now put on the market a smaller type of metal-clad unit which extends their range in a downward direction and gives a complete line of metal-clad switchgear with rupturing capacities from 1 500 000 kVA down to 25 000 kVA.

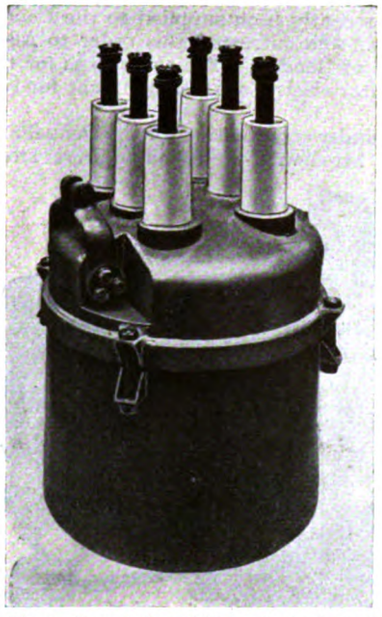

Fig. 1.—General view of triple pole circular tank breaker incorporated in the new unit.

The new units embody a number of novel features, and whilst maintaining the advantages and reliability of their existing designs enable manufacturing costs to be considerably reduced so as to render this gear an economic proposition for even the smallest sub-stations.

The whole of the component parts are manufactured to jig and template, and are interchangeable. The equipments will also be strictly standardised, so that mass production methods of manufacture can be employed and considerable stocks carried.

The space economy effected by the use of vertical pattern gear has been dealt with in previous articles, and the gear now under consideration is no exception to this rule. Taking, for example, a simple equipment including an oil breaker of 25 000 or 50 000 kVA rupturing capacity, the overall height of the equipment is only 4 ft. 4 in., the width 2 ft., and the depth from back to front 2 ft. 8 in., with an additional 10 in. or the operating handle. If a potential transformer is required he overall height increases to 5 ft. 11 in., the other dimensions

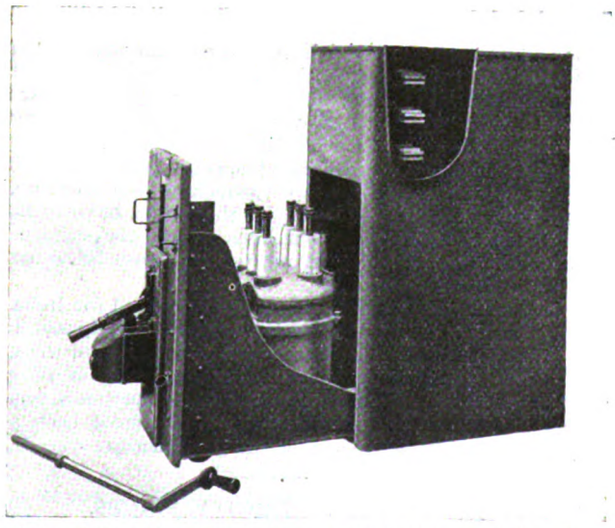

Fig. 2.—A view of the new unit with the breaker isolated and withdrawn from the housing.

remaining unaltered. The floor space required for the installation and operation of a complete equipment is only 11½ sq. ft. This, of course, compares favourably with truck or stationary cubicle type gear.

The general construction of the unit is interesting, in that cast iron has been entirely eliminated. The fixed portion of the unit is built up of a substantial boiler plate construction with welded joints, separate chambers being provided for the busbars and circuit connections. Porcelain insulation is employed in all places requiring mechanical strength, and the clearances and insulation employed are such that filling of the unit is optional. Automatic shutters are provided for screening all live metal when the oil breaker is withdrawn, and the relative disposition of the various parts, together with a simple interlocking arrangement, prevents any incorrect sequence of operation and renders the gear foolproof. The isolating plugs and sockets are of the makers' patent self aligning pattern.

The movable portion of the unit consists of a truck carriage which carries the oil circuit breaker together with its raising and lowering gear. It is interesting to note in this connection

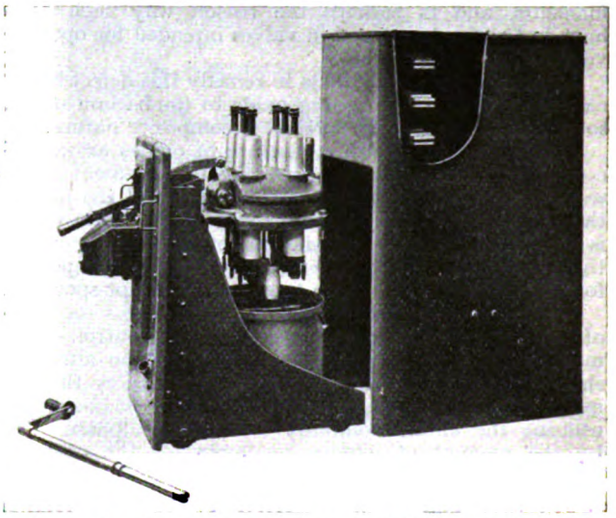

Fig. 3.—Another view of the unit with the breaker isolated and withdrawn from its housing.

that despite the simplicity of the unit each equipment retains its own raising and lowering mechanism so that it is not necessary to have a portable racking device for isolating or transportation purposes, and any number of units can be inspected simultaneously. Furthermore, as will be seen from an examination of Fig. 2, no tank truck is required, as this is incorporated in the moving portion.

The oil circuit breaker has a fabricated domed top and a single circular tank with domed base. It is generally recognised that the adoption of circular tanks in breakers of this class increases the factor of safety, and special groove and gasket joints between the tank and top plate prevent oil throwing under heavy pressure. The tank is lined throughout with insulating material, and arcing barriers are also fitted. The tank is fastened to the top plate by four short steel bolts which, even under heavy pressure, do not elongate sufficiently to destroy the efficiency of the gasket. The contacts are of the wedge and finger type and the whole of the operating mechanism is enclosed inside the breaker. A pebble vent of the latest type is fitted to each breaker, and discharges into a vent pipe which carries all gases outside the unit.

This gear has been primarily designed for simple equipments, but potential transformers can readily be fitted on the top of the fixed portion of the unit. These transformers form complete units in themselves and can be added or replaced at any time whilst the equipment is in commission.

Provision for instruments is made by providing a special panel which is mounted in front of the fixed portion. The question of extension has received careful consideration.

In connection with the shut down in the Stalybridge power station on February 1st, the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., state that the trouble was in no way due to the turbine, but arose through a fault in some of the auxiliary wiring, which affected the protective device installed in connection with the turbo-generating unit; this, functioning properly, shut down the set. As no other unit was running at the time some time had to elapse before power could be got on to the busbars again.

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MANUFACTURERS' EQUIPMENT & MATERIALS.

Special Protective Paints—Methods of Removing Fumes—An Extinguisher for Electrical Fires—Glass for Advertising Signs—Dust Collectors—Silent Fans for A.C. Supply.

AS the cost of applying paint to structures is considerably more than the cost of the paint it is obviously important to reduce the frequency of repainting to a minimum. A special paint known as "Ferrodor," made by GRIFFITHS BROS. AND CO. (LONDON), LTD., Macks Road, Bermondsey, London, S.E.16, possesses qualities which render it particularly suitable for covering such structures as electrical manufacturing works, power stations and transmission towers. In its natural steel grey colour it is specially recommended for steel overhead line towers. Its heat resisting powers also fit it for use on chimneys. The "Ferrodor" ore is iron oxide in the highest known form of oxidation, and the micaceous or flaky structure of the pigment adds considerable value to qualities of the paint. The flaky particles lie flat and overlap one another, interleaved with oil film, forming a flat surface which is only displaced with difficulty. The elasticity of the paint is another desirable feature, as the expansion and contraction of iron and steel structures quickly cracks paint surfaces which are insufficiently elastic. An interesting descriptive booklet produced by the manufacturers shows power stations and other structures treated with "Ferrodor," and includes a shade card and a film of the natural steel grey paint produced by coating a sheet of zinc with "Ferrodor" and then dissolving off the zinc in a bath of sulphuric or hydrochloric acid solution. The paint shows no signs of damage from its immersion in the acid.

Efficient and reliable fans must be employed to remove the fumes resulting from interior paint spraying operations, not only for health reasons, but also to secure quick drying and well finished products. In some cases the fixing of suitable fans in existing finishing rooms is sufficient to satisfy all requirements; in other cases it is necessary to have separate spray cabinets, each fitted with an exhaust fan. The JAMES KEITH BLACKMAN CO., LTD., 27, Farringdon Avenue, London, E.C.4, have developed for this purpose the "Streamline" fan. One design allows the fan to function inside the fume removal hood, with the motor working externally in clean air and easy of access. The motor is firmly secured to the external wall and the spindle is enclosed in an extended tube which carries the fan bearing at one end, and at the other is secured to the motor bracket. Where conditions make it impossible to discharge fumes direct to atmosphere, and duct work has to be employed, the "Paddle Wheel" fan is used instead of the propeller type.

Fire Extinguishers.

For the rapid extinction of fires, particularly in electrical manufacturing works and power stations, the British-made "Fire Foe" powder extinguisher is worthy of consideration, as its makers, the FIRE-FOE CO., King Street, Bury, Lancs., claim for it many advantages over other types, while offering it at a very moderate price. It is said to be as efficacious with electrical as ordinary fires. Operation is simple, as the contents of a canister are merely thrown at the base of the flames. Unaffected by climatic conditions, the powder is always ready for use, and never needs inspection. The gases generated when the powder comes in contact with a fire are claimed to be harmless to machinery, insulation, and to life.

The vast extension in the use of refractive signs, which has taken place during the last two years, has brought into prominence the refractive qualities of certain types of glass. It has been found that the use of coloured or crystal glass with high diffusion and transmitting indices obtains the maximum benefit from day or artificial light. For a shop sign or shop fascia a prepared stencil behind the glass enables any announcement, name or slogan to be shown in vivid letters, and changed, if need be, at comparatively little cost. It is, however, imperative that the glass employed should have a high transmission. The glass known as "Selenalyte" is claimed to possess great power of transmitting light, and its texture enables an almost perfect evenness of illumination to be obtained; in fact, the high degree of transmission and diffusion which it provides is the real secret of brilliant effect. Moreover, glass is said to retain its brilliance permanently. To take an example, a piece of amber-coloured "Selenalyte" glass, 3 mm. thick, has a light transmission index of 43. Ordinary glass of the same colour and thickness has an index of only 12. Thus it is not only the strength and quality of colour that count, but it is the texture of the glass itself which provides high refractive power and enables it to be effectively employed in outdoor advertising. The following table of light-transmission indices compares "Selenalyte" with ordinary coloured glass:—

Colour.	Selenalyte.	Ordinary Glass.
Scarlet	190%	100%
Flame	220%	100%
Orange	190%	100%
Amber	310%	100%
Olive	260%	100%

There has long been a need for a satisfactory method of collecting the dust generated during dry grinding operations. That this dust is extremely harmful when inhaled by human beings is well known, but to eliminate the danger and provide hygienic conditions is by no means easy. Settling chambers, coke boxes, water tanks and cyclone separators have hitherto been extensively used to this end, but in very many cases very crude arrangements are still employed. Simply to draw the dust from the wheel hood and along a pipe by means of a fan and blow it outside the building is unsatisfactory.

A Point of Law.

Apart from the unhealthy atmosphere created, the annoyance to neighbours, and the disfigurement of adjacent buildings, the dust finds its way back to the workshop through open windows. It is now required by law that efficient methods of dealing with this dust problem shall be employed, but space limitations very often make it almost impossible to adopt a method better than that of blowing dust into the open air. On the other hand, settling chambers, coke boxes, water tanks, and cyclones are bulky in themselves, and all require a more or less extensive system of connecting pipework. The "Visco" self-contained dust collector unit, which has been developed by the VISCO ENGINEERING CO., LTD., of 162, Grosvenor Road, London, S.W.1, is claimed to furnish a satisfactory solution of the problem. The outfit consists of an efficient exhauster and the dust collector. The exhauster is a special type for dust work, suitably mounted on the grinder itself, or alongside it on a separate pedestal, and in some cases on the collector casing. It is usually driven by belt from the grinder shaft, though with some machines an independent motor may be necessary. The exhauster suction inlet is connected to the grinder cowls, or, in the case of cylinder grinders, is fitted with a flexible pipe and suction hood. The discharge branch delivers the dust-laden air directly into the collector. This collector has only two parts, a rectangular box and a "Visco" filter cell. The box is provided with suitable baffles so that the dust stream is deflected and a considerable portion of the dust forced to settle in the bottom of the box, whence it can occasionally be removed by hand. The air then leaves through the filter cell. The metal "Visco" filtering rings lie irregularly between two expanded vertical metal walls, forming a substantial yet easily handled cell. These filter rings have an extremely large surface, dividing the air into innumerable small streams which continually change their direction and are flung against the viscous surfaces and into dead air pockets, where the dust is retained by a fine coating of "Viscinol" oil. The cell rests in the box on two small brackets, and is firmly held in position by a quick-release fastener. It can be removed and refixed in a few seconds. A large percentage of the collected dust can be removed by jarring the cell on the floor, but, occasionally the whole cell must be washed in hot soda water and after drying recoated with "Viscinol." The intervals between this operation entirely depend on the nature of the material ground and the daily working hours of the grinder. While ideal as self-contained units with single machines, these dust collectors are of equal value for a number of machines grouped together.

Efforts to produce silent running alternating current exhaust fans have led Messrs. S. G. LEACH AND CO., LTD., of 26-30, Artillery Lane, London, E.1, to put on the market a new range of single-phase regulating pattern types. These are all of the self-starting pattern, and even at full speed the usual hum noticeable on many a.c. machines is absent.

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PHYSICAL AND OPTICAL EXHIBITION.

Obtaining Frequency Response Curves—A New Wavemeter—A 40 W Valve for 10-Metre Work—Plotting Magnetic Fields Round Straight Conductors—Telegraph and Telephone Testing Instruments.

(*Concluded from page* 65.)

THE apparatus shown by the BRITISH THOMSON-HOUSTON CO., LTD., was devised in order to provide a quick method of obtaining the frequency response curves of loud speakers and with such equipment it is possible to obtain a complete characteristic within a few moments of modifying a loud speaker.

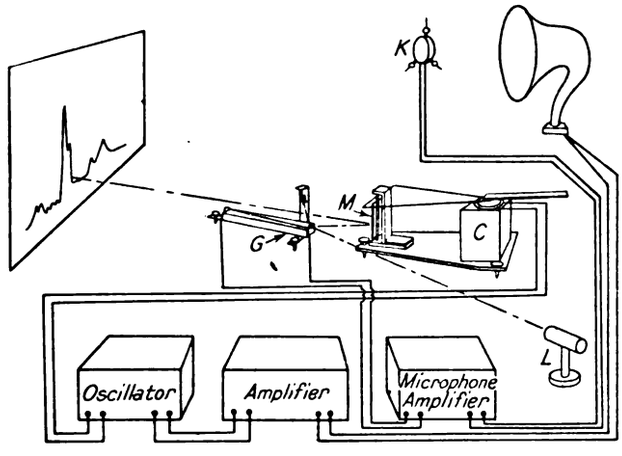

Fig. 1.—Illustrating the arrangement of the B.T.H. exhibit for testing loud speaker efficiency.

The general principle of the apparatus will be gathered from Fig. 1. The loud speaker to be tested is supplied with constant current of variable frequency from an audio frequency oscillator of the heterodyne type. A calibrated condenser microphone (*K*) is placed a few feet in front of the loud speaker to pick up the emitted sound. The output from *K* is amplified through the amplifier shown, and the output from this operates a special form of hot wire galvanometer (*G*) which will be described later. The frequency of the heterodyne oscillator is controlled by a condenser *C*, which is connected in one of the tuned circuits of the oscillator. Mechanically coupled to the spindle of condenser *C* is a mirror *M*, which rotates upon a vertical spindle. A beam of light from an arc lamp *L* falls first upon the small mirror of the hot wire galvanometer, which rotates about a horizontal axis and thus gives to the beam of light a deflection in a vertical plane proportional to the square of the amplified microphone current, and, therefore, proportional to the sound energy. After reflection from this mirror, the beam passes to the second mirror *M* and there receives a deflection in a horizontal plane corresponding to the rotation of the condenser *C*, and therefore corresponding to the frequency. From the second mirror, the light proceeds to the screen giving a luminous spot which, owing to the two deflections en route, traces out the frequency-output curve to rectangular co-ordinates.

The output of the oscillator is passed on to the detector and the unwanted radio frequency component filtered out. The signals are then fed into an ordinary resistance-capacity-coupled low frequency amplifier, the final stage having two power valves in parallel. This amplifier is capable of delivering 2·5 W of undistorted audio frequency power. The microphone amplifier which, owing to the insensitivity of the condenser type microphone used, has to have a very high overall amplification, in this case of the order of 20 000 : 1 voltage ratio. The galvanometer used consists of a very fine tungsten wire 0·6 mils. in diameter, stretched down a long metal tube and passes 90° around a fine spindle carrying the small galvanometer mirror; it is then secured to a spiral spring. It will be realised that any extension of the wire will be taken up by a contraction of the spring and that this must result in a rotation of the small spindle as the wire rolls over it. This construction is very simple, is dead-beat in operation, and requires only about 30 mA to obtain full scale deflection.

The MARCONIPHONE CO., LTD., exhibited receiving and rectifying valves, transmitting valves, including the new 'Detisw," a double-ended short wave transmitter dissipating up to 40 W and workable on wavelengths down to 10 metres. New apparatus was also shown by MARCONI'S WIRELESS TELEGRAPH CO., LTD., including a naval direction finder designed primarily for fitting on all classes of naval ships as a navigational instrument or as a means of locating other naval and mercantile ships.

The MULLARD WIRELESS SERVICE CO., LTD., this year exhibited a wide selection of transmitting valves, in addition to loud speakers, battery chargers and radio components. A transmitting valve for an input of 30 kW was shown, as was also a Holweck molecular pump. The "First Grade" induction instruments shown by NALDER BROS. AND THOMPSON, LTD., were of novel construction and it is claimed possess an inherent accuracy higher than B.E.S.A. first grade. The temperature coefficient is less than 0·02% per degree C. and the frequency error is less than 0·3% for a rise or fall of 10% in frequency. The momentary overload capacity is 5 000%. The length of the scale is 17 in. for 8 in. dial instruments. Other exhibits were indicating and recording power factor meters for single-phase and polyphase (balanced and unbalanced load) systems, the indications being independent of variation of current, pressure, temperature, frequency, and wave form met with in ordinary practice.

Many newly developed components, outfits, and complete apparatus for radio reception and gramophone electrical reproduction were shown by the IGRANIC ELECTRIC CO., LTD. The short-wave section of the exhibit comprised a new screen grid valve short-wave receiver employing h.f. amplification, with an over-all efficiency on wavelengths as low as 10 meters, a neutro-regenerative short-wave receiver, which also incorporated h.f. amplification and covered wavelengths from 15 up to 2 000 metres approximately, and various components for use in short-wave radio apparatus. The Igranic "Universal" portable receiver was also on view and this contains many features which represent considerable advances in portable receiver design. Other exhibits were the transverse current microphone, incorporating several striking features which enable it to respond uniformly to sound waves of all frequencies, with freedom from "background" noises, and a microphone control unit.

Telegraph Equipment.

Telegraph apparatus of various types, including an improved sounder in which more efficient methods than those hitherto used in such instruments are employed, both for converting the electric current into motion and for utilising that motion for producing sound were shown by the INDIA RUBBER GUTTA PERCHA AND TELEGRAPH WORKS CO., LTD. Among other features of the stand were self-contained direct reading portable Wheatstone bridges and a standard artificial telephone cable. The instrument shown was a 60-mile cable (standard cable, 20 lb. per mile), adjustable in steps of one mile by means of throw-over switches. The resistance of the two lines for each mile of cable consists of two resistances of 44 ohms each, and a mica condenser of 0·054 microfarad, representing the capacity between the lines. It is made in sections of two miles, each containing a separate condenser, and shielded by metal plates to prevent interference between sections. ISENTHAL AND CO., LTD., displayed an assortment of various types of sliding rheostats now manufactured, including enamelled steel tubular patterns, some wound on slate formers, and a new type employing ceramic formers which can be supplied in either the open or enclosed pattern. Special attention was drawn to the latter, as this had not been previously shown. A new type of testing transformer, for connection to the supply mains at 110 V up to 440 V a.c., designed to provide current of any value up to 2 000 A for short periods, was also shown. The whole is contained in a case for easy transport. Another exhibit was a large selection of various types of mercury switches capable of handling currents up to 20 or 30 A, some being suitable for use on circuits up to 1 000 V. A new type of direct reading voltmeter which can be made for voltages up to 500 000 V was exhibited, and this consists essentially of two condenser plates between which an electro-static field is created; the effect of this field upon a light rotating vane is directly shown as a luminous line on a scale according to the distance apart of the condenser plates. The instrument can be calibrated for comparatively low voltages (say 1 to 10 000 V)

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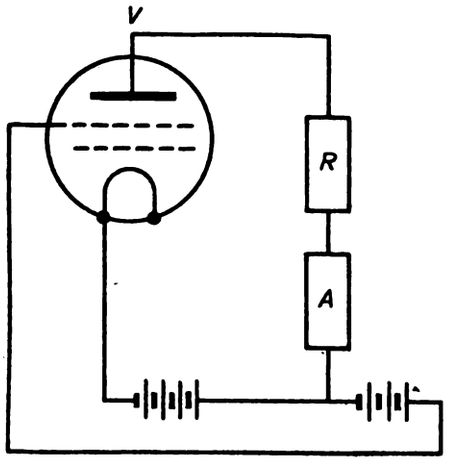
and the calibration curve extended up to any desired voltage. The movement of the vane is practically aperiodic and without friction. The instrument is suitable for researches in high voltage fields, being independent of frequency; it is also used in connection with therapeutic and diagnostic X-ray work.

Probably the most interesting of the exhibits of H. W. SULLIVAN, LTD., were those relating to radio frequency determinations. These included a phonic wheel and double amplifier for standardisation of the tuning fork of a multi-vibrator wavemeter. For the exact determination of the frequency of the tuning fork of a standard multi-vibrator wavemeter, a phonic wheel, to the design of Dr. D. W. Dye, has been developed in collaboration with him. The wheel is valve driven, following the principle given by Dr. Eccles, but has an additional driving magnet. A double thermionic amplifier is supplied with the wheel; this comprises two independent three-stage transformer-coupled low-frequency amplifiers. One of the amplifiers serves to run up the wheel as a self-driving motor and the other amplifies the small output e.m.f. given by the output winding of the tuning fork, and thus supplies power which can be applied to the additional driving magnet. After starting the wheel and running it up to speed (controlling its own power), power is gradually applied from the fork under test. The wheel quickly pulls into synchronism, and, upon cutting off the self-driving power, continues to run as a pure synchronous motor. A contact, operated through a suitable gearing from the main shaft of the wheel, gives impulses of one per sec. to the pen of a chronograph, which is also impulsed by seconds from the standard clock through a relay. With a run of 1 000 secs. duration, the frequency of the fork can be measured to one part in 100 000. Another interesting exhibit was an oscillation generator, due to Dr. N. W. McLachlan, in which a four-electrode thermionic valve is employed as a negative resistance. Two oscillatory circuits, one having an adjustable natural radio frequency, and the other a fixed natural audio frequency, are associated with the valve so as to produce a radio frequency oscillation modulated at audio frequency. This type of wavemeter should prove useful in tuning non-oscillating broadcast receivers—tuning being much more accurately effected than with a buzzer wavemeter, and yet with the same simplicity of operation. The theoretical circuit of the device is shown in Fig. 2. Potentiometers, wattmeters, galvonometers, Wheatstone bridges, inductance and capacity apparatus, wavemeters, etc., were shown by H. TINSLEY AND CO. Time switches in a variety of models for different applications, both hand and electrically wound switches representing a wide range of capacities were displayed by VENNER TIME SWITCHES, LTD. Thermostats fitted with a special type of mercury tube switch and of three types and three capacities were also shown. Time switches for Marconi d.f. wireless lighthouses and the "Venner-Dyke" buoy lamp for use by submarine cable companies for maintenance work at sea, were also shown.

An Interesting Oscillator.

The exhibits of the NATIONAL PHYSICAL LABORATORY included a beat note oscillator for use as a low and telephonic frequency source of good wave form and constant output for testing purposes. The apparatus comprised two similar high-frequency sources consisting of series fed Hartley circuits fitted with toroidal coils and the frequency of one of these was continuously variable by the adjustment of an air condenser. This was so designed that with the frequency of the fixed source at 100 kc per sec. the beat frequency varied between 10 and 10 000 cycles per sec. logarithmically over the condenser scale. A low-frequency amplifier capable of supplying an average output peak voltage of about 150 V, of good wave form, was included. Four output transformers, having seven ratios in all to suit a variety of loads, were provided in a separate box with an automatic change-over switch. Another exhibit was an apparatus for recording wireless time signals on wavelengths from 1 000 to 20 000 metres. The receiver comprised four separate units, each contained in a screened box with internal compartments for the mutual screening of stages. The second unit contained the main four-valve amplifier with two radio-frequency stages, one of which was provided with tuned transformer coupling. The local oscillator used for heterodyne reception on continuous wave signals was capacity-coupled to the detector of this amplifier. The fourth, an audio-frequency stage was followed by a selective audio-frequency amplifier comprising two amplifying stages and one output rectifying valve. This unit formed an important feature of the set, as it was found that even the fairly high selectivity given by the three tuned radio-frequency circuits was insufficient to prevent disturbance of the relay by interference. A switch was provided to enable the selective stage to be disconnected, as certain of the signals are not pure continuous waves and thus cannot be heterodyned to the appropriate frequency. The recorder shown was constructed by Messrs. NEGRETTI AND ZAMBRA, LTD., in consultation with the Meteorological Office. Mr. E. B. MOULLIN showed an ammeter for currents of extremely high frequencies and which could be calibrated by steady current. This instrument has been designed for measuring currents whose frequency is about thirty-million cycles per second, such as are employed in the beam system of radio communication. Its action depends on measuring the force between two circular cylinders carrying oppositely directed currents. The force increases slightly with the frequency because the current in the cylinders departs from axial symmetry and increases along the length of the system. The ammeter is a simplified current balance whose geometrical arrangement is such that the various magnetic and electric fields are capable of exact solution. The system is two long circular cylinders placed symmetrically within a circular screen tube, and so the longitudinal and transverse current distribution is calculable, and hence the correction factor for any frequency may be derived. In the instrument exhibited, the force at 3×10^7 cycles ($\lambda = 10$ m.) exceeded the force for the same steady current by 6%; in the most sensitive pattern of the instrument full deflection is produced by 1·2 A, but instruments can be made for any current up to many hundreds of amperes.



V = Screened Grid Valve.
R = Radio Frequency Circuit.
A = Audio " "

Fig. 2. The theoretical circuit of the Sullivan-McLachlan wavemeter.

The WIGAN AND DISTRICT MINING AND TECHNICAL COLLEGE demonstrated an apparatus for showing certain magnetic effects of a current. The apparatus consisted of three rectangular coils of different sizes and a specially designed mercury cup, a current of 2 to 3 A being used. The following effects, etc., were demonstrated:—(1) setting of a current-carrying coil in the earth's field; (2) effect of reversing the current in the coil; (3) setting of a current-carrying coil in the magnetic field due to a current in another coil; (4) effects of reversing the currents; (5) direction of motion of a current-carrying conductor when a magnet pole is presented to it (left hand rule); (6) mutual effect between two current-carrying conductors; (7) plotting the magnetic field round a straight current-carrying conductor; (8) plotting with other magnetic fields superimposed on that of the current; and (9) verification of the formula $F = \frac{2i}{d}$ using either an oscillation magnetometer or a deflection magnetometer.

On the stand of the M.L. SYNDICATE, LTD., were shown M.L. anode converters, rotary transformers and motor generator sets. These machines have a large number of applications and have been successfully used for supplying power for radio receiving and transmitting sets, gramophone amplifiers, public address equipment, talking picture equipment and television apparatus. There are also a number of uses for the machines in the laboratory. By their use a steady voltage is obtained for insulation testing, and they are useful for providing current for operation of cathode ray oscillographs. The M.O. VALVE CO., LTD., displayed a wide range of receiving and transmitting valves, high power rectifiers, and valves as used in the G.P.O. and beam stations. Examples were given of the technique of glass-to-metal gas-tight joints, e.h.t. rectifiers, screen grid and pentode valves, a.c. mains valves, etc.

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CORRESPONDENCE.

The Editor welcomes the free expression in these columns of genuine opinion on matters of public interest, although he disclaims responsibility alike for the opinions themselves and the manner of their expression.

"Salesmanship."

[To the Editor.]

Sir,—As a one-time regular attendant at the E.D.A. Salesmanship Conferences, I was interested to read your comments under "Current Topics" last week. The achievements of the early pioneers in our industry were admirable, but instead of browsing over their experience we should try to utilise it as a jumping-off point for further developments and regard it as an inspiration to those with little faith. There is so much work to be done in spreading electrification in this country that we have but little time to sit back and examine what our predecessors did under very different conditions. It is therefore highly desirable that Salesmanship Conferences should deal with selling first and last, and that the tense should be future and not past.—I am, etc.,

"Sales Engineer."

London, S.E.22.

Safety Factor of Concrete Poles.

[To the Editor.]

Sir,—On page 89 of your January 25th issue, Mr. Gauvain refers to poles, saying: "The factor of safety allowed is two in the case of iron, steel, and reinforced concrete, calculated on the crippling load . . ."

As the climatic conditions in New Zealand are about the same as this country, the quality and state of cement at least as good or better here, the manufacturing plant and labour and other conditions for best manufacture and erection at least as good or better here, and a person's life just as valuable there as here, why cannot this country have the same factor of safety and loading conditions?

Those responsible for the New Zealand Regulations are, without doubt, quite well aware that the problem is both complicated and complex. That is, it very closely involves such practical questions as: (*a*) the *type* of reinforced concrete pole; (*b*) the best method and process of mixing, making, curing, drying; (*c*) the most effective size, number, manner, and depth of placing of longitudinal steel rods; (*d*) the best shape spacing, holding or keying, roughness, of longitudinal steel rods; (*e*) the best ratio of modulus of steel and concrete; (*f*) the best richness of mixture, etc. Also (*g*) whether the pole is made in sections and with or without taper, or made in one continuous column with or without taper; (*h*) whether the spirals (or hoops) are included (or not) directly or indirectly in the area of steel; and (*i*) whether the calculated area of the concrete is only that within the spirals and/or the longitudinal steel.

Without a good general knowledge of these and other conditions we cannot arrive at the most reasonable and just factor of safety. As with the different timbers used for poles, there is a wide difference in the strength, etc., of the different types and makes of reinforced concrete poles.

It is well understood that the Regulations for this country militate against the use of reinforced concrete construction for overhead lines—the required factor of safety of 3·5 is high, and is made much worse because it is calculated on the *elastic limit* of the steel. Thus, the factor of safety is as 3·5 : 2·0 favouring New Zealand electrical development; the elastic limit is but *one-half* the ultimate strength of the steel, yet, for a reinforced concrete pole, the latter (ultimate strength) may be appreciably less than the real crippling value.

Of additional importance is the fact that, when the crippling load on a steel, iron, or wood pole or structure is reached, there is no factor of safety left; not so, however, for the reinforced concrete pole, which generally retains a valuable factor of safety, varying in degree with the type of reinforcement and make and type of pole. In view of these various reinforced-concrete advantages, the writer ventures to propose that this country now adopt the same total net area as used in New Zealand, with a factor of safety of 2·5 based on the ultimate strength, but *preferably* on the crippling load, the factor of safety preferably reading: $F = F_f/F_d$; where, F_f = stress in material at failure, and F_d = stress in material when carrying designed load.

What is the formulæ used in New Zealand? Can Mr. Gauvain tell us if the figures for total safe load are based on the formula—

$$\text{Safe load} = f_c[A_c + (E_s/E_c)A_s] = f_c A[(1 + n - 1)p];$$

and if so, what are the constants, etc., used?

Where—

A = total net area.

f_c = compressive unit stress in concrete. (What figure between the values of 450 and 700 is taken?)

E_s = modulus of elasticity for steel. (Is this taken at 30 000 000 lb./sq. in.?)

E_c = modulus of elasticity for concrete. (Is this figure taken at 2 000 000 lb/sq. in.?)

$n = E_s/E_c$ = modular ratio. (What figure between 15 and 10 is used?)

A_s = effective area of steel. (Does this include any of the circular hoops or spirals? If any, what proportion?)

A_c = effective area of concrete. (Does this include the area outside the spirals? If so, what?)

p = ratio of effective area of steel to effective area of concrete. (Between the values of 0·015 and 0·05, what is the more common figure used?)

I would like to add five further questions:—

(1) Is the mixture taken at 1 : 2 : 4? (2) Is bonding strength between 300 and 400 lb./in. sq.? What is the opinion? (3) Can the cement used be taken at around 90 lb./cu. ft.? (4) Does the ultimate strength of steel employed range between 55 000 and 80 000 lb./sq. in.? What value is taken? (5) Can the co-efficient of expansion of steel used be taken at 0.0000065 per deg. F.?—I am, etc.,

London, February 1st. W. T. Taylor.

Glass Insulators.

[To the Editor.]

Sir,—With reference to the article on "the Development of Glass Insulators for Transmission Schemes" in your issue of January 25th, we are astonished to find that any high voltage engineer to-day harbours the notion that the insulating qualities of a porcelain insulator for overhead transmission depend on its glaze, and not on the thoroughness of the vitrification of the porcelain proper.

It seems difficult to realise that in the case of a metal cap and pin insulator of average thickness of ¾ in., its electric strength of the order of 130 kV to 160 kV lies mainly in the glaze of the thickness of a few mils, especially as, at any curved part, the glaze is thinner still!

Further, the statement that endosmose of moisture through highly vitrified porcelain, in which, even under pressures of 1 ton per sq. in., absorption of moisture does not take place, cannot be accepted.

In conclusion, Mr. North's contention that the flashover voltage for most porcelain insulators "depends almost entirely on their glaze" would not be accepted even by our junior students, taught to respect the field intensities (due to shape, etc., of insulator) as the predominant factors.—We are, etc.,

A. E. Marchant
G. A. Robertson } Students.

College of Technology, Manchester.

January 28th.

How Many Contractors?

[To the Editor.]

Sir,—"A Northern Contractor" indulged in speculations, in your last issue, as to the probable total number of electrical contractors in this country who are of sufficiently good standing to have their names entered on the National Register. It is difficult to agree that his suggested figure of 5 000 is correct, but it is equally difficult to prove him guilty of under-estimation. Probably the secretary of the E.C.A. could give as good a ruling as anyone on this point. Personal knowledge of the conditions in one large provincial centre suggests that if really reputable contractors only are counted, some current estimates are much too high. In the city in question, the supply authority is aware of the existence of about 500 so-called contractors within its area, but of these only about a hundred have so far shown themselves to be qualified for registration.—I am, etc.,

January 28th. "Sales Manager."

[Several letters are unavoidably held over, due to pressure on space.—Ed.]

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NEWS IN BRIEF.

Another Electrical Band to Broadcast—Preston and Electric Cookers—Old Finsbury Students' Annual Dinner—Electrical Wages—Annual Meeting of the A.S.E.E.

THE Revo Electric Works Prize Band will broadcast from 5GB to-morrow (Saturday), from 3.45 to 5.30 p.m.

There are now over 1 000 electric cookers in use at Preston.

The generating plant installed in the Stirling Combination Poorhouse has resulted in a £100 decrease in the lighting costs.

An assisted wiring scheme to be applied to the Princess Road houses is the latest decision of Seaham Harbour Housing Committee.

Four sets of tenders for electrical equipment were opened by Hull Telephones Committee last week, and in only one case was a British tender accepted.

A conference on Industrial Canteen Management will be held by the Industrial Welfare Society on February 14th and 15th at the Hotel Victoria, London.

At a meeting of the Scottish Centre of the I.E.E. on January 30th, Mr. E. Seddon read a paper entitled "Recent Extensions to Portobello Power Station."

The annual dinner of the Finsbury Technical College Old Students' Association will be held on March 1st, at the Trocadero Restaurant, London, with Mr. E. W. Moss in the chair.

The Prince of Wales will give the toast of "The British Industries Fair" at the banquet at the Mansion House, London, on February 18th, and the proceedings will be broadcast.

At Fishpool Hospital, Bolton, improvements have been made consisting of a new all-electric laundry, to deal with 25 000 articles a week, to replace an out-of-date laundry department.

Mr. George Fletcher, late member of the Water Power Resources (Ireland) Committee, read a paper before the Royal Society of Arts last week on the Shannon Hydro-Electric Power Scheme.

The current issue of "Distribution," published by W. T. Henley's Telegraph Works Co., Ltd., gives some uses of statistics in business, with special reference to the electricity supply industry.

The next meeting of the Institute of Fuel will be held on February 13th, when Mr. W. F. Goodrich will read a paper entitled "Fuel Economy and the Small Steam User." Dr. Thomas Barratt will preside.

At a meeting of the North Eastern Students' Section of the I.E.E. to-night (Friday), Mr. S. Gibson will deliver a paper on "The City of Winnipeg Hydro-electric Installation." On February 22nd Mr. G. Waters will give a paper entitled "The Progress of Electrical Installations on Shipboard."

In accordance with the National Wages Agreements entered into by the N.F.E.A. and the E.T.U. it is announced that the variation in cost of living justifies a 27½% reduction in basic rates of wages, and that net hourly reductions and rates of pay now applicable are: Grade A, increase ½d.; B, increase, ½d.; C, nil; and Grade D, ½d. increase. These rates will remain current until the first pay day in June.

The telephone cable between Finland and Sweden was recently opened for traffic.

A charge engineer, salary grade 8, Class F, is wanted at the Lancashire Electric Power Co.'s Padiham station.

The chimes of the five bells in the new clock at the Exchange, Nottingham, are controlled by electric motors.

Accommodation has been provided in Fulham (London) Borough Council's new electricity showrooms for the accounts section.

Birkenhead Libraries Committee has authorised lighting experiments in the large (oil painting) rooms at the new art gallery.

Eastbourne Watch Committee has instructed the chief constable to investigate the advantages of automatic traffic signalling.

The Post Office Telephone services are providing for a chain of underground communications from Southampton to Birmingham.

Electric lighting is to be installed at Alma Road School, St. Alban's, at a cost of £140, and at the Garden Fields School at a cost of £150.

Seaham Harbour Electricity Committee recommends, in connection with the proposed assisted wiring scheme, that local contractors quote for separate installations.

The Egyptian Government has appointed a committee to study a scheme for utilising the Assouan dam for the generation of electricity.

An assisted wiring scheme and a scheme for hiring of meters for electric advertising signs, shop window lighting, etc., are being considered by Bolton Electricity Committee.

Tynemouth Electricity Committee has authorised the electrical engineer to arrange for demonstrations to be given of electric cooking ovens, water heating apparatus, etc.

The date of the annual meeting of the Association of Supervising Electrical Engineers which was to have taken place on February 12th has been postponed until March 19th.

The next meeting of the Optical Society will be held on February 14th, when a demonstration of Prof. Coker's "Photo-electric apparatus" will be given by Adam Helger, Ltd.

Tenders have been invited for the erection of a telephone exchange at Shere, Guildford, and for the erection of the Evington, Belgrave and Stoneygate telephone exchanges at Leicester.

Stepney (London) Finance Committee recommends that four Benham electric radiators, estimated to cost £90, be installed in the first class swimm ng baths at Whitechapel to prevent condensation of vapour rising from the water.

A Sunderland man, Mr. Lawrence Robert Callum, has patented an electrical signal device for motorists. Coloured illuminated arrows, or pointers, are fixed to the vehicle one on each side at both front and rear, and the device is controlled by a single four-way switch.

THE chairman, directors and staff of the Wholesale Fittings Co., Ltd., at the company's annual dinner at the Moorgate Street Restaurant, on February 2nd. The dinner was followed by an excellent concert, the names of the artists being given on page 170.

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PERSONAL.

MR. H. H. Dewey, of Schenectady, has been appointed vice-president of the International General Electric Co., Inc.

Mr. G. W. Brench has received a clock, as a wedding present, from the staff of the British Hanovia Quartz Lamps, Ltd.

Chester Electricity Committee has recommended that the salary of Mr. S. E. Britton be increased to £1 100 per annum.

Major C. E. Prince, late of Marconi's Wireless Telegraph Co.,Ltd., has joined the board of Radiovisor Parent, Ltd.

Mrs. J. Glynn has been appointed Canteen Superintendent to the Isleworth Works of Lissen, Ltd., London.

Ald. Nuttall, of Burnley, has been appointed vice-chairman of the Mid-Lancashire Electricity Advisory Board.

Burnley General Purposes Committee recommends an increase in the salary of Mr. J. E. Starkie, chief electrical engineer, from £731 to £900.

Coun. A. E. Kempson has been elected chairman of Shoreditch Electricity Committee and Ald. W. Hebden, vice-chairman.

Mr. W. Parker, late sales manager of British Furnaces, Ltd., has joined the staff of Premix Gas Plants, Ltd., as their sales engineer.

Mr. J. W. Dunning, chief traffic assistant, succeeds Mr. Howell David, who is retiring, as traffic superintendent in the Cardiff tramways department.

Major H. J. Holmes, late of the Strand Electric and Engineering Co., Ltd., has joined Messrs. Mortimer and Gall, in the capacity of contracts manager.

Mr. G. Langford has been appointed factory manager of Everlite, Ltd., and Mr. S. R. Mullard has resigned from the board of directors. See page 180.

It is announced that Mr. Andrew Robertson, chairman of the Westinghouse Electric and Manufacturing Co., has been elected a director of the Radio Corporation of America.

Mr. B. T. Ware has been appointed assistant works manager of Petters, Ltd. He was previously with the British Thomson-Houston Co., Ltd., Birmingham.

The marriage of Mr. Denis Ziani de Ferranti and Miss Elizabeth Thomson will be solemnised at All Saints' Catholic Church, Hassop, to-morrow, February 9th.

Mr. Newcomb Carlton, president of the Western Union Telegraph Co., was a passenger in the "Aquitania," which left New York on February 2nd. While in London he is staying at the Ritz Hotel.

Estate of the gross value of £2 741 with net personalty £2 606 was left by the late Mr. Reginald Alexander Dalzell, formerly director of British Telegraphs and Telephones, who died on November 27th last, aged 62 years.

The marriage of Mr. W. H. Rossitter, electrician and radio engineer, of Market Street, Bradford-on-Avon, and Miss Robinson, was solemnised at the Parish Church, Bradford, on January 19th.

Mr. D. A. S. Porteous, formerly and for the past twelve years with Johnson and Phillips, Ltd., has been appointed works manager to the Enfield Cable Works, Ltd., as from the beginning of the current year.

Many of our readers will join us in expressing sympathy with Sir Charles and Lady Bright in their recent loss through the death of their only grandchild, Julian Cunliffe Berthoud. It will be remembered that their only son died only a few years ago whilst he was still at Oxford.

Mr. E. H. Adams, of Vancouver, formerly of London, and Mr. J. I. Newell, also of Vancouver, have been appointed vice-presidents of the British Columbia Electric Railway. This change has been made necessary by the appointment of Mr. W. G. Murrin, the former vice-president, as president of the company.

Ald. J. W. Longley has been elected chairman of Bradford Electricity Committee in succession to Mr. Wilfred Turner, who has resigned from the City Council. Ald. Longley is a consulting engineer in both the mechanical and electrical branches and the vacancy of deputy chairman of the Committee caused by his new appointment has been filled by Mr. Chris Watkin.

Mr. F. Brown having resigned his position as repairs engineer in the Hammersmith (London) electricity department, the Establishment Committee proposes that Mr. G. A. Tottman, engineer-in-charge, be promoted to the position at a salary of £398 18s. 2d. per annum, and that Mr. D. D. Evans, junior engineer-in-charge, be promoted to the position of engineer-in-charge.

Following on the appointment of Mr. F. A. Fitzpayne as manager of Edinburgh Transport Department, the Transport Committee has recommended that Mr. Robert M'Leod be promoted from his present position of traffic superintendent to that of deputy transport manager. The committee has also recommended that Mr. T. Kinghorn be promoted to traffic superintendent.

Mr. J. W. McKay, general secretary of the Electrical Wholesalers' Federation, has been adopted as prospective Liberal candidate for Coventry at the next election. He has held a number of important appointments in the electrical industry and was the pioneer in the overseas wireless transmission of commercial market reports. He is a practised speaker on business building and management.

In anticipation of the silver wedding day of the Mayor and Mayoress of Brighton, Ald. and Mrs. H. J. Galliers, the employees at the Mayor's electrical depots at Brighton, Hove, Worthing, Lewes, and Hayward's Heath, have presented them with a handsome silver rose bowl, bearing the arms of the places mentioned, together with the inscription: "Presented to Alderman H. J. Galliers, J.P. and Mrs. Galliers, Mayor and Mayoress of Brighton, with the best wishes of their employees, to commemorate their silver wedding, February 25th, 1929."

Obituary.

COL. H. J. WALDUCK, on January 23rd. He was a former President of the British Industries Fair.

MR. JOHN ALFRED HENDERSON, aged 35 years. He was an official of the Vera Cruz Electric Light, Power and Traction Co., and served his time with the old British Westinghouse Co.

MR. HENRY MARSHALL, on January 20th, aged 66 years. He was associated with the firm of John Tinsley, Ltd., electrical engineers, of Darlington.

MR. CHARLES CLARKE, on January 31st. He was joint managing director of Waygood-Otis, Ltd., and was actively associated with the lift industry for a period of over 40 years.

MR. CHARLES WESLEY PARKES, on January 19th. He was for over 25 years on the staff of the Westinghouse Electric International Co., for whom he travelled extensively as construction superintendent.

MR. RICHARD TOOTALL, on February 2nd, aged 69 years. He was formerly in partnership with his brother in an electrical engineering business at Darwen, and before the local undertaking was started he installed electric light in several business premises in the town.

ALDERMAN CEDRIC CHIVERS, on January 30th, aged 75 years. He was in his sixth mayoralty of the City of Bath, the last five years having been consecutive. Members of the I.M.E.A. and visitors to last year's convention will remember that he played an important part in the social activities of the gathering. Alderman Chivers was a self-made man who revolutionised the art of bookbinding in two ways: one by a new method of stitching which greatly added to the life of library books, and the other by a new decorative process for special books. He had factories in Bath and in Brooklyn, New York. See page 177.

MR. SYDNEY MORSE, on January 27th, aged 75 years. Mr. Morse, a solicitor, specialised for many years in work connected with London electrical companies. He acted for the original promoters of the Chelsea, the City of London and the County of London Electric Lighting Orders and many others. He was also connected with the promotion of a large number of Tramway and Light Railway Orders. He was at one time an associate member of the Council of the Institution of Electrical Engineers and chairman of the Electrical Trades Section of the London Chamber of Commerce.

MR. ROBERT MONTGOMERY HORNE-PAYNE, on January 30th, aged 59 years. He had for a long time been intimately connected with some of the largest industrial and power companies of Western Canada. He was for many years chairman of the British Columbia Electric Railway. This company was the first big electrical venture on the Canadian Pacific Coast, and it prospered so greatly that recently there was a struggle between two or more contending parties to secure control of it. Finally the control passed into Canadian hands after a long and successful English management. In the tramway, light, and power companies at Rio de Janeiro and Sao Paulo in Brazil, Mr. Horne-Payne was director and vice-president. He had also interests in the West Gloucestershire Power Company.

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LEGAL INTELLIGENCE.

Electricity Supply Companies and the London Joint Authority.

MR. JUSTICE ASTBURY, in the Chancery Division, on January 31st, heard a motion by the Attorney-General at the relation of the Richmond (Surrey) Electric Light and Power Co., Ltd., the County of London Electric Supply Co., Ltd., the Chiswick Electricity Supply Corp., Ltd., and the Hendon Electric Supply Co., Ltd., for an injunction against the London and Home Counties Joint Electricity Authority. Plaintiffs sought to restrain the defendants until judgment in the action, or further order, from applying any of the funds of the defendants in or towards the payment of any costs or expenses incurred or to be incurred in relation to the preparation or promotion of a Bill in Parliament entitled "A Bill to transfer to the London and Home Counties Joint Electricity Authority the powers of local authorities to acquire electrical undertakings in their district, to extend such district, to confer further powers upon the said authority and for other purposes," or otherwise in relation to such Bill, also for employing at the expense or upon the credit of the defendants any of their officers or servants or other persons in the preparation or promotion of such Bill unless and until they should be authorised by Parliament so to do.

Mr. Tyldesley Jones, K.C., Mr. Wilfrid Greene, K.C., and Mr. C. S. Crossman appeared for the plaintiffs, and Mr. R. Stafford Cripps, K.C., and Mr. S. G. Turner for the defendants.

For the Defendants.

Mr. Tyldesley Jones said defendants were a lawfully constituted joint authority and under the Act of 1919 and later Acts they had power to levy contributions on the plaintiff bodies who were bound to contribute to the defendants' administrative expenses. In his view the Bill in question was contrary to the scheme and was *ultra vires*, and he asked his Lordship to restrain the application of defendant's funds for that purpose.

Mr. Jones further said the idea under the act was that the distribution should remain in the hands of the distributors, but that the generation of the energy should not, the underlying idea being that generation should be absorbed into the hands of joint authorities. Generating stations and undertakings of distributors might be acquired by agreement and the joint authority was to supply electricity in bulk to the distributors. Under the Electricity Act of 1926 an entirely different scheme was prescribed, and a new body called the Central Electricity Board was created which was to operate for the whole of England, and was to do practically what each joint authority was supposed to do.

The defendants promoted a Bill authorising them to construct a generating station at Chiswick to which there was considerable opposition. A clause was put in the Bill by Parliament to the effect that the scheme was not to be carried out unless within five years the Central Board made the station a "selected" one. Within two years the new body said that they would not select that station, and the result was that the constituent bodies of the joint authority had had to pay nearly £9 000 as administrative expenses of a Bill which was now waste paper.

Mr. Stafford Cripps, K.C., for defendants: The Commissioners were the people who urged the authority to promote the Bill.

In reply to his Lordship, Mr. Jones said the Bill was objected to because it altered the scheme and extended the district and altered the powers of the joint authority and because it also enabled the authority to delegate its powers to committee and not of themselves, and indeed to go right outside the whole scheme.

At the resumed hearing on February 1st, Mr. R. Stafford Cripps, K.C., said the Bill dealt with several matters and each of these must be judged separately. But in order to get the injunction which was asked for the onus was on the plaintiffs to show that the whole of the things in the Bill and each of them was something upon which the defendants were not entitled to spend money. He submitted that there was no limitation on the expenditure of the administrative fund in question.

Mr. Cripps, continuing his arguments on Tuesday, contended that Parliament contemplated the formation of a body having power to promote Orders or Bills to vary the terms of the incorporating documents. The Act of 1919 stated that the purpose for which a scheme might be put on foot by the Commissioners, and the object or purpose of the scheme, was to create a joint electricity authority for the improvement of the existing organisation for the supply of electricity in a district. The scheme itself included the power to vary the scheme. Some mention had been made by Mr. Tyldesley Jones of the Chiswick Act of Parliament which was promoted by the joint electricity authority, and that, he said, was an example of the sort of thing the defendants could do. The powers given by the Act of 1919 and the scheme included powers to apply by Special Order or a Bill in Parliament to vary the scheme and the powers given to the authority, and, therefore, there was no implied limitation preventing the defendants from spending their money on obtaining a variation of their powers. Every clause in the proposed Bill was a clause asking for powers which were incidental to or ancilliary to the main purposes of the scheme. He therefore submitted that the injunction sought ought not to be granted.

Mr. Tyldesley Jones, K.C., replying on behalf of the plaintiffs, contended that there was in the Act an express limitation on the expenditure of the fund, and a necessary limitation by reason of the fact that the body in question was one created for limited purposes.

His Lordship on Wednesday granted an injunction restraining the joint authority from applying their funds to the promotion of the Bill. His Lordship said that the authority had no right to levy upon its members the costs of promoting such a Bill, and for which they would have to pay both for its promotion and for their opposition.

Court Petition Granted.

In the Chancery Division on January 28th, Mr. Justice Romer granted a petition by the City of London Electric Lighting Co., for confirmation of a proposed alteration to its memorandum so as to enable it to guarantee an issue of debenture stock by a subsidiary company—the Bankside Investment Trust.

Mr. Buckmaster, for the petitioning company, said it supplied electrical energy to the City of London and the Borough of Southwark, and had to provide transformer stations to split up the distribution. The Bankside Investment Trust was formed to acquire leasehold properties, recondition them and let them out as offices, etc., reserving a portion for the purpose of providing transforming stations for the petitioning company, which owned all the shares in the Bankside Trust. Owing to the extension of the work of the City of London Company it was necessary to provide further stations, and it was proposed that the Bankside Trust should issue debentures to the amount of £1 000 000, of which £700 000 worth would be issued at once. If that issue could be guaranteed by the City of London Company it could be issued much more cheaply. It could be issued at 97½, with an underwriting commission of 1¼% and a small overriding commission.

THE NATIONAL REGISTER.

Further Additions Made to the Register at Last Meeting of Executive Committee.

AT a meeting of the Executive Council of the National Register of Electrical Installation Contractors on February 1st fourteen applications from electrical contractors for membership were considered. Of this number eight were accepted by the Committee and six were declined.

The names and addresses of the accepted applicants are:—Skinner and Burtonshaw, 76, London Road, Southborough; Jones and Gifford, Silver Chambers, Conway, North Wales; Barratt and Co., 2, Grange Terrace, Wilmslow Road, Rusholme, Manchester; Thomas K. Richardson and Co., 6, Errol Street, Aigburth Road, Liverpool; John Passmoor, 7, Lorne Terrace, Sunderland; J. V. Meiklejohn, Ltd., 115, Bath Street, Glasgow, C.2; Sparkes Electrical Co., 43, Victoria Road, Aldershot; and Stone and Co. (Bristol), Ltd., Redland Road, Bristol.

The staff of Black and Decker, Ltd., portable electric tool makers, of the Trading Estate, Slough, have formed a social club, and the following officers are among those appointed:—President, Col. W. B. Franklin; vice-presidents, Messrs. O. F. Smith, E. H. Williams, J. V. Franklin, and C. H. Vidall; hon. secretary, Mr. W. L. Brown; hon. treasurer, Mr. T. Garnett; chairman of committee, Mr. G. S. Barnett. The club's activities will be opened with a carnival dance at the Castle Hotel, Windsor, on February 15th.

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BRITISH INDUSTRIES FAIR.

Special Conference Arranged — Improved Conditions of the Fair.

ALWAYS under one continuous roof, the British Industries Fair in Birmingham is this year for the first time one single building, approximately 11 acres in extent. Not only have the five large exhibition halls occupied by the heavy section been thrown into one, with the removal of all passages and dividing walls, but lateral extensions, stage by stage, have been made all along, the area now taken up by the Birmingham Section having grown to four times its size in as many years. These improvements and extensions, systematically carried out at a capital charge of about £30 000 a year, have made it possible in 1929 to arrange the whole of the exhibits in symmetrical lines throughout the length and breadth of the Fair. Parallel avenues a third of a mile long stretch from one end of the building to the other; they are intersected by similar avenues across the Fair. Lengthwise every row of stands is numbered, crosswise every row is lettered. Moreover, illuminated signs above the aisles indicate from a distance exactly where any individual stand will be found.

As already announced in THE ELECTRICIAN, it is interesting to note that an outside service of petrol-driven cars will be inaugurated at the Fair this year, and these will run the entire length of the building on the south side, serving three public entrances as well as the new Conference Hall and the Outside Section of some 50 000 sq. ft. This service is free to all visitors, who will be able to board the cars or alight at any point that best suits them, according to the section of the display to which their business takes them. Recent alterations and extensions have afforded new facilities for meeting the convenience of visitors, these including an entirely new block in a central position, comprising a reception and luncheon hall to be known as the Bradford Room, a spacious public restaurant to seat 2 000, a buffet bar and smoke room, occupying more than half an acre; the Royal Room, public dining-rooms, smoke room and refreshment buffets at various points account for another acre. In addition, the new Conference Hall, immediately outside the building, seats 250 for lunch and 350 for conference.

It has been arranged to hold a conference of electrical engineers and others connected with the industry at 11.15 a.m. at the Fair, Castle Bromwich, on February 22nd. The chair will be taken by Sir John Gatti, president of the E.D.A., and an address upon how to increase the sales of electricity and electrical apparatus will be delivered by Lt.-Col. W. A. Vignoles. After the address the meeting will be open for discussion. The chairman of the local committee, Mr. R. A. Chattock, city electrical engineer, 14, Dale End, Birmingham, will, on application, be pleased to send an admission ticket to anyone who proposes to attend the conference.

IN PARLIAMENT.

Replies to Questions of Electrical Interest in the House of Commons.

THE Electricity Commissioners expect to be able during the present year to complete the preparation of schemes for South-West England, and East England, respectively, in that order.

Transatlantic telephone calls which originated in this country and passed to Canada were 16 in September, 39 in October, and 21 in November last.

The number of wireless receiving licences in force on December 31st, 1926, was 2 178 430; on December 31st, 1927, 2 395 106; and on December 31st, 1928, approximately 2 628 000.

Underground trunk telephone cables augment rather than displace existing main overhead routes. It is estimated that about 13 500 miles of overhead wires will be replaced by underground wires within the next three months.

The Postmaster-General has received reports from the German authorities concerning an experimental service which is in operation on certain trains running between Berlin and Hamburg for the provision of telephonic communication between passengers in trains and telephone subscribers. Similar experiments conducted in this country have demonstrated the practicability of establishing telephonic communication with moving trains, but at present the demand for such communication does not seem likely to be sufficient to justify the expense involved to the railways in the provision of facilities.

THE SOCIAL SIDE.

THE staff of Marchant and Co., electrical and radio engineers, of Folkestone, held their second annual dinner at the Bouverie Hotel. Mr. W. Marchant presided, and responding to the toast of his health, said that the past year had been the most prosperous in the history of the firm.

The staff of Walker Brothers, Birmingham, held their fifth annual whist drive and dance on January 18th at the Priory Rooms, when upwards of 200 employees and friends were present. Prizes were distributed by Mrs. G. N. Walker.

At the second annual dinner of the Rochdale Electricity Works Benevolent Fund, which was attended by over 100 subscribers, all employees of the electricity department, a presentation was made to Mr. Charles Smith who had retired from the service of the department on attaining the age of 73. The gift took the form of a gold mounted walking stick.

Hospital Saturday Fund.

At the 25th annual committee meeting of the Brookhirst Hospital Saturday Fund held at the offices of Brookhirst Switchgear, Ltd., it was stated that since the formation of the fund £1 221 had been subscribed by the employees of the firm and contributed to local hospitals. Last year's collections amounted to £144, which was a record for the firm.

Members of the Welfare Club of the Relay Automatic Telephone Co., Ltd., gathered at Anderton's Hotel, Fleet Street, E.C.4, on January 26th, to attend their annual dinner. Major White, the sales manager of the company occupied the chair, and Mr. W. T. Finlay, the chairman of the Welfare Club, responded to the toast of the evening. The Richard Fox Trio kindly provided the musical entertainment, and were an invaluable contribution in the enjoyment of the evening.

The annual staff dinner of the Wholesale Fittings Co., Ltd., was held at the Moorgate Street Restaurant, London, on February 2nd, with the chairman of the company, Mr. J. Altman, in the chair. The gathering included some 120 guests, and following the dinner a concert was given by Miss Nellie Walker, Miss Nancie Haines, Messrs. Ashmoor Burch, Will Kings and Walter Montague. The speeches during the evening were brief yet pertinent, being given by Mr. J. Altman, Messrs. Barnet, Bedwell, Rose, Francis and John. A photograph of the gathering is given on page 167.

A recent development by the Shropshire, Worcestershire, and Staffordshire Electric Power Co. has been the acquisition of the Stratford-on-Avon Electric Power Co. The S.W.S. Co. is now operating the whole of the old company's plant over an extended area including many villages and hamlets in Warwickshire. To mark the fusion, a fancy dress ball was organised by the company at the Red Lion Hotel and this was attended by about 200 old and new employees of the company. Mr. J. T. H. Legge, the company's chief engineer and manager, was in attendance, and the event symbolised in a complete manner the happy relations which the company is careful to cultivate with its employees.

The annual staff dinner of Ernest F. Moy, Ltd., of Greenland Street and Bayham Street, Camden Town, N., was held on January 19th, at the Britannia, High Street, Camden Town, about 100 of the staff being present. As is usual at this dinner, the Mayor of St. Pancras was the guest of honour, and the chairman of the company, Major C. G. Fox, presided. Other guests present included Messrs. G. Baker and Collins (Underground Railways), Messrs. Rowland, Mace, Dean and Cox (St. James's and Pall Mall Electric Light Co., Ltd.), and Messrs. Walters and Mann, of the St. Pancras Electricity Department. During the evening the following cricket club prizes were presented:—1st (best batting), W. Kirby, a barometer; 2nd (best bowling), H. Sadler, a leather case; 3rd (best improvement), R. Cheesman, an 8-day clock; club prize, S. Winkworth, a leather case.

The Area Circle associated with the S.W.S. Electric Power Co. held its second annual dinner at the Lion Hotel, Kidderminster, on January 24th. There was an excellent attendance. The company was presided over by Mr. J. T. H. Legge, chief engineer and manager of the company and chairman of the Circle; and the guests included the Mayor of Kidderminster, Mr. E. C. Eddy, Lt.-Col. W. A. Vignoles, and Mr. R. Matthias. During the evening a presentation of a case of pipes was made to Mr. E. E. Hamar, commercial engineer of the company and hon. secretary of the Circle; and to Mr. C. C. MacLeod, Circle Officer, a two-bottle Tantalus was presented. An enjoyable concert programme followed, by the Merry Optimists Party,

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FACSIMILE TRANSMISSION.

Successful Demonstration of Picture Transmission by Wireless Across the Atlantic.

FOLLOWING upon the success of the first public wireless telegraphic picture service which has been in commercial operation between Radio House, London, and New York, since May, 1926, it is interesting to learn that the Marconi short-wave beam services have opened the way to new achievements in facsimile transmission and a system has been developed for application to short-wave wireless and to land-line circuits which will give higher speeds and clearer reproduction. A demonstration of this system was given by Marconi's Wireless Telegraph Co., Ltd., on Sunday, at the Somerton station, the transmission being made from Rocky Point.

The new system differs both mechanically and electrically from any other, and while there are certain difficulties still to be overcome before practical perfection is attained, it is now possible to transmit two images each 8 in. by 10 in. in less than 20 minutes.

The new system eliminates the necessity of stopping the apparatus every time a new picture is put on the transmitter or taken off the receiver, for as soon as one message is finished another can be placed on the cylinder and transmission begins at once, thus obviating the running-up of the machinery and synchronising the two ends of the circuit separately for every picture.

The process is that of translating the blacks and whites of the message into electrical impulses by means of a photo-electric cell. The picture or message to be transmitted is placed upon a metal cylinder, around which is a narrow slit, across which the messages are slowly drawn by a traversing mechanism. A point of light, focussed through the slit, revolves and so lights up, successively, every part of the image as this travels along the cylinder. The light is focussed into a fine spot on the surface of a steel chopper disc, 14 in. in diameter with 144 equally spaced holes near its periphery, running at speeds up to 5 000 r.p.m., its purpose being to provide a maximum carrier frequency of 12 000 cycles per sec. which is modulated by the varying intensities of the image. The interrupted light emerging from the chopper disc is collected by a condensing lens and focussed down to give an intense illumination in a pin hole, from which the light is collected and converted into a parallel beam. This beam travels down the hollow spindle of the motor driving the optical rotor to the inside of the transmitting cylinder, and is there thrown through a slit in the cylinder on to the image to be transmitted. The reflected light from the image, varying according to the tone shades, is collected by a lens and again converted into a parallel beam which is thrown on to the photo-electric cell. The varying current flowing through the latter is applied to the input grid circuit of a bank of amplifying valves, the output of which is utilised to modulate the beam transmitter.

The Receiver.

The receiver is similar in its main features to the transmitter, but provides a means of reversing the process. This is achieved by the application of a Kerr cell acting as a light shutter, and allowing a spot of light to fall on a sheet of sensitised paper only when an electrical current is passed through the cell. A source of light is passed through two Nicol polarising prisms, between which is placed the Kerr cell. The light traversing the first prism is polarised and passes between the two small electrodes of the cell, which is filled with nitro-benzine. After traversing the cell, the light passes to the second prism, which is so arranged that the light is cut off from the receiving cylinder when no voltage due to an incoming signal is applied to the electrodes of the cell.

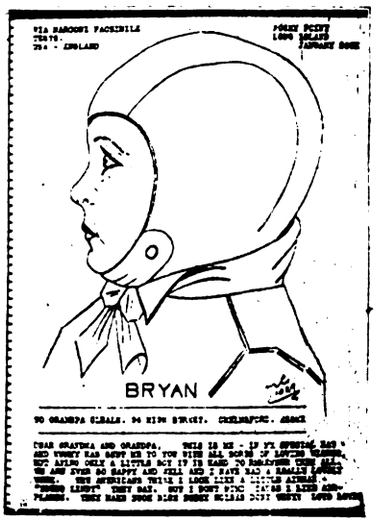
When a signal causes a voltage to be applied the light is able to pass to the receiving cylinder. This light is then collected in a parallel beam which throws a fine spot of light through the slit in the receiving cylinder on to a piece of photographic bromide paper which is placed around it and laterally pushed over the slit. In this manner the light and dark portions of the image on the transmitting apparatus are recorded.

Synchronous rotation is achieved by motors whose speed is controlled by valve-maintained tuning forks at the transmitting and receiving stations. In order to obtain constancy in the rate of vibration the forks are enclosed in a heat-insulating box, the air of which is kept at a steady temperature.

BUSINESS ITEMS.

THE address of the L.C.C. tramway offices has been changed to 23, Belvedere Road, S.E.1.

Mr. W. T. Fenn, of THE CENTRAL WIRELESS AND ELECTRICAL STORES, on January 29th opened larger premises at 1, Camden Road, Tunbridge Wells.



SPECIMEN of message received by the Marconi facsimile system during the trans-atlantic tests between New York and Somerton, referred to in the previous column. The size of the picture when received was 8 in. by 10 in. *See also page 177.*

MR. ALFRED H. SHIRLEY, electrical and radio engineer, of 327, Banbury Road, Oxford, has taken larger premises at 130, Cowley Road.

POLLOCK AND CO., electricians, 222, Argyle Street, Glasgow, have acquired the wireless business previously carried on by W. and A. Smith, Ltd., 236, Argyle Street, Glasgow.

The MARCONIPHONE CO., LTD., Tottenham Court Road, London, W.C., announces that in addition to the lecture entitled "The Screen Grid Valve," a second one, "A.C. Mains Valves," is now ready for loan to secretaries of radio societies and others.

The Red Bank Restaurant in D'Olier Street, Dublin, has been floodlighted, and is said to be the first restaurant in the Free State to be so treated. MI. PATRICK RYAN, 204, Pearse Street, was the electrical contractor, the projectors and lamps being manufactured by the General Electric Co., Ltd.

A manufacturers' representative, with offices in York Street, Sydney, and agents in other states, desires to get into touch with British manufacturers of electrical and radio apparatus and of small refrigerating plants. Inquiries to the Commercial Officer, Australia House, Strand, London, W.C.2, quoting ref. No. 581.

Approximately 5½ lb. of 48 S.W.G. 0·0016 in. enamelled copper wire were stolen from the BROMLEY-LANGTON ELECTRIC WIRE AND INSULATOR CO., LTD., 34-35, Newman Street, London, W.1, and in view of the unusual size of such wire, the company would be pleased to hear from anyone to whom the material may be offered.

The "Daily Telegraph" on Monday and Tuesday contained articles, extending to two pages each day, on Efficient Power Generation. The inception and growth of the organisation of INTERNATIONAL COMBUSTION, LTD., was dealt with, and the titles of the articles included "Power Station Requirements" and "Development in High Pressure Steam Generation."

A firm of agents in Johannesburg, the partners of which have had considerable technical and commercial experience in South Africa with connections among the principal mining groups, desire to obtain the agency for South Africa of British manufacturers of steam turbine and electric generator sets, condensing plants, water-tube boilers, electric motors and switchboard gear. Further information from the Department of Overseas Trade, ref. No. 53.

The RELAY AUTOMATIC CO., LTD., Relay House, Streatham Hill, London, S.W.2, has been awarded in open competition the contract for the supply of a 350 line private automatic telephone system to be installed in the Imperial Japanese Navy Department at Tokio. The installation is to be equipped forthwith with 300 lines. In addition, the same department has placed an order with the Relay Co. for the equipping of the H.I.M.S. "Mamiya" with an automatic system.

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BUSINESS OPENINGS.

Latest Particulars of Electrical Engineering and Wiring Installation Contracts for which Tenders are being Invited at Home and Abroad.

WE give below the latest particulars of contracts for which tenders are invited. The closing date is given, when available.

STIRLING CORPORATION.—Electric light and power installation at municipal slaughter house. Particulars from Burgh Electrical Engineer.

FEATHERSTONE (YORKS).—Electric light installation at North Featherstone Lane Council Schools. Specification from Mr. C. Harris, Education offices, Knottingley.

THE above photograph relating to the recent gas explosion in London, has been sent to us by Ferranti, Ltd., who state that in the basement of the building at the back of the flames there was installed an amplifier, containing an AF5 audio frequency transformer, an OP1 output transformer and a B1 choke, the whole of this being submerged in water for two days. When the basement was pumped dry the owner tried out the set and found that it functioned perfectly. Ferranti, Ltd., also point out that similar experiences were common in the Fleetwood flood disaster some time ago.

LEEDS GUARDIANS, February 8th.—Re-installation of electric light wiring in the Children's Block, at the Rothwell Institution. Specification, etc., from Mr. J. H. Ford, Poor Law Offices, 11, South Parade, Leeds. Stamped, addressed envelope to be sent.

MANCHESTER CORPORATION, February 8th.—Supply of 20 500 kVA transformers, for sub-stations. Specification, etc., from Mr. H. C. Lamb, Electricity Department, Town Hall, Manchester; deposit £1 1s.

LONDON, MIDLAND AND SCOTTISH RAILWAY, NORTHERN COUNTIES COMMITTEE (IRELAND), February 9th.—Twelve months' supply of stores, including telegraph ironwork, wire, electric lamps, porous pots, etc. (tender form No. 26). Forms of tender (6d. each) from Mr. F. J. Martin, Stores Superintendent, York Road Station, Belfast.

NEWMILNS CORPORATION, February 9th.—Electric wiring, in connection with Council's housing scheme. Specifications from the Burgh Surveyor.

BRUNSWICK P.M. CHURCH, MORLEY, February 11th.—Electric light installation. Particulars from Mr. J. R. Gaunt, 6, Hartley Street, Morley.

HENDON URBAN DISTRICT COUNCIL, February 11th.—Manufacture and erection of 29 closed circuit code-signalling street fire alarms. Specifications from Mr. A. G. Knight, engineer to the Council; deposit £3 3s.

ETON RURAL DISTRICT COUNCIL, February 12th.—Electrically-driven pumps, etc., at sewage disposal works, Iver, Bucks. Specification, etc., from Mr. A. Gladwell, Denmark House, Windsor Road, Slough; deposit £3 3s.

MANCHESTER CORPORATION, February 12th.—Supply of stores for the tramways department, including parts of tramcar electrical equipments, electrodes, cable, rubber strip, tramcar axles, wheel tyres and centres, etc. Schedules, etc., from the General Manager, Corporation Tramways, 55, Piccadilly, Manchester.

SALFORD CORPORATION, February 12th.—Supply and installation of sunlight apparatus. Specification from the Medical Officer of Health, 143, Regent Road, Salford.

STOKE-ON-TRENT CORPORATION, February 13th.—Twelve months' supply of mains and cables (contract No. 2 904); and a.c. and d.c. meters (No. 2 905); sub-station e.h.t. switchgear (No. 2 906), and static transformers (No. 2 907). Specifications, etc., from the City Electrical Engineer, St. George's Chambers, Kingsway, Stoke-on-Trent; deposit £2 in respect of each contract.

STOKE-ON-TRENT CORPORATION, February 13th.—Overhead wiring and services to 170 new houses on Hanford housing site. Specification, etc., from the City Electrical Engineer, St. George's Chambers, Kingsway, Stoke-on-Trent; deposit £2.

SHEFFIELD CORPORATION, February 14th.—Equipment for new generating station at Blackburn Meadows, Sheffield, including turbo-alternator, with condensing, evaporating and steam pieheating plant (specification B.M. 67); water-tube boilers, with chimneys, superheaters, stokers (or pulverised fuel firing equipment), economisers, valves, etc. (B.M. 68); wagon tippers, conveyors and elevators (B.M. 70); cooling towers (B.M. 72), and overhead electrically and hand-operated cranes (B.M. 73). Specifications from Mr. S. E. Fedden, general manager and engineer, Electric Supply Department, Commercial Street, Sheffield; deposit, £3 3s. for each.

CENTRAL ELECTRICITY BOARD, February 15th.—Supply and laying of 66 000 V cables in London area, in connection with South-East England Electricity Scheme. Specification (S.E.E.-L.C.1) and form of tender from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit, £2 2s.

LEEDS CORPORATION, February 15th.—One year's supply of stores to the electricity department, including castings (section C.), i.r. covered cables, mains boxes and fittings, jointing and insulating materials, fittings and sundries (section N.). Forms of tender, etc., from Mr. C. N. Hefford, manager, 1, Whitehall Road, Leeds. State section for which it is desired to tender.

ST. THOMAS'S CHURCH, GOOLE, February 16th.—Electric light installation in church, presbytery, schools and club. Specifications from the Rev. J. J. O'Shea.

BELFAST CORPORATION, February 18th.—Twelve months' supply of stores for the electricity department, including electrical accessories (form No. 8), lamps (No. 9), carbon brushes (No. 10), bitite strip, prepared tape and rubber tape for joints and joint box compound (No. 12), c.i. street box frames and covers (No. 14), copper cable connectors and solder (No. 18), electricity meters and instrument transformers (No. 19), m.d. indicators (No. 20), automatic time switches (No. 21), cut-outs (No. 22), transformers (No. 23), cables and joint boxes (No. 24), v.i.r. cables, wires and flexibles (No. 26), etc. Forms of tender, etc., from Mr. F. H. Whysall, city electrical engineer and manager, East Bridge Street, Belfast.

BETHNAL GREEN (LONDON) BOROUGH COUNCIL, February 18th.—Six or 12 months' supply of electric lamps, lanterns, etc. Specifications from the Borough Engineer.

CENTRAL ELECTRICITY BOARD, February 18th.—Supply and erection of 132 000 V overhead transmission lines, in connection with the North-West England and North Wales Electricity Scheme. Specification (No. N.W.E.-P.L.1) and form of tender from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

Overhead Lines for Central England Scheme.

CENTRAL ELECTRICITY BOARD, February 18th.—Supply and erection of 132 000 V overhead transmission lines, in connection with the Central England Electricity Scheme. Specification (No. C.E.-P.L.1) and form of tender from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

HULL CORPORATION, February 18th.—Twelve months' supply of stores to the tramways department, including controller parts, trolley parts, car truck parts, cables, lamps, lighting fittings, armature repairing material, overhead line material, etc. Forms of tender, etc., from the General Manager, Albion Street, Hull.

LANCASTER CORPORATION, February 18th.—Supply of 400–600 Ah battery (at one hour rate) booster, switchgear, cable connections, etc., for Caton Road generating station. Speci-

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fications, etc., from Mr. G. C. Milnes, borough electrical engineer; deposit £2.

STOKE AND WOLSTANTON GUARDIANS, February 18th.—Electric lighting installation at Relief Offices, 18, Church Street, Tunstall. Specification from Mr. W. Pendleton, Union offices, Stoke-on-Trent.

TYNE IMPROVEMENT COMMISSION, February 18th.—One 1½-ton portal, electric, travelling, level luffing crane, for Riverside Quay, Albert Edward Dock, North Shields. Specification, etc., from the Secretary, Bewick Street, Newcastle-on-Tyne; deposit £1 1s.

WEST HAM EDUCATION COMMITTEE, February 18th.—Electric light installation in South Hallsville New School, Agate Street, Tidal Basin. Specifications, etc., from Mr. J. H. Jacques, 61, West Ham Lane, Stratford, London, E.15; deposit £1.

HOVE CORPORATION, February 20th.—Supply of electric lamps, etc. Forms of tender, etc., from the Borough Surveyor.

METROPOLITAN ASYLUMS BOARD, February 20th.—Electric lighting installation at Southwark Casual Ward. Guildford Street, London, S.E.1. Specification, etc., from the Board's office, Victoria Embankment, E.C.4; deposit £1 1s.

DUMFRIES CORPORATION, February 21st.—Supply and erection of one 1 500 kW turbo-alternator and condensing plant. General conditions, specification and form of tender from Mr. W. S. Johnston, engineer and manager, Electricity Works, Leafield Road, Dumfries; deposit £1 1s.

BEDFORD CORPORATION, February 22nd.—Supply of e.h.t., h.t., and l.t. underground cables (section 1) and incandescent electric lamps (section 2) during year ending March 31st, 1930. Only British manufacturers in the U.K. are invited to tender. Specifications, etc., from the Borough Electrical Engineer, Prebend Street, Bedford.

CENTRAL ELECTRICITY BOARD, February 22nd.—Supply of 132 kV outdoor switchgear, for transforming stations in area of Central England Electricity Scheme. Specification from Sir R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2.

BAKEWELL GUARDIANS, February 23rd.—Three-valve wireless apparatus, with three loud speakers (for connection to a.c. mains), for Haddon District Hospital. Tenders to the Clerk, Hospital Committee, Union Offices, Bakewell.

HASTINGS CORPORATION, February 25th.—Electrically-driven pumping plant, of British manufacture, for Kent Street pumping station. Specification, etc., from Mr. G. M. C. Taylor (J. Taylor and Sons), Caxton House, Westminster, S.W.1.; deposit £5.

NEWTON ABBOT GUARDIANS, February 28th.—Electric lighting installation at the Institution. Forms of tender and specification from Messrs. Watson and Watson, 36, Torwood Street, Torquay; deposit £2 2s.

CENTRAL ELECTRICITY BOARD, March 2nd.—Supply and erection of 33 000 V overhead line—Luton to Aylesbury—in connection with the South East England Electricity Scheme Specification (No. S.E.E.-S.L.2) and form of tender from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, Charing Cross, London, W.C.2.; deposit, £2 2s.

CENTRAL ELECTRICITY BOARD, March 2nd.—Supply and erection of 66 000 V and other transformers in the London area, in connection with the South-East England Electricity Scheme. Specification (No. S.E.E.-L.T.1) and form of tender from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit, £2 2s.

Bromley School Lighting.

BROMLEY EDUCATION COMMITTEE, March 4th.—Electric lighting installation in Raglan Road Council School. Particulars from Mr. W. G. Trend, borough electrical engineer, West Street, Bromley.

CENTRAL ELECTRICITY BOARD, March 4th.—Supply and erection of 132 kV outdoor switchgear, for transforming stations, in the area covered by the North-West England and North Wales Electricity Scheme. Specification (N.W.E.-P.S.1) from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit, £2 2s.

CENTRAL ELECTRICITY BOARD, March 4th.—Supply and erection of 132 000 V transformers in connection with the North-West England and North Wales Electricity Scheme. Specification (N.W.E.-P.T.1) from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit, £2 2s.

ERITH URBAN DISTRICT COUNCIL, March 4th.—Supply of h.t. and l.t. underground cables, joint boxes and other accessories during 12 months. Particulars and form of tender from the Electrical Engineer, Walnut Tree Road, Erith.

CENTRAL ELECTRICITY BOARD, March 6th.—Supply and erection of 66 000 V switchgear, for South-East England Electricity Scheme (London area), and supply and erection of 132 000 V transformers. Specifications from Sir R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2.

Overseas.

UNLESS otherwise stated, particulars of overseas contracts are to be had from the Department of Overseas Trade (Room 52), 35, Old Queen Street, Westminster, London, S.W.1. *Note.—An asterisk denotes that local representation is, in practice, essential.*

EGYPTIAN STATE RAILWAYS, February 9th.—Electrification and equipment of Heluan line, including equipment of power station, overhead transmission lines, track bond in motor and trailer coaches, etc. Tenders to General Manager, Cairo Station.

GHENT MUNICIPALITY, February 11th.—Supply of 16 electric portal cranes. (Reference A.X. 7 398.)

NEW SOUTH WALES PUBLIC WORKS DEPARTMENT, February 11th.—Supply, erection and maintenance of hydro-electric generating plant, in connection with Hume reservoir hydro-electric development. (Reference B.X. 4 989.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, February 12th.—Supply of 110 kV switchgear, and controlling equipment, for Waitaki power scheme, section 3. (Reference B.X. 4 848.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, February 12th.—Supply of dry cells, for telephone work. (P. and T. 151/1 205.) (Reference B.X. 4 991.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, February 12th.—Supply of v.i.r. wire (No. P. and T. 151/1 184). (Reference B.X. 4 951.)

JOHANNESBURG MUNICIPALITY, February 14th.—Supply of two single-phase transformers, each of 1 080 kVA (contract 115). (Reference B.X. 5 005.)

LOUGH DERG, PETTIGO, CO. DONEGAL, February 14th.—Supply and erection of two heavy oil engine-driven, continuous current, 10 kW, 220/250 V generating sets (section I); storage battery, on nickel-iron-alkaline system (section II); and d.c. switchboard (section III), for the Venerable Dean Keown. Specifications for each section from Messrs. MacEntee and O'Kelly, 23, Upper O'Connell Street, Dublin; deposit, £2 2s.

SOUTH AFRICAN RAILWAYS AND HARBOURS, February 14th.—Supply of 15-ton electrically-driven portal titan crane (tender No. 1 366). (Reference A.X. 7 272.)

EGYPTIAN MINISTRY OF THE INTERIOR, March 6th.—Supply and installation of underground and overhead cables, for transmission of current from Mit Chamr power works to the town of Kom el Nour. (Reference B.X. 5074.)

POSTMASTER-GENERAL'S DEPARTMENT, Melbourne, March 12th.—Supply of telephone relays (schedule C. 408). (Reference B.X. 5078.)

CAPE TOWN MUNICIPALITY, March 21st.—Supply of 300 A fuses (specification 453/1928). (Reference B.X. 5080.)

SOUTH AFRICAN POSTS AND TELEGRAPHS, March 28th.—Supply of telephone switchboard cords. (Tender No. 148.) (Reference B.X. 5 048.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, April 2nd.—Supply of jumper rings and terminal strips (schedule C. 405). (Reference B.X. 5 066.)

VICTORIAN ELECTRICITY COMMISSION, April 8th.—Galvanised steel transmission line towers (specification 29/13). (Reference A.X. 7 401.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, April 9th.—Supply of induction voltage regulators, for Lake Coleridge scheme (section 215). (Reference B.X. 5 018.)

VICTORIAN ELECTRICITY COMMISSION, April 29th.—Supply of two or three steam turbo generator sets, with condensers, etc., for Yollourn power station extension (specification 29/7). (Reference B.X. 5 062.)

VICTORIAN ELECTRICITY COMMISSION, April 29th.—Steam turbo-generators (section 1), condensing plant, including circulating water pumps (section 2); and evaporating, deaerating and feed heating plant, including boiler feed pumps (section 3). Specification, etc., from the Agent-General for Victoria, Victoria House, Strand, London, W.C.; deposit, £3 3s.

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VICTORIAN ELECTRICITY COMMISSION, April 29th.—Supply of two swing hammer mills, with electric motors, for brown coal (specification 29/9). (Reference A.X. 7 434.)

TANGANYIKA GOVERNMENT, June 1st.—Concession for utilisation of Pangani River Falls for the development of electric power. Copies of the draft concession may be obtained from the Crown Agents for the Colonies, 4, Millbank, London, S.W.1.

STATE ELECTRICITY WORKS, MONTEVIDEO, July 8th.—Construction and equipment of 50 000 kW power station.

Tenders Accepted.

ILFORD CORPORATION.—Union Cable Co., Ltd., supply of cable, £1 060.

DUMFRIES CORPORATION.—R. Macaulay, electrician's work for ensuing year.

CHELMSFORD CORPORATION.—Carter and Co., supply of fire alarms, etc., £280.

GENERAL POST OFFICE, DUBLIN.—Edison Swan Electric Co., Ltd., supply of electric lamps.

WIMBLEDON CORPORATION.—W. F. Iles, electric lighting installation for new swimming baths, £265 10s.

HERTFORDSHIRE COUNTY COUNCIL.—Griffins, electric lighting at Buntingford police station, £79 18s. 3d.

SALFORD CORPORATION.—S. Dickinson, re-wiring premises at Encombe Place, for the Medical Officer of Health.

GLASGOW CORPORATION.—British Insulated Cables, Ltd., supply of insulated bolts, for tramways department.

DIRECTOR OF NAVY CONTRACTS.—Metro-Vick Supplies, Ltd., Met-Vick (Cosmos) vacuum and gasfilled lamps.

YORK CORPORATION.—Callender's Cable and Construction Co., Ltd., supply of cables, £4 770 3s. 5d. (Recommended.)

GLASGOW CORPORATION.—W. T. Glover and Co., Ltd., 220 yards of lead covered cable, for Dalmarnock power station, £628.

FULHAM (LONDON) GUARDIANS.—Hammond Bros. and Champness, installation of two electric elevators at hospital, £1 079.

PORT OF LONDON AUTHORITY.—General Electric Co., Ltd., six months' requirements of Osram gasfilled and vacuum lamps.

BRISBANE CITY COUNCIL.—Babcock and Wilcox, Ltd., supply of three boilers, for new power house, £74 266. (Recommended.)

EDINBURGH EDUCATION COMMITTEE.—Robert Edgar and Co., electric light installation at Leith Academy Secondary School, £3 951 15s. 1d.

WANTAGE RURAL DISTRICT COUNCIL.—Callas, Sons and May, electric light installation and other works, at Old Cottage Hospital, £237 7s. 6d.

ADMIRALTY.—Siemens Electric Lamps and Supplies, Ltd., large quantity of Siemens vacuum and gasfilled lamps, for ship and dockyard use.

WORTHING CORPORATION.—Callender's Cable and Construction Co., Ltd., supply and laying of e.h.t. cable to Ferring sub-station, £8 404. (Recommended.)

GREAT HORTON INDUSTRIAL SOCIETY, BRADFORD.—A Taylor and Co., Ltd., electrician's work in connection with alterations and additions to offices at Blacksmith Fold, Bradford.

SOUTHWARK (LONDON) BOROUGH COUNCIL.—Hackbridge Cable Co., Ltd., supply of cable, £3 018; W. Lucy and Co., Ltd., supply of feeder pillars, £53 15s. each. (Both recommended.)

WEST HAM CORPORATION.—Hewittic Electric Co., Ltd., installation of mercury static rectifiers, etc., in connection with the supply of electricity to the tramways, £13 200. (Recommended.)

WESTMINSTER CITY COUNCIL.—Buchanan and Curwen, electric light installation on entrances, staircases and in laundries, at Regency Street dwellings, £579. (Recommended.)

MARYLEBONE (LONDON) BOROUGH COUNCIL.—Davidson and Co., Ltd., fitting six sets of receivers to induced draught fans for two Brock chimneys at power station, £1 080. (Recommended.)

ROTHERHAM CORPORATION.—British Thomson-Houston Co., Ltd., supply of Tungar rectifier for keeping batteries of petrol-driven 'buses fully charged during winter months, £45. (Recommended.)

LEEDS CORPORATION.—Cables: W. T. Henley's Telegraph Works Co., Ltd., £865; Enfield Cable Works, Ltd., £1 552 10s.; Macintosh Cable Co., Ltd., £1 177 10s.; Greenwich Cable Works, Ltd., £2 315 9s. 6d.

HULL CORPORATION.—The Automatic Telephone Manufacturing Co., Ltd., supply of automatic telephones and bell sets, £378 15s. 9d.; Richard Johnson and Nephew, Ltd., supply of one mile of trolley wire, £108 5s. 4d.

MANCHESTER CORPORATION.—Metropolitan-Vickers Electrical Co., Ltd., repairs to generator transformer at Barton; Stewarts and Lloyds, Ltd., supply of weldless steel spigot and faucet tubes; Brooks and Co., Ltd., electric lighting at Oldham Road depot.

SOUTHEND CORPORATION.—Edgar Allen and Co., Ltd., tramway points and crossings, £1 097 15s.; Titan Trackwork Co., Ltd., two sets of scissors crossings for pier tramway, £990; Richard Garrett and Sons, Ltd., two six-wheel double-deck top-covered trackless trolley vehicles, £2 004 5s. each.

LONDON COUNTY COUNCIL.—Electrical Installations, Ltd., electric light wiring and fittings, at stores, Clerkenwell, £852. Also tendered: J. Briggs (Electrical Contractors), Ltd., £1 200; A. Hawkins and Sons, £1 249; A. Dean and Co., Ltd., £1 260; Smethhurst and Co. (London), Ltd., £1 897.

GLASGOW CORPORATION.—Hadfields, Ltd., and Edgar Allen and Co., Ltd., special tramway track work; James Robertson, car-washing machine; Macfarlane Engineering Co., Ltd., motor generating set for battery charging at new garage; Brush Electrical Engineering Co., Ltd., forgings for car trucks.

LONDON COUNTY COUNCIL.—Supply of insulating materials for 12 months: Attwater and Sons, British Central Electrical Co., Ltd., Butterfield and Renton, Connollys (Blackley), Ltd., Hamnett and Andrew, Mica and Micanite Supplies, Ltd., Micanite and Insulators Co., Ltd., Rykneld Mills Co., A. A. Sample and Siemens Bros. and Co., Ltd.

STOKE-ON-TRENT CORPORATION.—Hamworthy Engineering Co., Ltd., supply of electrically driven air compressor, £552 4s.; Metropolitan-Vickers Electrical Co., Ltd., supply of switchgear, £8 354 10s.; Hawley, Ingram and Co., wiring and fitting eight all-electric houses in Avenue Road, Hanley, £361 11s.; Crompton, Parkinson, Ltd., switchboard, at Stoke sub-works, £712 16s.

POST OFFICE.—Standard Telephones and Cables, Ltd., automatic telephone equipment for Newcastle, comprising main exchange, Newcastle Central, and eleven satellite or sub-exchanges, providing in all nearly 20 000 lines, with an ultimate capacity of 42 000. The exchanges will be equipped with step-by-step apparatus, and it is expected that they will be completed by the end of 1930.

NEWTON-IN-MAKERFIELD URBAN DISTRICT COUNCIL.—Electrical Apparatus Co., Ltd., supply of 80 2½ A and 70 5 A electricity meters, £1 4s. each. Also tendered: Ferranti, Ltd., £1 5s.; British Insulated Cables Ltd., £1 3s. 9d.; Chamberlain and Hookham, Ltd., £1 5s.; Metropolitan-Vickers Electrical Co., Ltd., £1 5s.; Measurement, Ltd., £1 3s. 9d.; British Electric Meters, Ltd., £1 3s. 3d.; R. Hornby and Co., Ltd., 18s.

INDIAN STORES DEPARTMENT.—Harland Engineering Co., Ltd., pumping set, Rs. 4 663; General Electric Co. (India), Ltd., generating set, Rs. 15 566; British Thomson-Houston Co., Ltd., rectifiers, Rs. 1 530; Crossley Bros., air compressor, Rs. 1 075; Siemens (India), Ltd., telephone sets, Rs. 945; Duncan, Stratton and Co., 25 generators, d.c., pipe ventilated, shunt wound, having continuous output of 1·5 kW at 220 V, 1 000/1 500 r.p.m. with fittings, Rs. 7 375; 25 regulators, vibrating reed type, 9⅜ in. dia., 7 in. deep, for panel mounting, suitable for above generators, Rs. 6 875.

Electric Pumping Equipment.

LONDON COUNTY COUNCIL.—W. H. Allen, Sons and Co., Ltd., supply of four electrically-driven pumping sets, at Abbey Mills pumping station, £36 677, on condition that a further four sets shall be supplied at £23 985. Also tendered: Lilleshall Co., Ltd., £36 780 and £24 110; Gwynne's Pumps, Ltd., £38 805 and £24 914; Metropolitan-Vickers Electrical Co., Ltd., £38 640 and £25 850; English Electric Co., Ltd., £39 800 and £25 800; Worthington-Simpson, Ltd., £39 800 and £25 800; Vickers-Armstrong, Ltd., £36 500 and £35 300. Chief engineer's estimate, £49 000 and £26 000.

CENTRAL ELECTRICITY BOARD.—Stream-Line Filter Co., Ltd., filter plant to deal with transformer and switch oils at each of the thirteen stations included in the Central Scottish Grid Scheme. The value of the order is understood to be approaching £20 000, and the scheme for the handling and storage of the dirty and clean oil has been prepared by Messrs. Kennedy and Donkin, in conjunction with the Board. The Stream-Line Filter Co.'s purification plant is based upon the stream-line principle of edge-filtration, the plant being a simple static one, independent of centrifugal principles.

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WORK IN PROSPECT.

BARNES.—Church hall to cost £3 867, for Holy Trinity Church Council. Particulars from the contractors, W. H. Gaze and Sons, Ltd., Kingston-on-Thames.

BATLEY.—Basket works. Particulars from the architects, W. Hanstock and Son, Branch Road.

BLACKBURN.—Additional 200 houses, for the Town Council. Particulars from the Borough Surveyor.

BRISTOL.—Additional housing scheme (246), for the Town Council. Particulars from the Borough Engineer.

DARLINGTON.—Central repair depot for the United Automobile Services, Ltd.

DARLINGTON.—Houses (46). Particulars from the architect, Mr. J. E. Chilton.

DORCHESTER.—Housing scheme (24), for the Town Council. Particulars from the Borough Surveyor.

FOLKESTONE.—Additional 20 houses, for the Town Council. Particulars from the Borough Surveyor.

GLOUCESTER.—Reconstruction business premises, Eastgate Street and Brunswick Road, for the Co-operative and Industrial Society, Ltd. Particulars from the General Manager.

HALIFAX.—Block of shops for the Town Council. Particulars from the Borough Engineer, Crossley Street.

HEADINGLEY.—Hostel for male students, for Leeds University Council. Particulars from the architects, John C. Proctor and F. L. Charlton, 40, Clarendon Road, Leeds.

HOLMFIRTH.—Housing scheme (56), for the Urban Council. Particulars from the Surveyor.

NORTHAMPTON.—Bazaar premises, Abington Street, for F. W. Woolworth and Co., Ltd., Kingsway, London.

MAIDSTONE.—Rebuilding licensed premises, Pudding Lane, for Style and Winch.

WREXHAM.—Additional 150 houses, for the Rural Council. Particulars from the Surveyor.

NORTH-EAST COAST EXHIBITION.

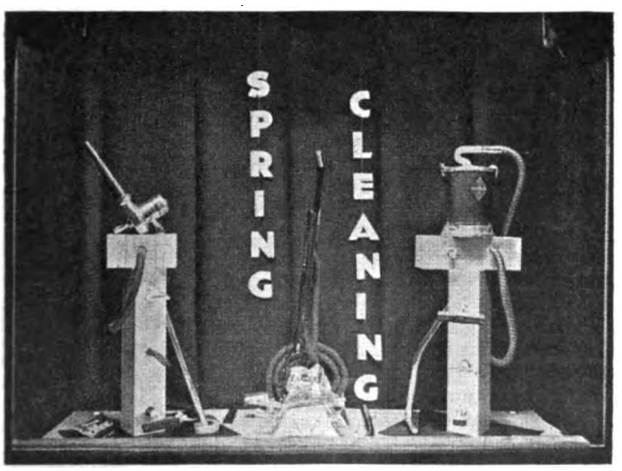
Electrical exhibits will form one of the many features of the forthcoming North-East Coast Exhibition which opens in Newcastle-upon-Tyne in May next and will run to the following October. The exhibits will be accommodated in two exceptionally large pavilions, which are known as the Palaces of Engineering and Industries. The floor space of these palaces totals 260 000 square feet, which gives a rough idea of their size. Forward progress has been made in getting the pavilions ready for the reception of goods. It is expected that in another week or so the heavier exhibits—and there are a number of them—will begin to arrive. Among more prominent electrical firms who are exhibiting are the Sunderland Forge and Engineering Co., Ltd., A. Reyrolle and Co., Ltd., Messrs. Robson and Coleman, John Taylor, Dunford and Co., Ltd., Clarke, Chapman and Co., Ltd., Bernard Holland and Co., and J. H. Holmes and Co., Ltd.

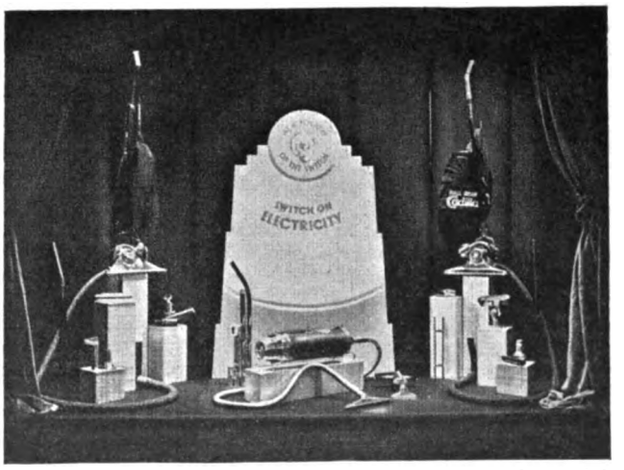
The exhibition gives promise of being one of the most attractive held in the north of England for a long period of years, and is certain of exceptional patronage from visitors from all parts of the country.

ELECTRICAL "BLUE BOOK."

Electrical Trades' Directory and Handbook for 1929.

THE 47th edition of this well-known work of reference, which has just been issued by Ernest Benn, Ltd., Bouverie House, Fleet Street, London, E.C.4, at the usual price of 25s. net, shows further expansion, as it contains nearly 50 pages more than its immediate predecessor, although the actual bulk of the book is not increased, in consequence of the use of super-calendered paper, which tends to a better printing effect and is more pleasant to handle. The book has been thoroughly revised and brought up to date; the geographical section, which was introduced for the first time last year, has been amplified, and Northern Ireland is now included. A new feature which will be of service to many users of the book is a complete list of electrical contractors, with the names of those enrolled upon the National Register of Electrical Contractors, members of the Electrical Contractors' Association, and members of the Electrical Contractors' Association of Scotland specially marked. Another new feature, which has been greatly appreciated, is the system of guide cards, which facilitate the turning up of particular sections of the book and headings in the classified trades' section, and the number of these cards has been increased in the present edition. There are, as usual, alphabetical and classified trades sections containing entries of the names and addresses of firms in (1) the United Kingdom, (2) the British Colonies and Dominions, (3) the Continent of Europe, (4) Asia and Africa, (5) Central and South America, and (6) the United States of America, and all these have been carefully revised so as to enhance their value for circularising and reference purposes. The British alphabetical division alone contains about 20 000 names and addresses, and there is again an increase in the number of pages comprised in this section. In the handbook portion of the book particulars are given of the Patents, Designs and Trade Marks Acts, procedure for obtaining patents, registration of trade marks, etc., useful tables in reference to resistance materials, wire gauges, electricity supply cables, aluminium, etc., notes on illumination, factory and workshop lighting, the international candle and the Imperial ohm, ampere and volt, the British Engineering Standards Association, the International Electro-technical Commission, international symbols, the British Electrical and Allied Manufacturers' Association's machinery standardisation rules, the rules, etc., of the National Register of Electrical Installation Contractors, loans for electricity supply, tramways, etc., import duties leviable upon imported electrical goods in British Colonies and foreign countries; particulars of British and foreign owned submarine cables, including lengths, landing places, etc., international telephone and wireless facilities, the constitutions, rules, officials, etc., of technical societies, the staffs of universities and technical colleges and schools, officials of British and foreign Government Departments, wiring rules, etc. The manufacturers' Who's Who, and the telegraphic addresses section have been improved and brought up to date, and should prove increasingly valuable.





THE selling campaign of the Electrical Development Association is this month devoted to Spring Cleaning, and special window displays in connection with the campaign are reproduced above. Both schemes are simple and easy to arrange, irrespective of size of window, and each should do much to promote "cleaner" sales.

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ELECTRICITY SUPPLY.

Many Extensions to Mains Proposed—The London Joint Authority and Electricity Charges—The Central Board and Southport—Assisted Wiring at Grays—Guildford's New Connections—Stoke Newington and Shop Window Lighting.

COVENTRY Town Council is applying for a loan of £17 805 for mains, etc.

Forty-seven objections have been lodged against the Grampian Electricity scheme.

Manchester Electricity Committee is seeking sanction to borrow £10 000 for h.t. mains.

Blakeney P.C. has asked the West Gloucester Power Co. to extend its cables to the village.

Eastbourne Corporation is seeking sanction to borrow £11 350 for electricity mains, extensions, etc.

Arrangements are being made by St. Helens Corporation to carry out extensions in the Rainford district.

Aberdeen Electricity Committee has authorised extensions to the generating station estimated to cost about £7 300.

An expenditure of £3 300 for a new feeder main and £4 183 for distributors is recommended by Bexhill Corporation.

Battersea Electricity Committee has decided to extend mains and services and convert gas lamps at a cost of £4 845.

Stoke-on-Trent Corporation is to extend mains at a cost of £720 to supply 38 houses to be erected in Marlborough Street, Fenton.

Forty cable extensions, involving an approximate cost of £4 000, have been authorised by Plymouth Electricity Committee.

A scheme for installing electric light in small houses on a system of payment by weekly instalments has been adopted by Grays U.D.C.

Lancaster Corporation proposes to promote a Special Order to include a considerable area of the Lancaster R.D.C. and the whole of Lunesdale R.D.C.

A scheme for extensions of works £4 300, distribution £47 862, and mains expenditure £12 000, has been prepared by Croydon Electricity Committee.

Southport Town Council is to seek sanction to borrow £1 900 for h.t. and l.t. mains, switchgear, transformer, etc., in connection with supply to Scarisbrick.

Colne Town Council has decided to apply for an Order to supply electricity to Trawden. The district has been canvassed and about 120 initial customers are expected.

Preston Corporation is seeking Parliamentary powers to construct three sluice gates in the River Ribble for impounding water in connection with the electricity undertaking.

Negotiations having been concluded for the installation of electric light in Dunbar, the Lothians Electric Power Company is preparing to lay cables from Luggate to the town.

The Central Electricity Board has made an application to Southport Corporation for a temporary bulk supply. The Corporation has appointed a sub-committee to arrange terms.

The Ministry of Transport has informed Stratford-on-Avon R.D.C. that Mr. A. D. Erskine will hold an inquiry on March 31st respecting objections to the use of overhead cables at Kineton.

Expenditure not exceeding £465 for providing electricity at the Bow, Burdett Road, Hammersmith, Old Kent Road, and West Hampstead fire stations, has been sanctioned by the L.C.C.

Droxford R.D.C. has received from Portsmouth Corporation an intimation that the latter contemplates applying for a Special Order to supply electricity within a portion of the rural district.

York Corporation is seeking consent to alter the system of supply to consumers at present taking continuous current from a three wire system at 230 and 460 V, to a supply of three-phase 50 cycle at 230 and 400 V.

Guildford Electricity Committee has decided that lighting by electricity be substituted for gas along the London Road from the White Horse Hotel to the borough boundary, and that 22 electric lamps be erected.

Hounslow U.D.C. are to extend mains from Lampton Corner in an easterly direction along the Great West Road at a cost of £435 to supply current to 34 houses to be erected on the Stuckley Estate, and along Heath Road, at a cost of £173 10s. to supply 10 houses.

Battersea Electricity Committee has authorised electricity services to 65 premises at a cost of £678 10s., mains extensions for private services at £443 and £53, and replacement with armoured cable of old vulcanised bitumen distributors in Northcote Road at £1 559.

Shipley Electricity Committee has agreed to the laying of a l.t. cable from Kendall Avenue, down Moorhead Lane, to the Saltaire Car Shed sub-station, in readiness for the contemplated change over from d.c. to a.c. in the Moorhead district. The length of the cable required is 300 yards.

During December, 100 new connections were made to Guildford mains for lighting purposes and 71 for heating, domestic, and power purposes. The number of new connections made during November was a record for the undertaking, which has in turn been exceeded during December.

As the result of an inquiry held at Ulverston on November 20th, the Ministry of Transport has approved, with modifications, the scheme of the Barrow-in-Furness Town Council for an overhead transmission line from Ulverston Viaduct to Meathop, in order to supply Cartmel, Lindale, and Meathop Sanatorium.

Stoke-on-Trent Electricity Committee has decided that an e.h.t. feeder be laid from Hanley to Greenbank Road, Tunstall, and l.t. mains from the sub-stations at Greenbank Road and Sneyd Hill, at an estimated cost of £13 000, and that two sub-stations be provided at an estimated cost of £4 000. It has been decided to extend mains at Trentham at a cost of £900.

Stoke Newington (London) Electricity Committee recommends that time switches be supplied on rental terms, for late shop window lighting and other purposes, at the following rates: up to 10A, 5s. per quarter; 10 to 15 A, 6s.; and 25 to 50 A; 10s.—The Committee seeks sanction for loans of £10 000 for mains and services and £1 500 for free wiring installations.

Beckenham Electricity Committee has considered a report by the engineer and manager recommending a revision of the percentage of rateable value, applicable to the "all-in" tariffs, in consequence of the revaluation of the district, to come into operation on April 1st next, and adjourned the matter, the engineer meanwhile to circulate a statement giving the effect of the proposed revision.

The borough electrical engineer, Wimbledon, has reported that it is advisable during the present year to supplement several of the existing h.t. mains at an estimated cost of £13 238 13s., and also to replace one of the existing e.h.t. mains between Raynes Park and Malden sub-stations, and a similar main from the electricity works to Raynes Park sub-station, by cables of a larger section, at the total cost of £23 000.

A letter has been received by Ilford Electricity Committee from the County of London Electric Supply Co., Ltd., stating that the company gives its consent to the Council's application to the Electricity Commissioners for a Fringe Order to permit the Council to supply electricity to certain premises in Grange Crescent, Grange Hill, and stating that the company consents to the Council's proposed extension of mains in the Chigwell area along a continuation of Tomswood Hill and Forest Lane and a proposed new road leading from Forest Lane.

Wrexham T.C. has adopted a scheme for installing electric light in houses on the hire-purchase system, with a maximum of five points, and a loan of £6 000 is to be applied for to meet the estimated cost of 400 installations during the first year. The wiring is to be carried out by electrical contractors, to the Corporation's specifications, and the charge for electricity is to be 8d. per kWh, through a slot meter, until 800 kWh have been paid for, when the ordinary lighting rate for slot meters generally will be charged. A net surplus of £280 per annum is anticipated.

Reporting on the Mid-East England electricity scheme, Sheffield Electricity Committee states that the saving in Sheffield over five years is £57 803, the difference between £1 929 193 (0·348 per kWh) the cost of 1 330·5 million kWh under individual development, and £1 871 390 (0·3376d. per kWh), estimated cost of the same supply under the scheme, a little less than 3%. This is by far the lowest saving anticipated for any undertaking in the area, and is, the Committee states, evidence of the fact that the present and prospective cost of generation in Sheffield is lower than in any other undertaking. —The electricity department committee is to extend mains at a cost of £7 000.

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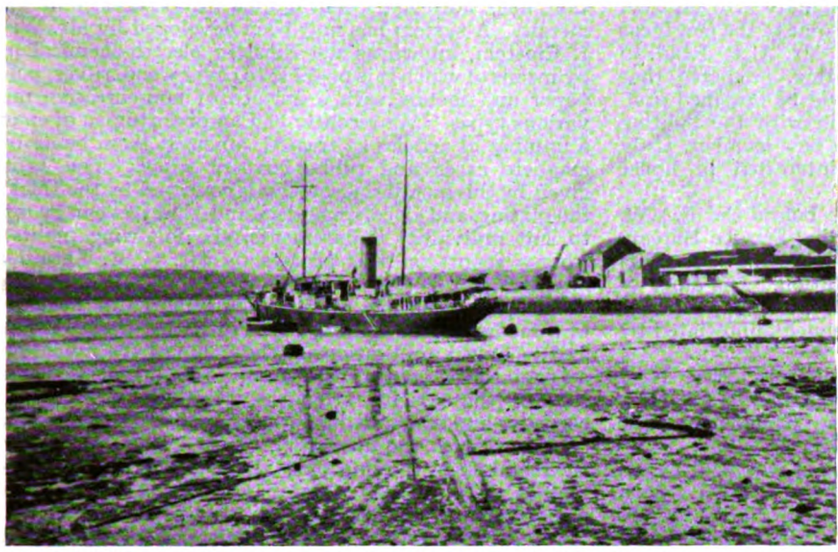
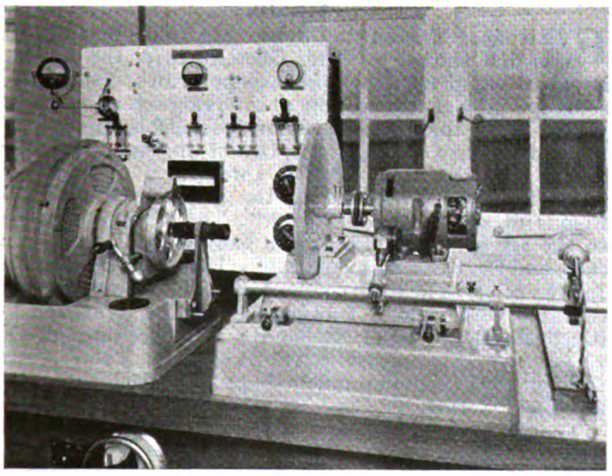
ELECTRICAL NEWS OF THE WEEK IN PICTURES.

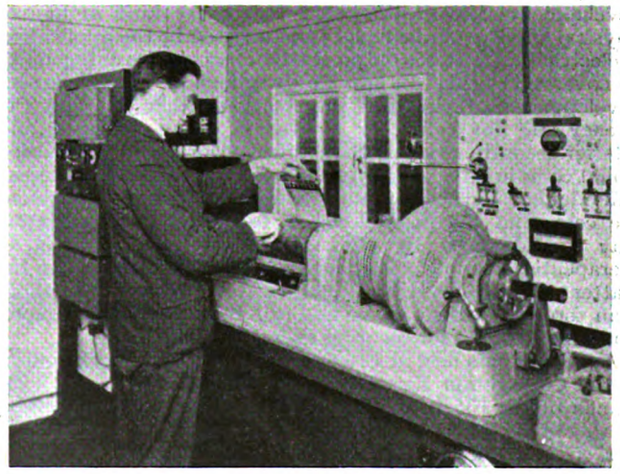


The left-hand picture shows the cable ship "John Pender" in Stonehouse Pool, Plymouth, while on the right is a snapshot taken on board while at sea. The names, left to right are: J. J. Denison-Pender, H. Spencer Saville, A. F. Cole (second officer), W. H. Skinner (chief engineer), F. L. Fisher (chief electrician), L. Hannaford (chief officer). Both these photographs were taken by Captain N. J. C. Lawson.

Alderman Cedric Chivers, who it will be remembered did so much at the last I.M.E.A. Convention to add to the social success of the gathering, died on January 30th, in his 76th year. He was six times Mayor of Bath, the last five years being consecutive. He was a bookbinder, and did much to advance the interests of his trade. See page 168.

The carnival at Nice is now in progress, and our view of some of the illuminations shows on the right the Casino Principal. The street decorations resemble those adopted at Blackpool during the summer.





A demonstration of the facsimile transmission of pictures by wireless was given by Marconi's Wireless Telegraph Co., on Sunday, through the stations at Somerton and Rocky Point, Long Island. Several pictures were received, and one of these is reproduced on page 171. The apparatus required for this system is shown in part in the left hand picture, the motor with stroboscope, motor driven chopper disc and lamp all being portions of the transmitter. The receiving gear is much the same in appearance, though the apparatus of course provides a means of reversing the process. The right-hand picture shows a message being placed in position for transmission. A technical description of the system is given on the page referred to above.

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ELECTRICAL WOMEN.

Successful Branch and Other Meetings of the Electrical Association for Women.

THE first fixtures of the New Year proved to be of exceptional interest. London members gathered at the showrooms of Troughton and Young, Ltd., on January 23rd, and had an opportunity of seeing for the first time some of the new ideas in lighting as expressed by Jean Perzel. Mr. A. B. Read, in an interesting lecture dealing with lighting, predicted that in future electric lighting equipment would be designed first, and the rest of the house later, to fit in with the lighting arrangements. Those present included a new member, Lady Balfour of Burleigh, who is herself interested in house decoration.

Mr. F. W. Purse gave his first lecture before the E.A.W. on January 27th, at the E.L.M.A. Lighting Service Bureau, London, and using lantern slides showed the improvements taking place in the West Ham power station. His story of the generation and the distribution of electricity "From the Coal Heap to the Electric Cooker," was much appreciated by the audience.

Further evidence of the work being done by West Ham Electricity Committee for the working woman was given by Coun. Mrs. Gregory, Mrs. Hollis, and Mr. Bridgeman. The chair was taken by Mrs. Llewelyn B. Atkinson.

On January 30th a very enjoyable social was held at 46, Kensington Court, in aid of the funds of the E.T.B.I. As a result Mrs. Llewelyn B. Atkinson and her Social Sub-Committee were able to hand over to the E.T.B.I. the useful sum of five pounds.

Swansea Branch.

Following a preliminary meeting, a well-attended inaugural meeting was held at the Corporation Electricity Showrooms, Swansea, on January 24th, to form a Swansea and District Branch of the Association. The branch is fortunate in having Lady Bryn Edwards as its president. The chairman (Mrs. J. W. Burr) opened the meeting, and introduced Miss C. Haslett. Mr. J. W. Burr, borough electrical engineer, in a short address welcomed the formation of the branch in the district.

Miss C. Haslett, in a most interesting talk, outlined very clearly the aims and objects of the Association. Mrs. Matters-Porter also spoke in support. The first fixture takes the form of a cookery demonstration to be held on February 20th, and lectures and visits are being arranged for the remainder of the session.

On January 30th Mr. Fleming gave an address to the Manchester and Salford Branch of the Association, the title being, "Milestones in the Progress of Electricity." He traced the progress of electrical development from the time of Thales of Miletus (1600 B.C.) down to the present time, noting the influence of its progress afforded by such experimenters as Dr. Gilbert of Colchester (1600 A.D.), Gray, Franklin, Galvani, Volta, Davy, Oersted, Faraday, Bell, Morse, Wheatstone, Clerk Maxwell, etc. As to future developments Mr. Fleming said that every kind of human physical effort could be replaced or assisted by the application of electricity, and it was only a matter of economics or ingenuity to cover this field. In specific directions one might expect developments of electrical illumination either by high frequency, by gas tubes, or by varied colour schemes, and interior decorations would be modified accordingly. Television would come in time. Means of wireless communication between individuals would become much more flexible than was at present the case, and the possibilities of telepathic communication may be advanced by electrical means. In the field of therapeutics one might look for the greatest advance. In the matter of the generation of electrical energy other methods than those at present in use and of a more efficient character would be adopted for securing energy from fuel.

A meeting was held at Bristol on January 15th at the offices of the Corporation Electricity Department, whereat a local branch of the Electrical Association for Women was formed. At this preliminary meeting, the chair was taken by the Hon. Mrs. J. H. Inskip, the chief speaker being Miss C. Haslett. Mr. H. Faraday Proctor, chief engineer and general manager of the Electricity Department, also spoke. The formal business concluded, the meeting took the form of a discussion, wherein suggestions and questions were invited.

A preliminary meeting was held at 21, Eastgate Street, Gloucester, on January 25th, to discuss the formation of a Gloucester and District Branch of the Association, and it was decided to hold an inaugural meeting.

THE EINSTEIN PROCESS.

The Electro-deposition of Metals on Non-Conductors by a New System.

ALTHOUGH the process of electro-plating both conductors and non-conductors of electricity is not new, its application has, however, been limited to certain materials and metals. A system has now been developed by Mr. Wladimar I. Einstein, known as the Einstein electro-chemical process, by means of which it is possible to cover wood, silver, porcelain, paper and metals with a surface of non-corrosive metal of various types. We recently had an opportunity of examining a number of articles so treated, amongst them being bakelite magneto cases and rubber-covered wires. The protection given by this metallising process is governed by the thickness of the plating, and since, we understand, that this can be arranged to suit individual requirements, the following points taken from a report on the process by Mr. C. E. Larard are of interest.

The process is one of the most remarkable developments of a modern invention, in virtue of its industrial, commercial and technical applications. The value of the invention from an engineering point of view resolves itself into the determination of the relative strengths, elasticity, durability, anti-corrosive and non-splitting properties of the metallised material compared with the untreated "base" material round which the metal forms the envelope. In addition there are important factors of protection against weathering (which primarily resolves itself into the relative absorption against moisture or rain), protection against organic pests (insects, etc.) and also immediate protection against fire. With respect to the problem of strength, experiments demonstrated that a very small thickness of the metallised coating was sufficient to increase the crushing or crippling load of certain metallised wood struts by nearly 65%, as compared with the corresponding wood struts when untreated; while for tension tests on a composite wood metallised over, produced an increase in tenacity of over 42%. At the same time, from cross-bending experiments the mean modulus of elasticity was increased by over 50%. Experiments on the absorption of water, in the case of wood metallised over the surface by the process, showed a percentage increase, after a three days' immersion of less than half of 1% by weight. With petrol immersion for the same length of time, the absorption was only 0·16%. Another interesting result came out in determining the ultimate tenacity obtained from a tension test on very light metallised fabric, compared with that from a tension test on the same kind of fabric when untreated—the former being reinforced over one side of the fabric only. The ultimate tensile strength of the metallised fabric per ft. width being 3-4 times that of the untreated material.

WIRELESS NOTES.

Tristan da Cunha now a Link in the Short-Wave Chain.

EVER since Tristan da Cunha, the world's loneliest island, was first settled by Peter Glass, in 1816, the inhabitants have been cut off from the world except for an occasional visit by some specially chartered ship at intervals extending up to two years. When the Rev. A. G. Partridge sailed last month to take up his voluntary duties as chaplain of the island he took with him a standard Marconiphone three-valve short-wave set, which has been presented to the island by the editor and friends of the "African World." The high tension supply to the set will be taken from a bank of 90 large Leclanché cells, and the valve filaments will be heated by special Sterling Invicta cells. The little community will be brought into daily contact with three continents—Europe, through 5SW (Chelmsford) and PCJJ (Holland); America, through 2XAD, 2XAF and other short wave transmitters, and Australia, through 2FC (Sydney) and perhaps 3LO (Melbourne). It is also possible that the Cape Town station may be received.

The MARCONIPHONE CO., LTD., this week placed on the market a Model 37 three-valve receiver for reception on the broadcasting and long-wave bands. The instrument may, with additions, be operated direct from the mains, while its price is likely to be popular.

Wireless telephone communication between Geneva and Buenos Aires was commenced last month, when the Argentine Consul at Geneva had a long conversation with an official of the Foreign Ministry in Argentina. The conversation was held through Nauen wireless station.

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COMPANY NEWS.

General Electric Shares still Rising—Henley's and British Insulated also Improve—London Power Co.'s Debenture Issue—St. James and Westminster Co.'s Final Dividends—Anticipated Television and Wireless Pictures Merger—Everlite Statutory Meeting.

GENERAL Electric shares are still buoyant. On Friday of last week they were as high as 78s. 9d., and at 75 the quotation shows a rise of 8s. 9d. as compared with that ruling when our last number went to press. W. T. Henley's Telegraph Works ordinary are 3s. 9d. higher, at 121s. 3d., and British Insulated Cables 1s. 3d. at 92s. 6d. Marconis Wireless at 81s. 3d. are 2s. 6d. to the good. Ever Ready shares have fallen 6s., to 25s. 6d., and Electric Constructions at 23s. 9d. are more than 3s. down. Shropshire Worcester and Staffs Power " B " ordinary shares have risen 9d. to 37s. 6d.

Last Annl. Divd.	Description.	This Week.	Last Week.	1912 to 1927. Highest.	Lowest.
%	**Electricity Supply.**				
(*d*)	Brompton & Kensington Ord. ..	27/-	27/-	45/-	23/9
4	Central Elec. Sup. 4% Deb. ..	93	93	100	67
(*a*)	Charing Cross Elec. Ord. (£1) ..	26/-	26/-	60/-	10/-
4½	" " " 4½% C.P. (£1)	17/6	17/6	19/6	10/-
(*a*)	Chelsea Elec. Sup. Ord.	27/-	27/-	39/6	10/-
10	City of Lond. Elec. L'ting Ord. ..	31/10½	31/10½	52/10½	20/3
6	" " " " 6% C.P. ..	23/-	23/-	40/-	15/6
7½	County Lon. Elec. Sup. Ord. ..	49/6	49/6	68/6	14/6
6	" " " " 6% C.P. ..	23/-	23/-	24/9	15/3
(*g*)	Kensington & K'bridge Ord. (£1) ..	27/6	27/-	104/6	3/-
(*b*)	Lon. Elec. Sup. Ord. (£1)	26/-	26/-	38/3	5/-
9	Metro. Elec. Sup. Ord.	46/3	46/3	43/-	8/-
4½	" " " 4½% C.P. ..	17/6	17/6	18/6	9/6
7½	N'castle & Dis. Elec. Ltg. Ord. ..	30/-	30/-	22/6	7/9
6	N'castle-upon-Tyne Elec. Sup. Ord.	26/10½	26/10½	26/-	11/6
6	N. Metro. Elec. 6% C.P.	23/-	23/-	23/9	10/1½
6	Notting Hill 6% C.P. (£10) ..	10½	10½	10½	6/13/9
(*c*)	St. James & P.M. Ord. (£1) ..	27/6	27/6	62/-	22/-
1/4½	Shrops.Worcs.& Staffs.Power B.Or.	37/6	36/9	23/-	20/9
(*f*)	W'minster Elec. Sup. Ord. (£1) ..	27/-	27/-	52/-	18/-
4½	" " " 4½% C.P. (£1)	17/6	17/6	21/6	13/-
8	Yorks. Elec. Power Ord.	36/6	36/6	32/9	12/6
6	" " " 6% C.P. ..	24/6	24/6	25/-	14/3
	Railways and Tramways.				
8	Brit. Elec. Trac. Pfd. Ord. Stk. ..	126	126	152½	24
6	" " " 6% Pf. Stk...	127½	127½	129½	53
4	Cent. Lon. Ry. Ord. Stk. (asstd.) ..	73	73	89½	40½
4	" " " 4% Deb.	81	81	103	56½
4	City & S. Lon. 4% Perp. Deb. ..	79½	79½	102½	50
4	Lon. Elec. Rly. Cons. Ord. Stk. ..	75½	75½	73½	10
4	" " " " 4% Pf. Stk.	75	75	84/2/6	43
4	" " " " 4% Deb. ..	81	81	98½	52
5	Lon. & Sub. Trac. A. Deb.	97½	97½	89	65
4	Lon. Un. Trams, 1st Deb.	61	61	82	30
4½	Met. Elec. Trams, 4½% Deb. ..	70	70	101½	49
5	" " " 5% Deb... ..	67½	67½	102/17/6	53
3	Met. Rly. Cons. Ord. Stk.	65½	67	84½	19
3½	" " " 3½% Pf. Stk. ..	65	65	88½	40½
3½	" " " 3½% Deb.	72	72	92½	51
4	Met. Dis. Rly. Ord. Stk.	80½	80½	66½	12½
4½	" " " 4½% 1st Pref. ..	82½	82½	91	45
6	" " " 6% Perp. Deb. ..	116½	116½	146/12/6	80
4	S. Met. Elec. Trams, 4% Deb. ..	70	70	73½	48½
5	Underground Electric Rlys. Ord.	27/6	27/6	5/3	2/1½
—	Yorks. (W.R.) Trams, Ord. ..	5/-	5/-	27/-	1/-
4½	" " " 1st Deb. ..	59	59	87	52
	Electrical Manufacturing.				
7	Brit. Elec. Transformer 7% C.P. ..	15/-	15/-	22/1½	11/6
15	Brit. Insulated Cables Ord. ..	92/6	91/3	86/3	26/6
6	" " " 6% C.P. ..	22/6	22/6*	25/6	14/6
7	British Thomson-Houston Pref. ..	23/3	23/3	24/6	19/7
7	" " " 7% Deb.	104½	104½	109½	92/-
10	Brush Electrical Ord.	28/9	28/9	29/9	10/-
15	Callender's Cable Ord.	85/-	85/-	86/-	22/-
6½	" " 6½% C.P. ..	25/-	25/-	26/7	3/-
7½	" " 7½% B. Pref. ..	27/6	27/6	27/6	16/6
8	Crompton-Parkinson 8% Cum. Pf.	25/7½	25/7½	25/-	9/10
6	" " 6% Cum. 2nd Pf.	19/-	19/-	18/-	8/-
7½	Edison Swan Elec. Ord. (1st Pref. ..	25/7½*	25/7½	26/-	5/-
5	" " " 1st Deb Stk...	86½	86½	—	—
7½	Elec. Construction Ord.	23/9	26/10½	25/9	6/7
7	" " 7% C.P. ..	22/6	22/6	25/3½	16/-
—	English Elec. Ord.	8/9	8/9	29/3	7/3
6	" " 6% C.P. ..	10/-	10/-	22/1½	10/6
7	Ericsson Telephones 7% Pref. ..	18/9	18/9	22/9½	12/7
35	Ever Ready (Gt. Britain) Ord. ..	25/6	31/6	93/9	18/6
6	Ferranti 6% Pref.	19/-	19/-	19/4½	10/9
7	" 7% 2nd Pref.	19/-	19/-	19/3	13/9
10	General Elec. Ord.	75/-	66/3	59/-	13/6
‡25	W. T. Henley's Ord.	121/3	117/6	108/9	23/3
12½	Johnson & Phillips Ord.	36/3	36/3	67/11	14/6
7½	Lon. Elec. Wire & Smith's Pref. ..	23/9	23/9	27/6	17/6
7½	Siemens Bros. & Co. Ord.	30/-	30/-	36/6	12/3
10	Telegraph Const. Ord. (£12) ..	25	25	56/2/6	19
	Telegraph.				
3½	Anglo-Am. Tele. Ord. Stk... ..	61½	61½*	68½	40
10	Eastern Ord. Stk.	272½	272½	213½	113/2/6
3½	" 3½% Pref. Stk.	68½	68½	84/17/6	49
4	" 4% Deb.	79½	79½	103½	60
10	Eastern Extension Ord. (£10) ..	27½	27½	21½	10/12/6
22	Gt. Northern Telegraph (£10) ..	34	34	42/12/6	19
10	Indo-European (£25)	54½	54½	47½	25
20	Marconi's Wireless T. Ord. ..	81/3	78/9	9/16/3	20/9
12½	" Int. Mar.	72/6	71/6	5/11/3	14/11
10	Western Tel. Ord. (£1)	27½	27½	23	11/3/6

(*a*) 1s. 7½d. per share. (*b*) £8 8s. 6·66d. per cent. (*c*) 1s. 6·949d. per share.
(*d*) 1s. 8·706d. per share. (*e*) 1s. 9·3d. (*f*) 1s. 0.912d. (*g*) 1s. 7·223d.
* Ex dividend. ‡ Including 1s. bonus.

TRUPHONIC RADIO, LTD.—Subscriptions have been invited during the present week for an issue of 425 000 2s. shs. at par.

LONDON POWER CO., LTD.—This co. announced on Wednesday an issue of £3 000 000 5% red. deb. stk. at £99 10s. %.

YORKSHIRE ELECTRIC POWER CO.—Final div. on ord. shs. of 1s. p. sh., less tax, payable Feb. 19, making 8% for year. Same as last year.

ALLGEMEINE ELECTRICITAETS GESELLSCHAFT.—Annual report for 1927-28 announces a div. of 8%. Rev. of co. increased by 30% over that of the preceding year.

ST. JAMES' AND PALL MALL ELECTRIC LIGHT CO., LTD.—Blce. divs. of 8·4d. p. sh. (=3½%) on £1 pref. shs. and 9·949d. p. sh. (makg. standard div. for year 1928) on £1 ord. shs. are recommended.

WESTMINSTER ELECTRIC SUPPLY CORPORATION, LTD.—Final div. of 13·12d. p. sh., less tax, on the ord. sh. cap. in respect of year 1928, payable March 1. This div. completes the co.'s standard div. of 8·8% in accordance with the provisions of the London Electricity (No. 2) Act, 1925. Div. for 1927 same.

METROPOLITAN RAILWAY CO., LTD.—Final pymt. of 2¼% actual, div. for the year 1928, 3½% on ord. cap. of £7 578 667, as compared with fin. of 2%, making 3% for 1927, increase £37 894 in cash distribution. Proposed repeat allocation reserve at £10 000 and to carry fwd. £23 988, as against £26 464 from last year. The £2 640 914 surplus lands stk. to receive fin. div. 2¼% actual, making 3¾%, as against 3⅝% for 1927. Traffics for 1928 £1 864 000, increase over 1927 of £59 000.

LONDON POWER CO.—Output of stations increased from 506 387 796 kWh in 1927 to 593 915 537 in 1928, and demand from 226 811 to 242 700 kW. Notwithstanding increased output, total amt. charged by co. for current decreased from £1 681 942 for 1927 to £1 641 162 for 1928, due to economies in costs of productn. The whole of the generatg. statns. and the 22 000 V transmissn. mains of the constituent cos. have now been transferred to, and are directly operated by, the Power Co. Directors recommend div. at rate of 6% p.a. on sh. cap. of £50 000.

NORWICH ELECTRIC TRAMWAYS CO.—In a statement published to meet requirements of Stock Exchange, it is announced that the authorised capital is £300 000 in £10 shs., and issued cap. £264 000 in fully paid £10 shs. There are £66 000 (including £2 200 owned by co.) 4% mtge. bonds of £100, redeemable at par, but only on purchase of undertaking by Corporation of Norwich. If and when unissued cap. of £36 000 is raised, co. has power to borrow further £12 000 on mtge. Co. works 16½ miles of track, which can be purchased by local authorities on Aug. 6, 1932, or any seventh year thereafter.

TELEVISION AND WIRELESS PICTURES MERGER PROSPECTS.—The " Daily Telegraph " understands that Wireless Pictures, Ltd. (Fultograph system) and the Baird Television Co. may shortly join forces. Conversations have recently taken place between representatives of the respective boards of directors with a view to a merger. It is hoped that under this new arrangement the B.B.C. will continue to transmit Fultograph still pictures, in accordance with the contract signed with Wireless Pictures (1928), Ltd., last year. It is possible that another test of the Baird system will be made shortly, so as to obtain views as to the present value of television with regard to occasional television transmission in the near future from B.B.C. stations. Officials of both companies admit that conversations have taken place, but are unable to make any further statement.

HALL TELEPHONE ACCESSORIES (1928), LTD.—Net pft. for 1928, £30 094. Placed to cap. res., £2 393; to gen. res., £5 000; and to income tax res., £5 800. Additnl. remuneration to directors, £1 070. Fin. div., 6%, less tax, makg. 10%. Fwd., £4 631. During year directors have been able to maintain growing expansn. of business and to obtain satisfactory contracts for thr. mfres. from several Government Departments and telephone cos., including further long-term contract from British Post Office. Directors have decided to purchase business of Thomas Watson and Sons, who are tenants of a portn. of co's. factory, and who are suppliers of telephone and allied equipment to home and foreign Govern-

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ments. Purchase consideration of £25 950 is payable in cash. Earning capacity of this business is such that directors expect to maintain present rate of distributn. on increased cap. Shareholders will be asked to authorise the creation of a further 70 000 shs., of which it is proposed to issue 56 000 to provide necessary funds for purchase.

Company Meetings.

RECORDAPHONES, LTD.—Mr. C. K. Sugden, presiding at the statutory meeting last week, said the company had taken orders for machines up to its present production capacity, including a considerable number to India. It had how trained a sufficient number of electrical technicians to carry out installations on a considerable scale, and they had organised a sales department to cope with the inquiries and orders they had been receiving. Another development was the successful conclusion of negotiations for the purchase of the Bowyer-Lowe Co., Ltd. The purchase included a modern factory, situated in Letchworth, with plant, machinery, patents, and trade marks. The Bowyer-Lowe Co. had for the past five years paid an annual dividend averaging over 30%, which was probably unique in that type of business. This purchase would enable the company to manufacture in this country in large quantities, at a considerable saving in the cost of production, and at the same time the existing business carried on at the acquired factory would bring immediate additional substantial profits.

EVER READY CO. (GREAT BRITAIN), LTD.—An extraordinary general meeting was held on January 31st, for the purpose of considering a resolution authorising the capitalisation of £74 000 from the undivided profits standing to the credit of the general reserve and its utilisation in paying up 296 000 ordinary shares to be distributed as fully paid among the ordinary shareholders in the proportion of one to every five ordinary shares held. Mr. Magnus Goodfellow, chairman and managing director, presided, and said that the proposed distribution of bonus shares to the ordinary shareholders would give them, calculated conservatively, a fair proportion of the increase in capital value, and earning power. Earlier reference had been made to the acquisition of an interest in Lissen, Ltd. The net profit earned by this business for the year ended September 30th, 1928, amounted to £115 000. From October 1st, 1928, to date its sales showed an increase of 25% over the sales for the corresponding period of the previous year, and this acquisition should have beneficial effects for both companies. The Ever Ready Trust and Finance Co., Ltd., had assisted financially in this transaction, and would consequently participate in the benefits obtained. The capital expenditure during the past year had been considerable, as, in addition to the Lissen Company interest, they had subscribed in cash for the deferred shares in the Trust and Finance Co., and had made considerable expenditure in the enlargement of their factories and plant. The resolution was carried unanimously.

EVERLITE, LTD.—At the statutory meeting on Monday, the Marquis of Winchester (chairman) dealt with the particulars in the statutory report abstracted in our last issue. They had, he said, acquired accommodation in the factory at Waltham Abbey which had been acquired by Metropole Developments from Imperial Chemical Industries. Here was a complete lay-out for assembling the lamps, and the manufacture of the refills was well under way. For the manufacture of the smaller lamps they had made arrangements with a very responsible and one of the largest concerns in the country and their programme in the smaller lamp would be carried out in time to make deliveries of these lamps from April onwards. The domestic lamps, which would be made chiefly out of Metduro, would be available during the coming autumn. Mr. S. R. Mullard, who was elected to the board on January 15th, had resigned his position as a director. On January 25th he (the chairman) received a letter from him in which he complained (*a*) That at demonstrations and interviews prior to his joining the company he had understood that the Metduro material was to be controlled by the Everlite Co.; (*b*) that the present quoted price of Everlite shares, in view of the company's capital, capitalised the undertaking at well over £1 000 000 sterling, and he desired that the board of the company should make a public statement to correct the position of affairs and not allow it to be misled by various rumours and statements which were at present permitted to be in circulation; and (*c*) that within a matter of hours the decisions at conferences were known all over the Stock Exchange. He recommended (1) That a statement be made to the Press which exactly related the present position of the company. (2) that immediate action be taken to preserve the secrecy of decisions made at all meetings; and (3) that the Everlite Co. be granted at least the selling rights of all Metduro articles suitable for the electrical industry. He concluded by stating that he could not see how it would be possible to make good the statement already issued that Everlite lamps would be on sale in April. The Chairman then said the large Birmingham firm of lampmakers who had undertaken to manufacture the lamps, the shareholders would think, knew better what they were doing than Mr. Mullard. There had never been any question of the Metduro forming part of the Everlite Co., and the cash resources of Everlite would be quite insufficient for the purposes of Metduro manufacture. He had informed Mr. Mullard that the market value of the shares was not a matter concerning the directors, but that in view of existing contracts and inquiries received, including inquiries from the Admiralty and the Board of Trade, it did not seem impossible to invisage a revenue compatible with the present market value of the shares. The "rumour" which Mr. Mullard had heard on the Stock Exchange had been public property since the latter part of December. They had secured in the person of Mr. G. Langford a man fully competent to carry out the important duties of factory manager. Mr. Langford had up to the period of his engagement with the company, been in the service of the Radiation Co.

New Companies.

ELECTRIC SUPPLIES (BLOXWICH), LTD.—Cap., £5 000. Manufacturers of electric supplies, apparatus and appliances, etc. Solicitors: Enoch Evans and Sons, Walsall.

CITY ELECTRICAL ENGINEERING CO., LTD. (HULL), LTD.—Cap., £2 500. Electrical, wireless and general engineers, etc. A director: S. T. Cooper, 24, Porter Street, Hull.

ELECTRICAL FACTORS, LTD.—Cap., £500. Factors of and dealers in electrical, wireless and engineering goods and equipment, etc. Secretary: R. Parker, 3, York Street, Manchester.

OVERHEAD, LTD.—Cap., £10 000. Electrical engineers and contractors, manufacturers and suppliers of and dealers in electrical overhead line equipment, etc. Solicitors: Blundell, Baker and Co., 16, Serjeants' Inn, London, E.C.4.

EDISON ACCUMULATORS, LTD.—Cap., £10 000. Electricians, electrical and mechanical engineers and contractors, manufacturers of and dealers in electric storage batteries, etc. Reg. office: 15, Upper George Street, Edgware Road, London, W.1.

VALE-ROYAL ELECTRIC LAMP MANUFACTURING CO., LTD.—Cap., £100. Electrical and wireless engineers, designers and manufacturers of and dealers in lamps, globes, brackets, dynamos, etc. A permanent director: J. Jones, 13, Vale Royal, Islington, London, N.7.

JERUSALEM ELECTRIC AND PUBLIC SERVICE CORPORATION, LTD. (Additional particulars).—Cap., £P500 000. Incorporated in Palestine to acquire concessions (1) for generating, supplying and distributing electrical energy, and (2) for supplying and distributing potable water in Palestine. British address: 66, Queen Street, London, E.C.4, where T. K. Anderson is authorised to accept service of process and notices on behalf of company.

METAL AND CHEMICAL PRICES.

TUESDAY, February 5th

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£80 15 0	£2 10 0	—
Electro Wirebars	„	£81 5 0	£1 5 0	—
H.C. Wires, basis	per lb.	11 7/16 d.	1/16 d.	—
Sheet	„	11 7/16 d.	—	—
Phosphor Bronze—				
Wire (Telephone) basis	per lb.	1s. 2 7/16 d.	1/16 d.	—
Brass 60/40—				
Rod, basis	per lb.	8¼d.	—	—
Sheet „	„	10½d.	¼d.	—
Wire „	„	10¾d.	¼d.	—
Pig Iron—				
Cleveland Warrants	per ton	£3 8 6	—	—
Galvanised Steel Wire, basis 8 S.W.G.	„	£14 15 0	—	—
Lead Pig—				
English	per ton	£23 15 0	5 0	—
Foreign or Colonial	„	£22 7 6	2 6	—
Tin—				
Ingot	per ton	£223 5 0	£1 0 0	—
Wire, basis	per lb.	2 11	—	—
Aluminium Ingots	per ton	£95 0 0	—	—
Spelter	„	£26 10 0	2 6	—
Mercury	per bottle	£22 8 6	—	—

Sulphur—Flowers, Ton £12 0 0 *Copper Sulphate*—Ton £25 to £25 10 0
„ Roll, „ £10 10 0 *Boric Acid* (Crystals) „ £30
Sulphuric Acid (Pyrites, 168°) Ton £6 15 0 *Sodium Chlorate*—Per lb. 2½d.
Sodium Bichromate—Per lb. 3½d.
Rubber—Para fine, 1/0½d.; plantation, 1st latex, 10¾d.
∴ The metal prices are supplied by British Insulated Cables, Ltd.

LEAD MARKET REPORT.

In commenting upon last week's market, James Forster and Co., state that a steady tone was characterised throughout the week. Prices opened higher on Monday, at £22 5s. for prompt and £22 6s. 3d. for April, but re-acted slightly in the middle of the week.

Closing prices on February 1st were £22 5s. for February, £22 7s. 6d. for March, £22 8s. 9d. for April, and £22 10s. for May, 3s. 9d. to 5s. per ton higher on the week.

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COMMERCIAL INFORMATION.

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debt. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

ALLEN, William, and BECKWITH, Hugh James (trading as EASTERN ELECTRICAL CONSTRUCTIONAL CO.), St. Clements Shipyard, Ipswich, shipbuilders and electrical engineers. £38 17s. 6d. December 17th.

ARNETT, Mr. F. T., 74, Norroy Road, Putney, wireless and electrical engineer. £14 7s. 7d. July 24th.

FAWKE, Mr. E. B., 9, Charles Street, Mansfield Woodhouse, electrical contractor. £14 13s. 5d. December 4th.

GORDON, Leslie Henry (trading as GORDONS), 31, Loughborough Road, West Bridgford wireless dealer. £10 16s. 11d. December 5th.

JOHNSON, Mr. R. A., 943, Romford Road, Manor Park, wireless supplier. £28 2s. 7d. December 14th.

JONES BROS., 193, Fawcett Road, Southsea, electrical engineers. £60 19s. 4d. December 11th.

JONES, Mr. I., Church Street, Merthyr Tydfil, electrical and wireless dealer. £16 8s. October 22nd.

JONES, William W., 45, Milnrow Road, Rochdale, electrical contractor. £16 2s. December 21st.

LEWIS, Mr. E. J., 15, Park Avenue, Bideford, wireless dealer £15 19s. 11d. December 8th.

PARKER BROS., 135, School Road, Moseley, Birmingham, electrical contractors. £10 4s. December 11th.

PEARCE, Mr. S. J., 2, Church Road, Stanmore, electrical engineer. £17 15s. 2d. November 9th.

PREMIER ELECTRICAL STORES, 184, Railway Approach, W., electrician. £21 2s. 9d. July 24th.

ROWNTREE, E., and Co., 86, Manchester Road, Limehouse, electrical engineers. £18 0s. 7d. July 24th.

TEASDALE, Southern, South Road, Chopwell (trading as TEASDALE BROTHERS), wireless dealer. £11 12s. 7d. December 12th.

Bill of Sale.

BEARMAN, Hyman Joseph, 48, Mayfield Road, Chadwell Heath, wireless engineer and retailer. Dated January 24th, filed January 26th. £40.

Deeds of Arrangement.

EAVES, Reginald Ernest Allen, 56, Furzehill Road, Mutley, and CAMERON, Harold Douglas, 20, Furzehill Road, Mutley, Plymouth, and trading at Manor Works, Emma Place, East Stonehouse, as EMPRESS RADIO AND ELECTRICAL CO. and at 105, Union Street, East Stonehouse, 14K, The Avenue, Bridgwater, 2, The Bridge, Taunton, and 10, Bank Street, Newquay, as WESTMINSTER RADIO, dealers in wireless apparatus and electrical engineers. Dated January 29th, filed February 4th. Trustee, P. White, 6, Sussex Terrace, Plymouth, I.A. Secured creditors, £1 200; liabilities unsecured, £5 103; assets, less secured claims, £1 437.

MACLEAN, Hector, 79A, High Street and 43, Suffolk Street, Stockton-on-Tees, wireless dealer. Dated January 30, filed February 4th. Trustee, H. T. Sherwood, 115, High Street, Stockton-on-Tees, accountant. Liabilities unsecured, £414; assets, less secured claims, £113.

Mortgages.

[NOTE.—*The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—allowed by the date of the Summary, but such total may have been reduced.*]

COLSTON ELECTRICAL CO., LTD., Bristol.—Registered January 10th. £3 000 debenture, to W. J. F. Dutson, Grove Lodge, Parry's Lane, Stoke Bishop, engineer; general charge. *Nil. September 20th, 1928.

GRAY (J. W.) AND SON, LTD., London, E.C., electrical engineers —Registered January 2nd, £1 500 debentures; general charge.

NANTWICH ELECTRIC, LTD.—Registered December 24th, £400 charge, to Sandbach Permanent Benefit Building Society; charged on 5, Hospital Street, Nantwich.

SAMDON WIRELESS CO., LTD., Manchester.—Registered December 29th, £150 debenture, to M. Morris Woodcroft, Broom Lane, Higher Broughton, waterproof manufacturer; general charge (subject to prior debenture).

SHEPHERDSON, (E. and W.), LTD., Morecambe, electrical engineers.—Registered January 15th, £350 debenture, to W. Shepherdson, Sunning Hill, Longlands Lane, Morecambe, electrical engineer.; general charge.

WHITE (J. C.) AND CO., LTD., Manchester, electricians.—Registered January 10th, debenture, to Bank; general charge.

YELDON (G.), LTD., Portsmouth, radio engineers. Registered January 23rd, £500 1st debenture and £2 500 1st debenture (subject to £500 debenture), to E. H. Hawkins, 4, Charterhouse Square, E.C., I.A.; general charge.

Satisfactions.

EDISON ACCUMULATORS, LTD., London, W.—Satisfaction registered December 31st, £18 000, registered May 29th, 1925.

MARCONI'S WIRELESS TELEGRAPH CO., LTD., London, W.C.—Satisfaction registered January 7th, £1 206 786, part of amount registered November 23rd, 1922.

METROPOLITAN ELECTRIC SUPPLY CO., LTD., London, W.—Satisfaction registered December 20th, £250,000, registered May 31st, 1917.

RADIO SERVICE (LONDON), LTD.—Satisfaction registered January 2nd, £125, part of amount registered July 26th, 1927.

REASON MANUFACTURING CO., LTD., Brighton, electrical manufacturers. Satisfaction registered January 26th, £25 000, balance of amount outstanding July 1st, 1908.

London Gazette, etc.

Companies Winding-up.

COUNTY ELECTRICAL AND WIRELESS STORES, LTD., Garrick Yard, St. Martin's Lane, London. Winding-up Order, January 28th.

NEUTRON, LTD., Sentinel House, Southampton Row, London. Second and final dividend, 4½d. per £, payable February 14th, at the office of the liquidator, 40–43, Norfolk Street, W.C.2.

Bankruptcy Information.

HUDSON, Fred James, 63, Thurnscoe Road, Bradford, electrical engineer. First meeting, February 8th, 11 a.m., Official Receiver's Office, 12, Duke Street, Bradford. Public examination, March 8th, 10 a.m., County Court, Manor Row, Bradford.

JENKINS, Edward Charles, 124, Cheltenham Road, Bristol, wireless dealer. Receiving order, January 26th. Debtor's petition.

Notice of Dividend.

NICHOLS, John Tucker, 4, Glebe Road, Kingsland Road, Dalston, London, wireless parts merchant. First and final dividend, 5s. 7½d. per £, payable, February 19th, Philip M. Mordant, 115–117, Cannon Street, E.C.4.

Partnership Dissolved.

DOWN AND ABBOTT (Albert DOWN and James William ABBOTT), electrical engineers and contractors, at Barnard Castle, Durham, as from December 30th, 1928. Debts received and paid by J. W. Abbott, who will continue the business under the style or firm of ELECTRICAL ENGINEERING AND SUPPLY CO.

Bankruptcy Proceedings.

ANGERS, Arthur, trading alone as A. ANGERS AND CO., 19, Bristol Road, Wavertree, Liverpool, electrical engineer. Liabilities of £3 190 against assets of £112 were disclosed in the statement of affairs presented at the adjourned public examination of this debtor, held recently at the Court House, Government Buildings, Victoria Street, Liverpool. In reply to questions, the debtor stated that he had suffered with neurasthenia since the war, which had interfered greatly with his business. He admitted that he had been aware of his position for some years, and had been in the hands of money lenders since 1924. The strike in 1926 and losses on contracts also contributed to his failure. He stated that for overdraft purposes he submitted balance-sheets to his bank which did not reveal loans and private debts, but the overdraft was guaranteed by his brother. The debtor added that he had had very heavy expenses in connection with the sale of a patent, his share of which he sold for £650, the money going into the business. The examination was closed.

SHEFFIELD ILLUMINATION SOCIETY.

A good company of members and friends of the Sheffield Illumination Society attended the fourth annual social evening, held at Stephenson's Restaurant, Sheffield, January 28th. The chair was occupied by Counc. R. H. Minshall (chairman of the Corporation Lighting Committee) and amongst those present were Counc. and Mrs. A. Ashmore; Counc. A. Smith and Mr. and Mrs. J. F. Colquhoun. The chairman in his opening remarks referred to the progress of the society, the increased membership, which is now 103, and the beneficial effects of social gatherings. The first portion of the entertainment consisted of musical items, and the remainder of the evening was devoted to a whist drive.

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PATENT RECORD.

The following information is prepared from the Illustrated Official Journal (Patents) by permission of the Controller of H.M. Stationery Office. Printed copies of full Patent Specifications, when accepted, may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at 1s. each.

Specifications Accepted.

290 643 Associated Telephone and Telegraph Co. Remote control of electric power sub-stations. (11/10/26.)
292 064 Maschinenfabrik Oerlikon. Transformer for polyphase rectifiers. (11/6/27.)
292 625 International General Electric Co., Inc. Electric switching-apparatus. (23/6/27.)
293 827 General Electric Co., Ltd. Electric incandescent lamps. (13/7/27.)
303 727 G. Pate and J. R. Laird, Insulating-blocks for the heating-elements of electric heaters and the like. (6/7/28.)
293 803 Marconi's Wireless Telegraph Co., Ltd. High-frequency signalling systems. (12/7/27.)
294 989 Telefunken Ges. fur Drahtlose Telegraphie. Coupling-devices suitable for use with rotatable frame aerials and the like. (3/8/27.)
295 280 G. Fischer. Current-collectors for electric vehicles. (8/8/27.)
297 466 International General Electric Co., Inc. Methods of securing fine wire cables or ropes to massive metal parts. (23/9/27.)
274 083 International General Electric Co., Inc. Excess current safety devices for electric circuits. (7/7/26.)
303 771 J. L. Baird and Television, Ltd. Reproduction of pictures, views, scenes, images, and the like. (5/7/27.)
303 574 D. F. Campbell and Electric Furnace Co., Ltd. Manufacture of linings of furnaces. (16/4/28.)
277 005 M. Zack. Electric arc welding. (31/8/26.)
303 814 British Hard Rubber Co., Ltd., and P. E. Wells. Ebonite and the treatment thereof, more particularly ebonite sheets, such as those employed as panels for wireless apparatus. (6/9/27.)
303 779 A. Reyrolle and Co., Ltd., and T. R. Warren. Electric synchronising apparatus. (5/10/27.)
288 594 Bastian-Morley Co. Heating apparatus. (13/4/27.)
278 730 Associated Telephone and Telegraph Co. Automatic train control systems. (6/10/26.)
303 767 E. Y. Robinson and Metropolitan-Vickers Electrical Co., Ltd. Vacuum electric discharge tube devices. (8/10/27.)
303 848 D. S. S. Steuart. Hand set telephones and the like. (11/10/27.)
282 351 Hall Telephone Accessories, Ltd. Coin collecting apparatus for telephone services. (14/12/26.)
278 763 Associated Telephone and Telegraph Co. Telephone systems. (11/10/26).
303 920 S. Baxter. Electric motors. (12/10/27.)
303 921 Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. Key-operated impulse-sending devices. (12/10/27.)
303 925 Standard Telephones and Cables, Ltd (Western Electric Co., Inc.) Wire drawing machines. (14/10/27.)
303 928 W. E. Beatty (Bell Telephone Laboratories, Inc.). Methods of treating magnetic materials. (14/10/27.)
303 929 Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. Telephone systems. (14/10/27.)
303 930 Automatic Telephone Manufacturing Co., Ltd., and A. E. Flenley. Automatic or semi-automatic telephone systems. (14/10/27.)
303 919 W. E. Beatty (Bell Telephone Laboratories, Inc.). Submarine cables. (17/10/27.)

Applications for Patents.

December 27th.

38 195 British Thomson-Houston Co., Ltd. Electric lamps. (28/12/27, U.S.
38 181 S. G. S. Dicker (N. V. Philips' Gloeilampenfabrieken). Advertising, etc., devices.
38 182 S. G. S. Dicker (N. V. Philips' Gloeilampenfabrieken). Means for transmitting electric impulses.
38 183 S. G. S. Dicker (N. V. Philips' Gloeilampenfabrieken). Control of electric circuits by light sensitive devices.
38 167 F. W. V. Fitzgerald. Electrolyte for secondary batteries.
38 137 E. A. Hailwood. Suspension fittings for illuminating ware.
38 139 B. W. and G. B. Hanley. Electric switches.
38 201 J. Y. Johnson (I.G. Farbenindustrie A.G.). Apparatus for production of electrical oscillations.
38 174 H. Leben and A. Reyrolle and Co., Ltd. Electric protective relays.
38 189 Lodge-Cottrell, Ltd. (Metallges Akt.-Ges.). Electrodes for precipitation of suspended particles from gases.
38 193 F. C. Malin and Marlo Refrigerating Co., Ltd. Fluid pressure operated electric switch.
38 196 L. M. Myers and Universal and General Radio Co., Ltd. Television apparatus.
38 209 H. Onishi. Telephone systems. (28/12/27, Japan.)
38 141 H. C. Sanders and Santon, Ltd. Electric liquid heaters.
38 236 L. Smeets. Electric safety device.
38 213 B. A. Spaull. Electric plug fittings, etc.
38 171 C. C. Turner and Young, Osmond and Young, Ltd. Resistance units, etc.

December 28th.

38 038 F. S. Adkins and R. W. Crabtree and Sons, Ltd. Dynamo-electric machines.
38 347 B. Baxter. Electric motors for gramophones, etc.
38 344 K. Brensing and U. Gottesmann. Producing uniform metal deposits electrolytically.
38 299 British Thomson-Houston Co., Ltd. Pressure measuring instruments. (28/12/27, U.S.)
38 245 W. Brown and T. Coughtrie. Short circuiting devices for electric couplings, etc.
38 264 English Electric Co., Ltd., and C. T. Scarf. Cam operated electric switches.
38 286 G. Ferrobino. Voltaic cells.
38 289 A. Gerhold. Electric switches.
38 337 F. C. Grund and Three Star Accumulators, Ltd. Carriers for galvanic cells, etc.
38 239 T. Hough and J. G. Threlkeld. Condenser microphones.
38 296 L. Mellersh-Jackson (Sunlight Electrical Manufacturing Co.). Dynamo-electric machines.
38 269 A. Jasicek and F. Polnauer. Electric shuttle-operating devices for looms. (28/12/27, Austria.)
38 247 A. C. Johnson. Hygienic device for telephone receivers.
38 312 Micafil Akt.-Ges. Manufacture of insulating materials. (28/12/27, Germany.)
38 308 Telefunken Ges. fur Drahtlose Telegraphie. Circuit arrangements for valve transmitters. (29/12/27, Germany.)
38 240 C. H. P. Wheatley. Direction finding, etc., apparatus.

December 29th.

38 412 F. C. Blackwell and Co., Ltd., and F. Firth. Electric conduit fittings.
38 392 British Electric Transformer Co., Ltd., and J. L. Thompson. Radiators for transformer tanks, etc.
38 382 Igranic Electric Co., Ltd., and A. H. Mackley. Gramophone pick-ups.
38 396 Landis and Gyr Soc. Anon. Electric switchgear. (1/1/28, Switzerland.)
38 362 R. Siddall and Siddall and Hilton, Ltd. Seats for tramcars, etc.
38 428 Soc. des Etablissements Industrielle de E. C. et de A. Grammont. Cathode from electron discharge device. (31/12/27, France.)
38 417 Standard Telephones and Cables, Ltd. Circuit arrangements comprising piezo crystals. (29/12/27, U.S.)
38 353 O. Sweeny. Electric reading lamp.
38 410 Telefunken Ges. fur Drahtlose Telegraphie. Circuit arrangements for valve transmitters. (31/12/27, Germany.)
38 390 L. Thurm. Television, etc., receiving apparatus. (30/12/27, France.)

December 31st.

38 466 H. Bakofsky and F. E. Raike. Fire alarms.
38 561 British Thomson-Houston Co., Ltd. Thermionic cathodes. (31/12/27, U.S.)
38 562 British Thomson-Houston Co., Ltd. Amplifying systems. (31/12/27, France.)
38 563 British Thomson-Houston Co., Ltd. Electric switches.
38 509 S. G. Brown. Sound reproducing instruments, etc.
38 539, 38 540 Central Mining and Investment Corporation, Ltd., and L. B. Woodworth. Electric junction boxes, etc. (22/6/28, Union of South Africa.)
38 469 B. S. Cohen. Telephone systems.
38 479 J. Dieux. Thermionic amplifiers, etc., operating on electric mains. (6/3/28, France.)
38 480 J. Dieux. Electromagnetic pick-ups.
38 481 Dubilier Condenser Co. (1925), Ltd. Valve for radio signalling, etc. (31/12/27, Germany.)
38 587 Electrical Research Products, Inc. Electric signalling conductors. (29/6/28, U.S.)
38 588 Electrical Research Products, Inc. Telegraph systems. (9/3/28, U.S.)
38 529 Felten and Guilleaume Carlswerk A.G. Electric conductors. (29/2/28, Germany.)
38 532 V. C. From, A. W. Larsky, and C. D. Rowley. Illuminated signs, etc.
38 470 General Electric Co., Ltd., M. Kahn, and R. Orsettich. Electric supply systems.
38 545 C. W. Hansel. Devices for making and breaking electric circuits.
38 546 C. W. Hansel. Apparatus for measurement of electric currents.
38 436 A. A. Hood. Thermoinic valves, etc.
38 434 A. Katsch and Loewe Audion Ges. Vacuum discharge device. (31/12/27, Germany.)
38 439 H. M. Price. Electrical distribution boxes.

COMING EVENTS.

Friday, February 8th.

Engineering and Scientific Club.—Paper by Mr. L. Southerns on "Sound-Waves and Musical Tones."

Institution of Electrical Engineers (London Students' Section).—Institution, Savoy Place, Victoria Embankment, London. Paper by Mr. H. H. Taylour on "Electric Welding." 6.15 *p.m.*

Institution of Electrical Engineers (South Midland Students' Section).—Birmingham University, Edmund Street. Paper by Mr. P. E. Lyddon on "Hydro-Electric Stations in Switzerland." 7.15 *p.m.*

Monday, February 11th.

Electrical Contractors' Association (Hastings Sub-Branch).—Ordinary meeting.

Electrical Contractors' Association (Liverpool Branch).—Ordinary meeting. 7 *p.m.*

Institution of Electrical Engineers (North-Eastern Centre).—Armstrong College, Newcastle-on-Tyne. Paper by Messrs. Johnstone Wright and C. W. Marshall on "The Construction of the Grid Transmission System in Great Britain." 7 *p.m.*

Tuesday, February 12th.

Electrical Contractors' Association (Swansea Branch).—Ordinary meeting.

Electrical Contractors' Association (Leicester Branch).—Corridor Chambers. Ordinary meeting. 2.30 *p.m.*

School of Engineering and Navigation.—High Street, Poplar. Lecture IV (Course of five lectures), by Mr. H. Brazil on "Electrical Sub-stations." 7 *p.m.*

Electrical Association for Women.—E.L.M.A. Lighting Service Bureau, 15, Savoy Street, Strand, London. Lantern lecture by Mr. H. de A. Donisthorpe on "Radio Progress and Its Connection with the Thermionic Valve." 7 *p.m.*

Institution of Electrical Engineers (North Midland Centre).—Hotel Metropole, King Street, Leeds. Paper by Messrs. E. B. Wedmore, W. B. Whitney and C. E. R. Bruce on "An Introduction to Researches on Circuit Breaking." (Electrical Research Association Report.) 7 *p.m.*

Electrical Power Engineers' Association.—Junior Institution of Engineers, 39, Victoria Street, Westminster. Paper by Mr. H. Gough on "The D.C. Pressure Testing of E.H.T. Cables, with Notes on Modern Systems of Fault Finding." 7.15 *p.m.*

Institution of Electrical Engineers (Scottish Centre).—Royal Technical College, Glasgow. Paper by Mr. W. B. Woodhouse on "Overhead Electric Lines." (To be presented by Mr. W. C. Barry, and illustrated by a cinematograph film.) 7.30 *p.m.*

Wednesday, February 13th.

Electrical Contractors' Association (Eastbourne Sub-Branch).—5, South Street. Ordinary meeting.

Rugby Engineering Society.—Benn Buildings. Paper by Messrs. C. H. Holbeach and Dr. Simey on "Application of Electricity in Curing Disease."

Polytechnic.—School of Electrical Engineering, 307, Regent Street, London. Lecture III (Course of eight lectures), by Mr. E. S. Ritter on "Picture Telegraphy." 5 *p.m.*

Electrical Contractors' Association (Sheffield Branch).—Ordinary meeting. 5.30 *p.m.*

Institution of Civil Engineers.—Great George Street, Westminster. Informal meeting. Paper by Messrs. H. P. Gaze and W. H. Patchell on "Merits of Alternative Methods of Driving Auxiliaries in Modern Power Stations." 6 *p.m.*

Thursday, February 14th.

Electrical Contractors' Association (Nottingham Branch).—Ordinary meeting.

Institution of Electrical Engineers.—Institution, Savoy Place, Victoria Embankment, London. Paper by Mr. W. Cruickshank on "Voice-Frequency Telegraphs." 6 *p.m.*

Electrical Wholesalers' Federation.—Savoy Hotel, Strand, London. Annual Dinner. 6.30 for 7 *p.m.*

Institution of Electrical Engineers (Dundee Sub-Centre).—University College. Paper by Mr. W. B. Woodhouse on "Overhead Electric Lines." (To be presented by Mr. W. C. Barry, and illustrated by a cinematograph film.) 7.30 *p.m.*

Friday, February 15th

Institution of Mechanical Engineers.—Storey's Gate, Westminster. Annual general meeting. Paper by Mr. H. J. Ward on "Refrigeration on Ship-board." 6 *p.m.*

Electrical Development Association.—Royal Society of Arts, John Street Adelphi, London. Conference on "Organising for Increased Sales—Spring Cleaning Season, 1929." Speaker, Mr. H. W. Roberts. 7.30 *p.m.*

Saturday, February 16th.

Association of Mining Electrical Engineers (Western Sub-Branch).—60, Wind Street, Swansea. Paper on "Fault Localisation," by Mr. S. T. Richards.

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THE ELECTRICIAN

Established 1861. The Oldest Weekly Illustrated Journal of

Electrical Engineering, Industry, Science and Finance.

Bouverie House, 154, Fleet Street, London, E.C.4. Telegrams: "Benbrotric, Fleet, London." Telephone: City 0244 (Ten lines).

[*Closed on Saturdays in accordance with the "Five-Day Week" plan adopted by Benn Brothers, Ltd., and its associated organisations.*]

No. 2646. [No. 7. Vol. CII.] Friday, February 15, 1929. Annual Subscription, 25s. Overseas, 30s.

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Current Topics.

The British Industries Fair.

WITH the opening of both the Birmingham and London sections of the British Industries Fair on Monday, the electrical industry will once again provide one of the largest, and certainly most interesting, collections of apparatus. As usual, the domestic appliances and industrial exhibits will be housed at Castle Bromwich, while at the White City in London, the industry will be largely represented by radio and high-frequency equipment of domestic types. Though the London section is of considerable importance, its interest from the electrical point of view is somewhat eclipsed by the Birmingham section, on account of the fact that the bulk of the heavy electrical equipment is included at the latter place, to say nothing of transmission lines and switchgear for every purpose. As a result, we are becoming more and more inclined to look upon the Birmingham section of the Fair as exclusively electrical; and since, in fact, it is nearly 25% of the show, such a regard is not without excuse. The extent to which the electrical industry has supported this year's Fair will be gathered from the list of exhibitors given elsewhere in this issue. This list is made up of firms whose stands contain items of interest to the industry as a whole, and though some of the stands do not fall within that portion of the Fair known as the Electrical Section, they are nevertheless still worthy of attention. In order that our guide and reference to the Fair at Castle Bromwich may be of even greater value to visitors than it has been in previous years, we include in this issue, a detailed plan of the Electrical Section, indicating not only the stand numbers, but the names of the exhibitors showing at those numbers. This plan, used by itself, will show at a glance whether a required exhibitor is within the Electrical Section, and if he is not, the list will indicate the stand number outside that section. We also include this week a brief review of some of the domestic equipment to be seen, and though, for obvious reasons, it is not possible to cover the whole of the exhibits in the space available, those not reviewed this week will be dealt with in a later issue, together with those of industrial and electrical interest. Evidence of the importance of the domestic side of the Fair is furnished by the arrangements which have been made by the E.D.A. this year for a conference upon the selling of electricity and electrical apparatus on February 22nd, a conference which we feel sure will be well attended and one which we heartily support. In expressing the hope that all readers who can make time to visit Castle Bromwich will do so during the coming fortnight we would also commend to their attention the invitation, which Mr. T. R. MARTIN makes in our correspondence pages, to consider during their visit the question of this annual Fair in all its bearings, and formulate plans and suggestions in regard to its future.

British Overseas Trade.

THE Board of Trade Returns for the month of January indicate to some extent a revival of British industry, showing as they do a big increase in the importation of raw materials, with an improvement in exports of £6 485 278 when compared with the previous month. The total imports for January amounted to £116 064 145, representing an increase on December, 1928, of £14 612 255, but, since this increase included £8 074 390 for raw materials, the figures may be taken as an expression of the confidence of manufacturers, since most of these materials will be made up and shipped abroad as manufactures. The coal position, so far as exports are concerned, showed a decline during January, 1929, of £805 120 when compared with the same month of 1927, and an improvemnt of £401 580e on the figure for January, 1928. The proportion of increase and quantity however, shows that whereas in January, 1927, 4 092 879 tons were shipped, at a value of £4 290 806, during January of this year 4 372 631 tons were shipped, at a value amounting to only £3 475 676. Similarly, comparing January, 1929, figures with those for the same month last year, shows us that, though 567 931 tons more were shipped abroad last month, the increase in value was only £401 580. Contributing to the total increase in exported manufactured goods during January were electrical equipment and apparatus which, as will be gathered from the detailed figures published elsewhere in this issue, amounted to £1 614 301 as against £1 546 691 for January, 1928, the increase being £67 610. Imports of electrical goods during January of this year amounted to £598 095, or £25 341 more than for the same month last year, thus giving a favourable balance of exports over imports of

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£1 016 206, an increase of £42 259 on the position at the same time last year. The increase in imported goods is largely due to telegraph and telephone instruments, various wires and cables, excluding submarine cables. On the export side improvement is shown in such items as motors and generators other than railway and tramway motors, rubber and other insulated wires and cables, glow lamps, and so on; submarine cables, on the other hand, declined by £11 464. These, the first returns for the current year, are decidedly hopeful, and with the British Industries Fair to assist us there is no reason why the months yet to come should not be equally hopeful. Though the electrical figures for January may be regarded as satisfactory, it should at the same time be remembered that many overseas electrical buyers withhold their purchases until after the British Industries Fair, and though our electrical exports for January amounted to £1 614 301, much additional trade anticipated in January has yet to come.

"Tote" Developments.

WE have every reason to believe that the early indications given in these columns of the big new electrical field presented by the decision of the Racecourse Betting Control Board to instal Totalisators on British racecourses had been vigorously followed up by certain electrical firms in this country, and that there will be keen competition in tendering for the necessary equipment, in respect of which bids have this week been invited. We hope in an early issue to give more technical details of systems designed to meet the complicated requirements of the Board.

Craigweil House.

IN connection with the King's journey last week to Craigweil House, Bognor, it is interesting to note that the BOGNOR GAS AND ELECTRICITY CO. has laid a special main in connection with an auxiliary supply thereto, over 700 yards of cable having been placed and jointed in three days. This supply, we understand, is principally for cookers, of which three large models have been installed, thus leaving the existing plant of Sir ARTHUR DU CROS, to deal with the lighting load. In addition, it is thought that several heating circuits on the original installation will have to be transferred to the company's supply. We understand from Mr. H. A. HARDING, the electrical engineer of the company, that the offers of manufacturers to loan plant, cookers, and electric fires for use in Craigweil House have been innumerable, and while present requirements are more than satisfied, we feel sure that future needs will meet with an equally wholehearted response.

The Profession Honoured.

COL. EDGCUMBE fittingly expressed the feelings of the electrical engineering profession when he described the PRINCE OF WALES'S acceptance of the honorary membership of the Institution of Electrical Engineers as an honour not only to the Institution but to the whole electrical profession. The interest of the Royal Family in general, and of the PRINCE OF WALES in particular, has in the past been of considerable service to a developing industry, and the outward and visible sign of this interest is a logical sequel. As an electro-farmer the Prince has already a more than nodding acquaintance with some of the practical applications of electricity, and it may not be unreasonable to hope that his experiences on the well-equipped electric farm at Lenton will in due course be set down for the benefit of fellow members of the Institution.

Organising for Increased Sales.

HAVING dealt rather severely, but not, we think, unjustly, with the "angle" of some of the speaking at recent E.D.A. Salesmanship Conferences, we look hopefully to the meeting which is to be held at the Royal Society of Arts this (Friday) evening to restore the right perspective. The subject for discussion is "Organising for Increased Sales—Spring Cleaning Season, 1929," and as the meeting is being opened by Mr. H. W. ROBERTS, one of the outstanding figures in electrical sales management, with Mr. F. W. PURSE in the chair, an interesting and stimulating evening may confidently be anticipated. If—as we persist in believing—contractors and commercial engineers in the London area prefer the planning of sales organisations to the exchange of reminiscences at a *sales* conference, seats will be at a premium and arrival before the advertised time of the meeting a desirable precaution.

Catalogue Economy.

So much money is spent each year by engineering firms in the production of catalogues, and so much of this expenditure is wasted because the catalogues get into the hands of people who are not particularly interested, that any scheme for reducing the proportion of unprofitable copies is of interest, as tending to free money for expenditure on other publicity activities. A promising essay has been made in this direction by a firm of chain drive manufacturers. In a recent catalogue they inserted a folded wrapper addressed to themselves, bearing, on an inside fold, the following note:—"This is an expensive publication. If you have no further use for it, please be good enough to return it to us in this wrapper, and we will be pleased to refund the postage." We have no knowledge of the extent to which this invitation has been complied with, but the idea seems to merit a trial.

Still Life.

IF further evidence were needed of the undoubted fact that electricity has emerged from the infant stage, we would wax enthusiastic over the discovery that a Continental artist has included in one of his still-life pictures a representation of an electric lamp. Its precise relation—practical or spiritual—to the pots of cacti and the sheet of postage stamps which share the surface of a table top in a window, is not obvious. It may be that the layman's description of the lamp as an electric bulb was considered sufficient reason for this unusual conjunction with specimens of plant life.

Money for Research.

IT is, we think, a reflection on an otherwise progressive industry, that the operations of the organisations concerned with co-operative publicity and co-operative research are hampered by meagre financial support from those who stand to gain most from their activities. We, therefore, commend to all concerned the plea made by Mr. C. P. SPARKS, in a speech reported on a later page of this issue, for a larger contribution, particularly from the electricity supply industry, to the funds of the British Electrical and Allied Industries Research Association. While there can be few who do not pay at least lip-service to the value of the work already achieved by this Association, we fear that neither the direction nor the extent of these services is generally appreciated. It should, for instance, be understood that co-operative research need not, and does not, interfere with, or overlap the independent researches carried out by a growing number of individual firms. In fact, observation has shown that the general trend of co-operative research has been to encourage independent private research. It is obvious that certain fundamental researches which would usually be undertaken contemporaneously by private research organisations, all searching in an unco-ordinated manner for the same thing, are better and more economically undertaken by a central body like the B.E.A.I.R.A. Then, looking at the financial side, it may confidently be asserted that co-operative research on electrical problems has justified itself up to the hilt. In round figures the Association has spent £160 000 during the last eight years. In return, it is already able to show an annual saving to the industry of nearly £1 000 000 as the result of seven specific researches. For the next five years, at least, an annual research expenditure of £50 000—twice the present figure—is desired. We hope the increased contribution will be forthcoming, for, as Col. EDGCUMBE has said, money spent in this direction is a really safe investment, and is bound to come back.

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EXPERIMENTAL METHODS FOR DETERMINING THE DISTRIBUTION OF ELECTRIC AND MAGNETIC FIELDS.

Problems Demanding New Methods of Calculation—Scope of Mathematical Methods—The Graphical Process—Use of the Magnetic Potentiometer—The "Electrostatic Probe."

By B. HAGUE, D.Sc., Ph.D., A.M.I.E.E. (Lecturer in Electrical Engineering, Glasgow University).

THERE has been, in recent years, a continually increasing interest among designers in the accurate determination of the distribution of electric and magnetic fields met with in engineering practice. The enormous development of modern electrical engineering has called into being a large number of problems to which the older methods used for the calculation of electric stresses or for the estimation of magnetic permeance provide, at best, inadequate solutions. For example, the high voltages used in modern electrical transmission plant have rendered necessary much more refined ways of dealing with the problems of insulation design in generators, transformers, transmission line insulators and cables than have hitherto been required. Again, in the theory and design of electromagnetic machinery the importance of an accurate knowledge of the magnetic flux distribution, especially of the leakage field in large modern generators and transformers, cannot be over-estimated when it is remembered that the solution of such practical problems as the economical calculation of excitation, the predetermination of reactance and regulation, and the computation of short-circuit forces depend upon such knowledge. It is not difficult to appreciate, therefore, the importance of an exact investigation of the electric and magnetic fields in order that more precise methods of design, such as modern practice renders necessary, may be obtained. The results of such an investigation are rendered requisite, not only in design, but also in the theory of the internal interactions in electrical machinery, wherein many difficult and complex problems still await solution.

Satisfying Laplace's Equation.

Confining attention for the moment to the electric field of a system of charged conductors maintained at specified potentials, it is well known that the qualitative and quantitative properties of such a field can be completely expressed if we are able to map out the equipotential surfaces and the lines of force (or better, the tubes of electric induction) which characterise the field. In other words, we must seek for (i) an electric potential function which will satisfy the potential conditions imposed at the boundary conductors, and which will express the distribution of potential throughout the field in such a way that Laplace's equation is satisfied: (ii) an electric flux or stream function which characterises the lines of force (these necessarily cutting orthogonally through the equipotential surfaces, starting and finishing on charged conductors) and which also satisfies Laplace's equation. The satisfaction of Laplace's equation by the potential and flux functions, which in three-dimensional cartesian co-ordinates may be written

$$\frac{\delta^2 f}{\delta x^2}+\frac{\delta^2 f}{\delta y^2}+\frac{\delta^2 f}{\delta z^2}=0,$$

where f is the potential or flux function as desired, expresses respectively the physical conditions, (i) that tubes of electric induction are continuous, that, is, the electric flux into a small element of volume is equal to the flux issuing therefrom; (ii) that the line integral of the electric force is zero round any closed path, in particular when of infinitesimal size. Such a field is a non-curl or scalar potential field, and in most problems found in engineering practice exists in a single dielectric medium, though there are many important instances where at least two media may be involved—e.g., the electric field in the porcelain of an insulator and in the surrounding air.

If we now briefly examine the magnetic field of an electrical machine, this field exists partly in regions of permeable iron and partly in regions of air; it is, moreover, produced by the action of currents flowing in conductors which are accommodated within or upon the iron members, and is consequently a curl or vector potential field. In the strictest mathematical and physical sense, such fields are not amenable to treatment by processes derived for use in dealing with non-curl or scalar potential fields, though by the adoption of some conventions and approximations we may make valuable use of those processes. We observe in the first place that the iron parts have usually a high permeability, so that the magnetic tubes of induction cross the interfaces between the iron and air regions in such a way that on the air side they are practically perpendicular to those surfaces; these surfaces will exhibit apparent north or south magnetisation as the case may be. Practical interest is largely centred in the air-space field. If, therefore, the region of the air-space field under consideration is such that it is not under the immediate local influence of the magnetising coils (as would be the case in the field under a pole, but not in the cases of the interpolar field issuing from a pole core or of the field inside a slot) we may picture the field as if it were set up in the air by a distribution of "magnetic potential" upon the bounding iron surfaces. With this idea in mind, it is possible to treat certain magnetic fields as if they were scalar potential fields—i.e., to solve them by the processes used for electrostatic problems.

Serious Limitations.

Unfortunately when we come to seek for the necessary solutions serious limitations are immediately imposed. All our problems are essentially three-dimensional and of such complexity as to be quite outside the range of mathematical analysis; moreover, of the available experimental, methods few are adaptable to three-dimensional problems and even those few present considerable difficulties. We are compelled, therefore, to divide up our three-dimensional fields into portions, each of which may be regarded with sufficient practical approximation as two-dimensional. In somewhat greater detail, we find a portion of our complex field wherein there is one direction in which the electric (or magnetic) force is practically zero; take this direction as the axis of z for the portion concerned and draw the plane of x, y, normal thereto. The form of Laplace's equation then is:

$$\frac{\delta^2 f}{\delta x^2}+\frac{\delta^2 f}{\delta y^2}=0.$$

Then the field can be fully depicted by drawing in the x, y plane a system of equipotential lines cut orthogonally by a system of lines of force; movement of this plane in the direction of z traces out the entire field in the region under consideration. When such a plane field map has been drawn it is a simple matter to compute from it the value of the electric stress at any point or the electrostatic capacity, if the problem be an electrostatic one, or the magnetic force and magnetic permeance, if the problem concern a magnetic field. Each approximately two-dimensional region may be so treated, and there become available a large variety of methods, both mathematical and experimental, by which solutions of such potential fields may be obtained. Some care is necessary in determining the way in which the field is apportioned, particularly in treating those parts where the solutions of different portions are to be fitted together.

The terms "lines of force" and "equipotentials" are given to the respective systems of orthogonally intersecting curves entirely on physical grounds; mathematically there is no distinction between them. It follows, therefore, that every field map, whether mathematically or experimentally obtained, is the solution of two distinct physical problems: one in which the two sets of lines are given their normal nomenclature and the other when their physical meanings are interchanged. This fundamental conjugate property is often made use of in practical work in order to provide both sets of lines.

It is not our intention here to enter into a discussion of the mathematical methods used for the solution of two-dimensional field problems, but we may briefly remind the reader of their scope. A large number of solutions to important engineering problems have been found by the use of the theory of conjugate functions, conformal representation and the Schwartz-Christoffel transformation, with both electric and magnetic applications. Considerable progress has been

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made in the treatment of the magnetic fields of currents both inside and external to the conductors—i.e., of two-dimensional vector potential fields, by combination of the method of images and simple Fourier's series in the work of Searle, Rogowski, Strutt, and the present writer, and by the use of double Fourier's series in the remarkable work of Roth. All these mathematical methods require for their use considerable mathematical skill and experience, and are often very laborious when numerical solutions are required. Many problems, also, are only formally soluble, the analytical work being of prohibitive complexity and difficulty. Hence it is necessary to use experimental ways of solving the problem of the two-dimensional field, particularly in those cases where mathematical methods fail to provide a useful solution. A considerable number of different physical phenomena have been utilised for this purpose, and it is with these that this paper is chiefly concerned. These experimental methods are of two classes. In the first class are those purely qualitative methods which provide a picture of the field without giving any numerical result—e.g., the use of iron filings in delineating magnetic lines of force. In the second class are the methods which give one or both of the sets of curves of the field map, properly spaced and with complete numerical data from which the quantitative properties of the field may be computed.

It is appropriate here to mention one process which is very much used, especially in France and in America, gives excellent and highly accurate results, and which is directly derived from the mathematical and physical properties of fields; this is the graphical process independently introduced by Richardson * and by Lehmann,† and brought to perfection by the latter. Briefly the method consists in drawing the boundaries of the field and marking their potentials; then, taking account of any obvious conditions of symmetry which the field must have, a freehand sketch of the possible shapes of the equipotentials and lines of force is made. This sketch will have obvious errors, which are corrected by making a second sketch on a sheet of tracing paper put over the original map. This is again amended, and so on, until the two systems of curves intersect accurately at right angles and divide up the whole field into small curvilinear rectangles all of which have the same ratio of mean length to mean breadth; this can be ensured partly by judgment by the eye and partly by the use of dividers. The method is somewhat tedious and requires not a little experience, but by adopting a systematic procedure and using suitable standard charts, as described by the inventors of the method, the work can be considerably reduced; the field maps obtained by its aid are in very close agreement with the results of mathematical analysis. Lehmann has solved a very large number of hitherto unsolved problems by the use of this method, and has extended its application to the treatment of the field inside current-carrying conductors‡ and to magnetic fields where the boundary iron is not infinitely permeable. The method is extremely valuable when used in conjunction with an experimental method, even of a merely qualitative kind; if, as is better still, the latter gives definitely one set of curves, e.g., the equipotentials, Lehmann's process enables the other set to be added and the field map completed with great ease and precision.

Another trial and error method has been applied by Müller§ to the solution of magnetic problems, the general procedure being as follows. The field region is set out on drawing paper and the boundary potentials are indicated; the entire region is divided up into small squares, values of potential being marked by trial at the corners of the squares. From the principles of the calculus of finite differences, it is not difficult to show that the value of the potential at the middle of each square is the arithmetic mean of the values at its corners. Proceeding systematically along the rows of squares the mid-point values are calculated from the trial corner values. Then, by extending the process, these calculated mid-point potentials may be used to check the original guess at the corners. Discrepancies will necessarily occur; the original trial values are adjusted and the process repeated successively until improvement is satisfactory. The potentials at a series of points being thus determined, it is easy to draw lines of equipotential; a precisely similar method may be applied to find the flux function and lines of force. The process is often rather slow, but the arithmetical labour can be considerably lightened by the use of a calculating machine or suitable charts.

Direct Depiction of Fields.

The simplest direct method of depicting the lines of force of a magnetic field in air is by the use of iron filings strewn upon the surface of suitably situated pieces of glass or card. The method, which is naturally only qualitative, is too well known to require detailed description. It has often been used as a guide or as a check in accurate work, beautiful examples of its application in this way being found in the classic papers of Du Bois.*

It is not very well known, however, that the lines of force of an electric field can be easily depicted by an analagous method. In one form of the process † suitably shaped tinfoil electrodes are stuck upon a sheet of plate glass, the surface of which has been strewn with a finely powdered dielectric material. The powder should be one in which the particles are not too small and are of an elongated shape, so that they may experience directive forces tending to align them with the electric field when a p.d. is applied to the electrodes by means of an influence machine; suitable powders are tourmaline, gypsum, glasswool, mica dust, mahogany dust, and even tea! Deutsch has investigated by this method the electric field in three-core cables. In a second form of the process‡ a shallow, flat-bottomed dish of large diameter is filled with turpentine into which a suspension of a fine dielectric powder in turpentine has been stirred; suitable electrodes are immersed in the liquid and, when the agitation has subsided, a p.d. is applied. The particles set themselves along the lines of force and are ultimately precipitated upon the bottom of the dish in that form; they can then be photographed. Seddig recommends for the powder either quinine sulphate or the aniline dye, glycin; alternatively, melted paraffin wax may be used instead of turpentine, with an indicator of fine particles of wood charcoal, the wax being allowed to set when the field has arranged the particles in position.

Quantitative Methods.

Turning from direct qualitative to quantitative exploration of the magnetic or electric field the best methods measure the potential differences between points in the field. For the magnetic field the magnetic potentiometer,§ invented by

* L. F. Richardson, "A freehand graphic way of determining stream lines and equipotentials." *Phil. Mag.*, Vol. XV, 6th series, pp. 237-269, 1908. "The approximate solution of various boundary problems by surface integration combined with freehand graphs," *Proc. Phys. Soc.*, Vol. XXIII, pp. 75-85, 1911.

† T. Lehmann, "Méthode graphique pour déterminer le trajet des lignes de force dans l'air," *La Lum. Elect*, Vol. VIII, 2nd series, pp. 103-110, 137-142, 163-167, 1909; also *Elekt. Zeits.*, Vol. XXX, pp. 995-998, 1019-1022, 1909. "Sur la réluctance de l'entrefer des machines a encoches ouvertes dans le stator et dans le rotor," *Rev. Gen. de l'El.*, Vol. XIII, pp. 165-173, 1923.

‡ T. Lehmann, "Détermination graphique des champs magnétiques laplaciens et tourbillonnaires à lignes de flux planes," *Rev. Gen. de l'El.*, Vol. XIV, pp. 347-357, 395-403, 1923. "Spectres ferromagnétiques," *ibid.*, Vol. XIX, pp. 43-50, 85-91, 1926. "La détermination des champs magnétiques partiels et résultants dans les dynamos saturées," *ibid.*, Vol. XXII, pp. 1105-1119, 1927. See also A. D. Moore, "Mapping magnetic and electrostatic fields," *Elect. J.*, Vol. XXIII, pp. 355-362, 1926; A. R. Stevenson and R. H. Park, "Graphical determination of magnetic fields," *G. E. Rev.*, Vol. XXXI, pp. 99-109. 153-164, 1928. There are in addition numerous papers in which the method is applied to specific problems.

§ A. O. Müller, "Ueber eine neue Methode zur Zeichnung der Feldbilder magnetischer Kraftlinien," *Arch. für Elekt.*, Vol. XVII, pp. 501-510, 1927. Müller ascribes the process to Liebmann, "Verfahren zur nummerischen Lösung partieller Differentialgleichungen zweiter Ordnung," *Sitz. der Bayerische Akad. der Wissen.*, 1918.

* See for example, H. Du Bois, "On magnetic shielding," *Elecn.*, Vol. XL, pp. 218-219, 316-317, 511-514, 652-654, 814-817; Vol. XLI, pp. 108-110, 1898.

† D. Robertson, "Dust figures of electrostatic lines of force," *Proc. Roy. Soc. Edin.*, Vol. XXII, pp. 361-365, 1900. C. Fischer, "Eine neue Methode der Darstellung elektrischer Kraftlinien," *Phys. Zeits.*, Vol. IX, pp. 221-222, 1908. W. Deutsch, "Die elektrische Festigkeit der Kabel," *Elekt. Zeits.*, Vol. XXXII, pp. 1175-1178, 1911.

‡ R. W. Chapman, "Lines of electrical induction," *El. Rev.*, Vol. XXIV, pp. 683-684, 1889. M. Seddig, "Darstellung des Verlaufes der elektrischen Kraftlinien, und insbesondere ihrer Richtungsänderungen durch Dielektrika," *Ann. der Phys.*, Vol. XI, 4th series, pp. 815-841, 1903 (important paper with numerous references). G. Addenbrooke, *Journal I.E.E.*, Vol. LXI, pp. 1141-1143, 1923.

§ A. P. Chattock, "On a magnetic potentiometer," *Proc. Phys. Soc.*, Vol. IX, pp. 23-26, 1888. W. Rogowski and W. Steinhaus, "Die Messung der magnetischen Spannung (Messung des Linienintegrals der magnetischen Feldstarke)," *Arch. für Elekt.*, Vol. I, pp. 141-150, 1913. W. Rogowski, "Ueber einige Anwendungen des magnetischen Spannungsmessers," *ibid.*, Vol. I, pp. 511-527, 1913. E. Alberti and V. Vieweg, "Untersuchungen an Stromwandlern. Der Magnetisierungsstrom," *ibid.*, Vol. II, pp. 208-216, 1914. F. Goltze, "Ueber die Verwendung des magnetischen Spannungs-

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Chattock in 1888 but reintroduced and developed by Rogowski in 1913, is the most important instrument.* The magnetic potentiometer consists of a flexible non-magnetic core, such as a strip of card or a piece of rubber-canvas hose, over which a coil of fine wire is uniformly and closely wound, preferably in an even number of layers. This coil is connected by twisted leads to a sensitive ballistic galvanometer. If one extremity of the coil be kept in a given position while the other is suddenly moved from a point A to a second point B in the field, it is not difficult to show that the transient throw of the ballistic galvanometer is proportional to the difference of magnetic potential between A and B, independently of the contour of the flexible core. By this means the potential of a number of points can be found relative to A, and from these results the magnetic equipotentials can easily be plotted; if desired the field map may be completed by drawing the lines of force by Lehmann's method. It is clear that the application of the instrument is not limited to two-dimensional investigations. Apart from its use in plotting equipotentials the magnetic potentiometer is a valuable instrument in research and has been used in the magnetic testing of iron, especially curved or very small specimens; the investigation of the distribution of magnetic potential over portions of a magnetic circuit; and in the measurement of the magnetisation characteristics of instrument transformers.

For the direct exploration of the equipotentials in an electric field the "electrostatic probe" of Semenoff and Walther† may be used. The two electrodes, between which the electric field is to be investigated, are joined to the terminals of a source of alternating voltage in parallel with a potential divider resistance. A testing electrode or "probe" (Sonde) is then inserted in the field and is connected through a telephone to the slider of the potential divider. If the testing electrode has the form of a portion of an equipotential surface it can be put into a position in the field where it coincides with part of such a surface; the telephone then emits a minimum sound, and by movement of the slider this sound may be made to disappear. Retaining this setting of the slider, the probe may be moved to a new position giving zero sound and so on, until the whole of the equipotential surface corresponding to the setting has been traced; the process is then repeated for other surfaces until an adequate map of the equipotentials has been found. The probe will be a small plane for the testing of the field between plane electrodes, a ring for a field with axial symmetry, or a thin straight wire for the exploration of the two-dimensional field between parallel cylindrical electrodes. The method has recently been used to plot the equipotentials in three-core cables;‡ enlarged models of the cores and sheath were made of sheet metal and the field, with air as the dielectric, was explored by the use of a thin wire probe.

These methods are all that have been described in technical literature for the direct investigation of magnetic and electric field distributions.§ We will next turn to methods in which we make use of the analogy between the potential and flux functions which characterise the magnetic and electric fields and the corresponding quantities found in other branches of physics where Laplace's equation is satisfied.

(To be continued.)

messer bei der Prüfung der magnetischen Eigenschaften des Eisens," *ibid.*, Vol. II, pp. 303-313, 1914. A. Campbell and D. W. Dye, "The magnetic testing of bars of straight or curved form," *Journal I.E.E.*, Vol. LIV, pp. 35-46, 1916. W. Rogowski, "Die Messung des elektromagnetischen (Poyntingschen) Energieflusses. (Messung des lokalen Eisenverlustes), *Arch. für Elekt.*, Vol. IV, pp. 279-293, 1916. W. Wolman, "Ueber ein Verfahren der Eisenprüfung mit dem magnetischen Spannungsmesser. Messungen an Eiseneinkristallen," *ibid.*, Vol. XIX, pp. 385-404, 1928.

* For another instrument, working on a compensation principle, see R. Goldschmidt, "A method of measuring magnetomotive forces," *Elecn.*, Vol. LIV, pp. 207-208, 1905.

† N. Semenoff and A. Walker, "Ueber eine Methode der Erforschung von elektrischen Wechselfeldern," *Zeits. für Phys.*, Vol. XIX, pp. 136-140, 1923.

‡ V. Fock, W. Malyschew and A. Walther, "Elektrische Felder einiger Hochspannungskabel," *Arch. für Elekt.*, Vol. XIX, pp. 463-471, 1928. For a somewhat similar method see T. Hayakawa, "Die Feldverteilung in Drehstromkabeln," *Journal I.E.E. Japan*, No. 473, pp. 1314-1345, Dec., 1927.

§ The following papers are of interest in connection with filings diagrams:—P. E. Belas and M. Hartog, "On the path of a small permeable body moving with negligible acceleration in a bipolar field," *Proc. Roy. Dublin Soc.*, Vol. XV, new series, pp. 33-40, 1916. W. Cramp, "The path of a small permeable body in a magnetic field," *Elec. Rev.*, Vol. LXXXIX, pp. 786-787, 1921.

BOOK REVIEWS.

Life and Work of Sir Norman Lockyer. By T. Mary Lockyer and Winifred L. Lockyer. (London: Macmillan and Co.). Pp. 474. 18s. net.

The late Sir Norman Lockyer, though best known for his work in the astronomical field, had many points of contact with electrical affairs, as would appear natural in the son of a father who, so long ago as the 1830's was lecturing to the Rugby Literary and Scientific Institution on "electromagnetism," "magneto-electricity," and "electricity." Inspired by Faraday's discoveries, Lockyer senior carried on researches connected with what became known as the electric telegraph. As his biographers say, Norman Lockyer's early years were spent in the atmosphere proper to these inquiries, and to the end of his days he recollected electric batteries located in the corners of some of the rooms of the house, and pieces of apparatus very like some which he saw during the Loan Exhibition of 1876 on a copy of Amperè's table. His literary bent, which early took the form of publishing his discoveries and ideas in technical form for the specialist and popular form for the general public, found various outlets, and in 1864 he was editing The Electrician during the absence of the regular editor; later he became first editor of "Nature."

In the early stages his scientific work was restricted by the apparatus available, but the provision by his friend Mr. (afterwards Sir William) Siemens of a gas engine driven Siemens dynamo, in place of a battery of 30 Grove cells, permitted experiments on a larger scale to be carried out.

In 1903, when his interests turned to meteorology, Sir Norman attempted to establish an accurate system of weather forecasting, and arranged with Mr. Marconi to receive weather reports from the Atlantic by the then novel method of wireless telegraphy; he called these wireless messages "ethergrams."

Of his many and important scientific discoveries, his spectroscopic researches, and of his striking personal qualities it is impossible to write here; they are all set out in very readable form in the book which contains, in addition to the main story, contributions on various aspects of Lockyer's work by Dr. C. E. St. John, Prof. Megh Nad Saha, Sir Napier Shaw, Prof. H. U. Russell, the Rev. J. Griffith, Sir Richard Gregory, and Prof. A. Fowler. B. C.

Practical Aids to Retail Selling. By A. Edward Hammond. (London: Sir Isaac Pitman and Sons). Pp. 160. 7s. 6d. net.

Without unkind intentions it may be said that in no sphere of commercial activity is the art of retail selling in so rudimentary a state as it is in the electrical trade. This is due, of course, to the fact that from the outset the industry's contact with the public was through the electrical installation contractor who held stock or obtained it specially for definite installations, and who was rarely called upon to provide things for casual sales. While circumstances have changed with the development of the use of electricity, the retail side of the trade has not shown corresponding progress, due mainly to the prevalence of the idea that shopkeeping is an undignified rôle for men trained as electrical engineers. Spurred by the competition of the supply authorities, many electrical contractors have in the past few years come to realise the importance of the despised shop, but only a relatively small proportion of them have brought to this new aspect of their business any up-to-date knowledge of the arts of presentation and display which are so important a factor in securing the attention and custom of a sophisticated public. For those who have not kept abreast of modern aids to retail sales Mr. Hammond's book will prove invaluable. Essentially practical and pleasantly written, it contains just the sort of information that is needed to make the show window the good salesman it ought to be, and to facilitate the service of customers. The quality of the author's work is well-known to retailer readers of The Electrician through the series of articles on window display and allied subjects which he has contributed to these columns. It is therefore, unnecessary to do more than indicate the ground covered by the various chapters. Starting with emphasis on the importance of retailer-manufacturer co-operation, he deals in turn with the printed appeal in the shop window; colour as an aid to display; price marking in the window; showcard printing machines; illuminated publicity and modern shop signs; moving display aids in the window; wax and papier maché models; linking up with press and cinema advertising; supplementary display aids; combining storage with display; modernism in display; and aids to quick service, and packing accessories. H. B.

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THE I.E.E. DINNER.

Prince of Wales Accepts Honorary Membership—L.C.C. Encourages Electricity for Tenement Dwellings—Electricity as the Antidote to Civilisation—Australia and the "Grid"—French Invitation for Summer Meeting Accepted.

THE annual dinner of the Institution of Electrical Engineers was held at the Hotel Cecil, London, on February 7th, when the President, Lt.-Col. Kenelm Edgcumbe, presided over an attendance of more than 600 members and their guests, among whom were Admiral of the Fleet Sir Charles Madden, Sir Ernest Rutherford, Air Marshall Sir H. M. Trenchard, Sir William Bragg, Sir Charles Parsons, Col. R. E. Crompton, Sir George Sutton, Sir Joseph Petavel, Sir J. R. Brooke, Sir Philip Nash, Col. T. F. Purves, Mr. W. T. Leech, the Earl of Clarendon, and Mons. P. Bunet. Special interest was lent to the proceedings by the announcement made during the evening that the Prince of Wales has consented to become an honorary member of the Institution.

Lt.-Col. C. B. LEVITA, chairman of the London County Council, in proposing "The Institution of Electrical Engineers," said that as the representative of a body responsible for the local government of some five million people, he was very appreciative of the work of the Institution. A thoroughly representative body of electrical engineers, it was not only of national fame and importance, but also of international relationship. Time would not permit a definition of the scope and magnitude of electrical applications, but they could be said to cover every industrial and commercial requirement of modern civilisation.

As a layman, he thought it was remarkable that, for so many ages this vast power should have lain dormant. From the time of the ancient Greeks with their amber experiments there was a very great hiatus until one came to the patron saint of electricity, Michael Faraday. He also thought we lacked the boosting properties of some of our friends, for if there was one science in the world for which Englishmen could take full credit, it was that of electrical inventions and development, with which the names of such men as Kelvin, Clerk Maxwell, Swan, Siemens, Bell, Hughes, Fleming, Ferranti, and Parsons, were indelibly associated.

There was, he thought, too much talk of the infancy of electricity. Electrical engineering to-day was a very healthy adult; its latest child was radio broadcasting, and waiting to be born was television.

He wondered whether the great developments of the last century could be traced to the advances made at the same time in education. It could at least be said that even if education had not produced these inventions it had produced a body of intelligent people who could make use of them.

Electricity for the Working Classes.

The London County Council was a very large user of electrical power, not only for transport, but for lighting and other applications. He was happy to say that they were now able to make electricity available for working-class dwellings. In L.C.C. estates of this character, there were at least 100 000 lamps installed, and these dwellings provided a load of some 4 000 kW for heating and cooking, while a further 8 000 kW was in preparation. In one block of their tenements alone, the tenants used as much electrical energy as a modern battleship, and he thought a load of 7 kW per tenement was fairly creditable.

The number of students receiving education in electrical work under the auspices of the L.C.C. was very great, and he was glad to say that this work was greatly facilitated by the Institution of Electrical Engineers.

Lt.-Col. KENELM EDGCUMBE, responding to the toast, announced that the Prince of Wales had consented to become an honorary member of the Institution. All who had heard the Prince's speech at their dinner two years ago must have been struck by the insight into electrical matters which he then displayed. It was therefore fitting to place on record their deep appreciation of the honour which the Prince had accorded, not only to the Institution, but to the whole profession, by becoming an honorary member of the I.E.E.

Apropos Col. Levita's references to the services which electricity had rendered to civilisation, Col. Edgcumbe recalled having heard civilisation described as a disease through which all had to pass, and from which many succumbed. If this were correct the common debt to electricity was even greater than was generally conceded. The most prominent symptom of the disease was a desire for speed, and to squeeze 90 minutes into every hour. It might be called the Einstein complex; and we were all suffering from it, though, perhaps, not so acutely as the lady of the limerick who "went out one day in a relative way, and came back on the previous night." Our only saviour was the electrical engineer with his labour and worry-saving devices, without which a large proportion of the populace would be occupying padded cells. But whether one called electricity an ally of civilisation, or its antidote, it was in either case absolutely essential.

Cheapness of Electricity.

Recent inspection of the Board of Trade cost-of-living index had shown, Col. Edgcumbe continued, that while commodity prices were considerably above pre-war figures, the cost of electricity was slightly below, in spite of the fact that coal prices had increased by 80 per cent. As the item for fuel and light in the B.O.T. index was 70 per cent. above pre-war he decided to make inquiries, as the result of which he found that the Board of Trade had apparently never heard of electricity, because the only items allowed were coal, oil, candles and gas. It was, high time that they revised the index.

In conclusion, the President referred to a suggestion that the "grid" should be enlarged to take in Australia. The reason of this was that as the hours of darkness in Australia corresponded with the hours of daylight in England, power stations would have a twenty-four hour load. A further advantage was that if Australia burnt the coal we might carry away the Ashes.

Mr. W. B. WOODHOUSE, who proposed "Our Guests," endeavoured to associate electricity with the five senses. Touch could be represented as the muscular effort which electricity replaced by the pressing of a button, eliminating drudgery and increasing production. As to taste, electricity helped the agriculturist to produce more and better food at less cost, abated the rigours of our climate, and persuaded the hen to work overtime and lay more eggs, while electric cooking and refrigeration would produce devilled kidneys or iced drinks to perfection. With regard to hearing, those who controlled the "mikey" paths of communication could claim that electrical communication was changing the habits of the world. By twisting a few knobs one could listen to all the countries of Europe, and could hear such musical masterpieces as "All by Yourself in the Moonlight" in twelve languages. The connection with the sense of sight was obvious, for the electrical engineer was illuminating the dark places of the world. The working classes could now enjoy its light instead of the candles and oil lamps of a bygone day, and instead of something not as good as either, which they had since used. Having dealt with four senses, Mr. Woodhouse acknowledged his inability to complete the task, as it was a recognised fact that electricity could not make a smell.

Referring to the presence among other distinguished guests of Mons. Paul Bunet, President of the Société Française des Electriciens, Mr. Woodhouse mentioned that the French society had invited the Institution to hold its next Summer Meeting in France, and that the invitation had been accepted.

THE EARL OF CLARENDON, who with Mr. H. T. Tizard, responded to the toast, said the Institution of Electrical Engineers, was correctly described as the representative body of electrical engineers in this country, and its founders had justly earned the title of true prophets in their realisation of the wide scope of the science in the days that were to come; exactly fifty-seven years ago one of their early members had said that electrical science would ultimately embrace every operation in nature, a prophecy which had been remarkably well realised. Electrical science to-day had not only transformed life but had accelerated civilisation and broadcasting was only one of the many current examples of that application of this science. Already about one in every three households in this country was equipped with some sort of wireless receiving apparatus. This meant that between 25 and 30 million people could hear and enjoy broadcast entertainment.

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ELECTRICAL INSTALLATION PRACTICE.

Continuity in Theory and Practice—The Cheap Installation for Small Houses—Need for Insulated Switches—New Switchboard Design.

By W. B. ROGERS, A.M.I.E.E.

WHEN one has absorbed the mass of literature on electrical installation topics, it will be realised that the best type of job, at the highest first cost, comprises 2 500 megohm grade v.i.r. cables, drawn into ¾ in. screwed conduit, and with an abundance of boxes to facilitate drawing in, repairs and extensions, etc., provided that horizontal conduit runs of any length are provided with a sufficient number of open tee pieces at intervals to ensure adequate ventilation.

No matter how or when erected, hemp cord or red lead at the screwed joints should in no cases be permitted or used. I know of a large installation carried out in London some three years ago where red lead was used at the screw threads by a firm of reputable electrical installation contractors, and I feel fairly confident that metallic continuity of the presumably earthed conduit system never did and never will exist, owing to the clogging insulation of red lead.

However, the foregoing applies to what is supposed to be an expensive, good-class job, whereas to-day we are more concerned with what is broadly termed, cheap small house installations comprising, say, 3 to 20 lighting points, and unfortunately usually a very meagre supply or equipment of standard interchangeable plug points, for other uses, such as domestic utility appliances.

Of literature on the subject there has been a flood during the past few years. I would, however, particularly draw the interested reader's notice to the following: "Modern Electric Wiring as Applied to Small Houses," by D. S. Munro (Proceedings of the Institution of Electrical Engineers, Vol. 66, No. 379, 1928; "Domestic Electrification: Its Development and Equipment," by J. L. Carr and J. D. Peattie (paper read at the I.M.E.A. Convention at Bath, during June, 1928).

Slip tube jobs have now served their purpose, and to my mind are out of date, as also is wood casing. The best that can be said of the former is that it is cheap, and, like most cheap things, nasty. It certainly does not cover the field of security and safety. How often does one actually find continuity of light gauge slip conduit to exist?

Frequently one finds a slip conduit section of an installation terminating at a wood block, the latter surmounted by a 5 A metal covered tumbler switch, the latter having the customary porcelain insulated base. Frequently the operator thereof is a lady standing on the conductive floor of a scullery or kitchen, and I have personally known of a number of cases where the switch manipulator has received a shock to earth, or even a minor shock from finger to wrist. To-day safety and security demand that we should give up the metal covered s.p. switch and instal something akin to the bakelite insulated variety.

From the point of view of the owner of a small installation the screw conduit system is too costly. The cheap slip tube competitor should be ruled out on the score of security and safety. It is now about seventeen years since tough rubber covered conductors were introduced and promptly became popular and known as C.T.S. Cubs of the date in question have disappeared, but the sterling properties of cab tyre sheathed cables and wire endures with ever increasing popularity. The C.T.S. system has of late been supplemented by another tough rubber compound known and marketed by the respective makers as "Maconite" and "Lecite."

With any of the foregoing tough rubber systems I submit that a perfectly safe and secure type of installation can be put in anywhere at a cost not exceeding that of the ⅝ in. slip conduit variety, with the added advantage of flexibility, neatness and all-round security and efficiency, provided that insulated insulation switches are provided. The main switch fuse for cutting off the entire installation has, however, not yet reached finality, as a really reliable insulated d.p. switch fuse at a reasonable cost, has yet to be put on the market.

At present, therefore, we are driven to put in the ironclad combination. Now, to secure safety and conformity with the regulations leaves us no other course than to earth all metal other than conductors on a safe installation. However, in regard to this latter problem, protection has recently been granted to a device which will, I believe, adequately clear the situation.

Imagine a plywood meter board carrying the whole of the main control devices in addition to the meter. The board in question is covered on the gear carrying side by a metallic conducting sheet, and is also equipped with a substantial earthing terminal. The whole design being such as to enable the earthing terminal to be adequately connected to the lead of the service cable, or the supply side of a house water pipe system. We thus have all metal other than conductors earthed and in conformity with the ninth edition of the I.E.E. Rules.

A point I have so far omitted is the question of distribution boards. Broadly speaking, the small type of home installation herein referred to should include a teak-cased distribution board. I have yet to meet a better article for the purpose than the "Desco" apparatus, which incorporates many advantages, particularly concentric compression virtues as appertaining to contacts and terminals.

AN EARLY CONTRACTORS' DINNER.

MANY of our older readers will be interested in this reproduction of a photograph taken at the first dinner of the London Electrical Contractors' Association in 1902. Mr. G. F. Ratcliff, by whose courtesy the picture is published, recalls that when he was articled in 1880 his employers "favoured" him by accepting a premium of only £210, "but," he adds, "we had a fine training—pushing hand trucks of casing and cable through the streets, filing castings, making small patterns, a term on the lathe, drilling machine, planing, helping with engine and pump and shafting repairs; then a turn at making joints, taking curves of dynamos, coupling in series and parallel, and then out on wiring and plant work. We also had a time in the drawing office and laboratory, with lectures."

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THE BRITISH INDUSTRIES FAIR.

Arrangements for the Official Luncheons at Castle Bromwich—Plan of the Electrical Section of the Fair—Stand Numbers and Names of Exhibitors.

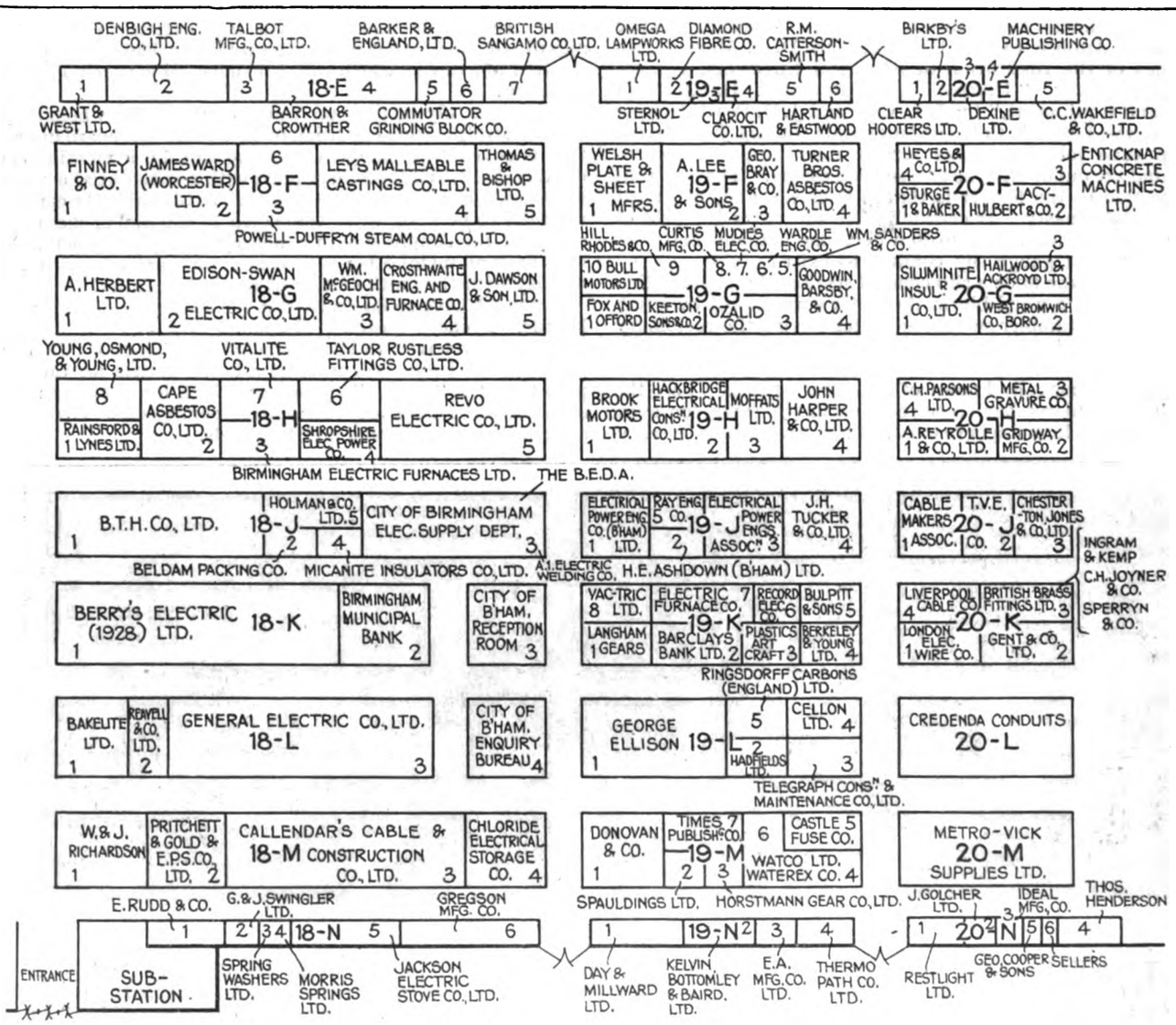
NEXT Monday sees the opening of the British Industries Fair, both at Castle Bromwich and at the White City, London. So far as the electrical exhibits are concerned the majority of the firms engaged in the industry are to be seen at Birmingham, and we give below a detailed plan of the Electrical Section. This includes the stand numbers of exhibitors, together with their names, while on the opposite page will be found a complete list of exhibitors of electrical interest within and outside the Electrical Section.

The arrangements for official visits to the Birmingham Fair, of Associations connected with every phase of electrical industry, are now complete, and a conference arranged by the South Midland Area Committee of the E.D.A. will be held in the Conference Hall on February 22nd, at 11.30 a.m.

A luncheon on the same day in the Royal Dining-Room (Electrical Section) will be attended by representatives of the Incorporated Municipal Electrical Association, the Incorporated Association of Electric Power Companies, the Provincial Electric Supply Association, the British Electrical Development Association, the Municipal Tramway and Transport Association, and the Tramways and Light Railways Association.

Representatives of the Electrical Power Engineers' Association will attend luncheon in the same room on February 23rd, while the South Midlands Students' Section of the I.E.E. will assemble for tea. After luncheon members of the E.P.E.A. will attend a conference in the Conference Hall.

On March 1st a luncheon will be given in the Royal Dining-Room to the Institution of Electrical Engineers, the Association of Consulting Engineers, the Association of Supervising Electrical Engineers, the Electrical Contractors' Association, the Electrical Contractors' Association of Scotland, the Electrical Wholesalers' Federation, Ltd., the Electrical Merchants and Manufacturers' Association, the Illuminating Engineering Society, and the Association of Mining Electrical Engineers. In the afternoon the Electrical Association for Women (Birmingham and Midlands Branch) will be entertained to tea.



A PLAN of the Electrical Section of the British Industries Fair at Castle Bromwich, showing stand numbers and names o exhibitors. A list of firms, including those of electrical interest whose stands are outside the Electrical Section, is given in alphabetical order on the opposite page.

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STANDS TO LOOK FOR AT CASTLE BROMWICH.

List of Exhibitors and Stands of Electrical Interest.

Name of Exhibitor.	Block and Stand No.
Accles and Pollock, Ltd.	16G-1
Aerostyle, Ltd.	14B-2.
Allen-Liversidge, Ltd.	14J-4.
Anchor Cable Co., Ltd.	20J-1.
Ashdown, H. E. (Birmingham), Ltd.	19J-2.
Attwood's Spraying Equipments, Ltd.	16F-6.
Avery, W. and T., Ltd.	15L-1.
Bakelite, Ltd.	6G-2, 18L-1.
Berkeley and Young, Ltd.	19K.
Berry's Electric (1928), Ltd.	18K-1.
Birkby's, Ltd.	6C-5, 20E-2.
Birmingham, City of, Elec. Supply Dept.	18J-3.
Birmingham Electric Furnaces, Ltd.	18H-3.
Blackstone and Co., Ltd.	15H-3, 15J-2.
Bray, Geo. and Co., Leeds	11E-2, 19F-3
Britannia Tube Co., Ltd., Birmingham	14C-1.
British Brass Fittings, Ltd.	20K-3.
British Electrical Repairs, Ltd.	16H-2.
British Sangamo Co., Ltd.	18E-7.
British Thomson-Houston Co., Ltd.	18J-1.
Bromford Tube Co., Ltd.	12K-1.
Brook Motors, Ltd.	19H-1.
Brown, S. G., Ltd.	16L-3.
Bull Motors, Ltd.	19G-10.
Bulpitt and Sons, Ltd.	5G-1, 19K-5.
Buncher and Haseler, Ltd.	4H-1.
Cable Makers' Association	20J-1.
Callender's Cable and Construction Co., Ltd.	18M 3,A-4,
Canning, W. and Co., Ltd.	17K-1.
Cape Asbestos Co., Ltd.	18H-2.
Carron Company	14E.
Castle Fuse and Engineering Co.	19M-5.
Chesterton, Jones and Co., Ltd.	20J-3.
Chloride Electrical Storage Co., Ltd.	18M-4.
Clear Hooters, Ltd.	20E-1.
Commutator Grinding Block Co., Ltd.	18E-5.
Crane (Frederick) Chemical Co., Ltd.	9K-2.
Credenda Conduits Co., Ltd.	20L.
Crossley Bros., Ltd.	16M-3, 16N-4.
Crosthwaite Engineering and Furnace Co.	18G-4.
Davey, Paxman and Co., Ltd.	17H-1.
Davidson and Co., Ltd.	17G-2.
Davis and Timmins, Ltd.	16G-5.
Dexine, Ltd.	20E-3.
Dick, R. and J., Ltd.	17N-6.
Diecastings, Ltd.	2J-2.
Donovan and Co.	19M-1.
Dorman, W. H. and Co.	17L-3.
Drayton Regulator and Inst. Co.	16F-5.
Earle, Bourne and Co., Ltd.	17K-3.
Edison Swan Electric Co., Ltd.	18G-2.
Electric Furnace Co., Ltd.	19K-7.
Electrical Power Engineering Co. (B'ham.) Ltd.	19J-1.
Electrical Power Engineers' Association	19J-3.
Ellison, George	19L-1.
Enfield Cable Works, Ltd.	20J-1.
Ever-Ready Co. (Great Britain), Ltd.	7G-3.
Fielding and Platt, Ltd.	15G-1.
Firth, Thos. and Sons, Ltd.	10F-1, 10G-1.
Foster Instrument Co.	11L-1.
Fox and Offord, Ltd.	19G-1.
General Electric Co., Ltd.	18L-3.
Gent and Co., Ltd.	20K-2.
Gillespies, Ltd.	7F-5.
Gilman, F. (B.S.T.), Ltd.	16E-4.
Gregson Mfg. Co., Ltd.	18N-6.
Hackbridge Electric Construction Co., Ltd.	19H-2.
Hadfields, Ltd.	19L-2.
Hailwood and Ackroyd, Ltd.	20G-3.
Hale, Thos. (Tipton), Ltd.	14H-4.
Harper, John and Co., Ltd.	4J-2, 19H-4.
Herbert, Alfred, Ltd.	18G-1.
Hewittic Electric Co., Ltd.	19H-2.
Heyes and Co., Ltd.	20F-4.
Holden and Hunt	14L-1.
Hollings and Guest, Ltd.	17L-5.
Holmes, W. C. and Co., Ltd.	12D-2.
Horstmann Gear Co., Ltd.	12D-3, 19M-3.
Imperial Chemical Industries, Ltd.	9K-1, 9K-2.
India Rubber, G.P. and Tel. Works Co., Ltd.	20J-1.
Ingram and Kemp	20K-3.
Jackson Electric Stove Co., Ltd.	18N-5.
Johnson, Rd. and Nephew, Ltd.	17F-3.
Johnson, Rd., Clapham and Morris, Ltd.	13H-1.
Johnson and Phillips, Ltd.	20J-1.
Joyner, Chas. and Co.	20K-3.
Kelvin, Bottomley and Baird, Ltd.	19N-2.
Lacy-Hulbert and Co., Ltd.	20F-2.
Lighting Trades, Ltd.	12G-2.
Lister, R. A. and Co., Ltd.	17G-1.
Liverpool Electric Cable Co., Ltd.	20J-1, 20K-4.
London Electric Wire Co. and Smith's, Ltd.	20K-1, 20J-1.
Macinlop, Ltd.	14C-4.
Macintosh Cable Co., Ltd.	20J-1.
Marconi's Wireless Tel. Co., Ltd.	10L-4.
May and Padmore, Ltd.	4E-1.
McGeoch, Wm. and Co., Ltd.	18G-3.
M.C.L. and Repetition, Ltd.	17N-3.
Metro-Vick Supplies, Ltd.	20M.
Micanite and Insulators Co., Ltd.	18J-4.
Midland Fan Co., Ltd.	1H-2.
Moffats, Ltd.	9H, 19H-3.
Moorwoods, Ltd.	8H-1.
Mudies' Electrical Co., Ltd.	19G-7.
Negretti and Zambra	16H-6.
Omega Lampworks, Ltd.	19E-1.
Pantin, W. and C.	16L-2.
Parker, Winder and Achurch, Ltd.	5H.
Parsons, C. H. Ltd.	20H-4.
Peebles and Co., Ltd.	12D-5.
Petters, Ltd.	17J-6.
Pritchett and Gold and E.P.S. Co., Ltd.	18M-2.
Ransomes, Sims and Jefferies, Ltd.	17F-6.
Rawlplug Co., Ltd.	4D-2.
Ray Engineering Co	19J-5.
Reavell and Co., Ltd.	18L-2.
Record Electrical Co., Ltd.	19K-6.
Restlight, Ltd.	20N-1.
Revo Electric Co., Ltd.	18H-5.
Reyrolle, A. and Co., Ltd.	20H-1.
Ringsdorff Carbons (England), Ltd.	19L-5.
Ruberoid Co., Ltd.	10E-6.
Ruston and Hornsby, Ltd.	15J-1.
Showell, Edwin and Sons, Ltd.	9E-5.
Shrops. Worcs. and Staffs Electric P. Co.	18H-4.
Siemens Bros. and Co., Ltd.	20J-1.
Siluminite Insulator Co., Ltd.	20G-1.
Silvertown Lubricants, Ltd.	17K-6.
Slingsby, H. C.	14G-4.
Sloan Electrical Co., Ltd.	9H.
Spauldings, Ltd.	19M-2.
Sperryn and Co.	20K-3.
Spring Washers, Ltd.	18N-3.
Standard Tel. and Cables, Ltd.	20J-1.
Stewarts and Lloyds, Ltd.	11D-1, 7L-4.
Streetly Manufacturing Co., Ltd.	10H-2.
Sturge and Baker, Ltd.	20F-1.
Sturtevant Engineering Co., Ltd.	13D-2.
Sugg, Wm. and Co., Ltd.	11H-2.
Swingler G. and J., Ltd.	18N-2.
Tangyes, Ltd.	16J.
Taylor and Challen, Ltd.	17K-2.
Telegraph Cons. and Maintenance Co., Ltd.	19L-3.
Terry, Herbert and Sons, Ltd.	13K-5.
Thermo Path Co., Ltd.	19N-4.
Thomas, Bertram	10H-3.
Thor Lamps and Supplies, Ltd.	16E-8.
Tubes, Ltd.	12K-2.
Tucker, J. H. and Co., Ltd.	19J-4.
Turner Bros. Asbestos Co., Ltd.	19F-4.
T. V. E. Co., Ltd.	20J-2.
Uniflo Pump Co., Ltd.	16H-7.
Union Cable Co., Ltd.	20J-1.
Vac-Tric, Ltd.	19K-8.
Wakefield, C. C. and Co., Ltd.	20E-5.
Welsbach Light Co., Ltd.	12G-3.
Wiggin, Henry and Co., Ltd.	14H-1.
Willis and Bates, Ltd.	4A-1.
Wynn, Timmins and Co., Ltd.	15D-1.
Young, Osmond and Young, Ltd.	18H-8.

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SOME DOMESTIC EXHIBITS AT THE FAIR.

A pressed steel cooker by the General Electric Co., Ltd.

A few particulars of the domestic equipment which will be displayed by some of the electrical exhibitors at Castle Bromwich, on Monday. A complete list of exhibitors of electrical interest is given on page 191, *while a detailed plan of the Electrical Section is given on page* 190. *A further article, dealing with the Fair at greater length, will appear in our next issue.*

A 3 kW "Louis Newberry" fire by Berry's Electric (1928) Ltd.

WE are able to give this week advance particulars of some of the equipments and appliances of electrical interest which are to be seen at the Birmingham Section of the British Industries Fair. In giving these descriptions we have confined ourselves mainly to domestic apparatus and though it is not possible to include in one issue details of the exhibits of all the manufacturers of such equipment, those which have been omitted will be dealt with in a subsequent issue, together with the remainder of the electrical exhibitors. In cases where a firm mentioned is also showing industrial equipments of electrical interest, these will be subject to description in a later issue.

CARRON COMPANY (Carron, Falkirk). In the electric cooking and heating appliances section of this stand will be seen an extensive range of fires, including the "Carraflex," "Stella," "Cathedral" and "Careole" series. The exhibit also includes a new electric dog grate and two new electric cookers. Small domestic appliances such as 4 and 5 lb. electric irons, large electric cookers with double-ovens and independent grillers are included.

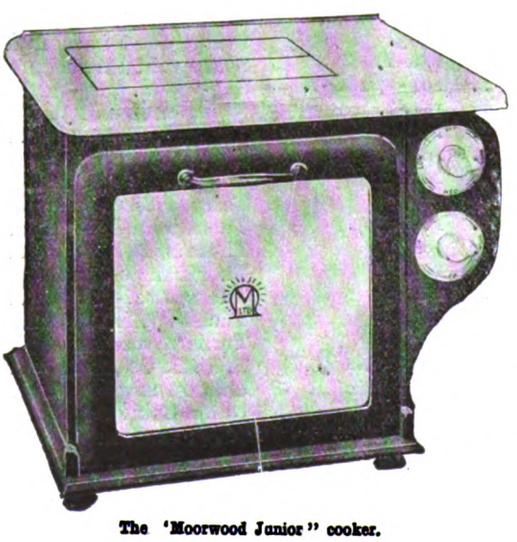
BERRY'S ELECTRIC (1928), LTD. (Touchbutton House, Newman Street, London, W.). This stand features a wide range of "Magicoal" fires, day and night signs, switchgear and Berry-McClary cookers. The exhibit includes a number of fires designed for inclusion in newly built houses, where the fire places have not been completed, while a range of new cookers is also shown.

MOORWOODS, LTD. (Harleston Iron Works, Sheffield). Electric cookers with various loadings up to 7 900 W are exhibited, together with a special junior model for use by small families. Cooking equipment in all finishes is shown, while the number of types and variety of loadings available cover practically every requirement.

THE OMEGA LAMP WORKS, LTD. (Rodney Place, London, S.W.19). Here are shown lamps of every type and for every purpose, including traction, factory and domestic use. Part of the exhibit is formed by a collection of the raw materials and parts used in lamp manufacture.

CORFIELD, LTD. (Trafalgar Works, Merton Abbey, London, S.W.19). This stand should be of interest to users of electric cookers in that the wide range of aluminium domestic utensils shown has been designed with a view to obtaining the best efficiency from a hot-plate. Specimens of presswork which have been made for the electrical industry are also shown.

CHARLES JOYNER AND CO. (Icknield Square, Birmingham). Electric cookers are also exhibited by this firm, including a new range incorporating an improved "Angelus" boiling ring. Another new exhibit is the "Perfection" oven, while overseas visitors will be interested in an "Empire" oven which has been specially designed for overseas use. Thermal heating systems, fires, etc., are also included.



The 'Moorwood Junior" cooker.

METRO-VICK SUPPLIES, LTD. (Trafford Park, Manchester). Besides a number of cooking, washing, ironing and cleaning demonstrations, this firm is showing various types of storage water heaters and electric geysers. A complete range of fires, as well as a range of radio apparatus for operation from both a.c. and d.c. mains are exhibited, while a display of wiring accessories includes lamp-holders and switches in various finishes, lamp standards, brackets, electroliers, etc. On the pillars and partitions of the stand more than thirty different types of panel fittings have been installed, several of these incorporating the new "Gilbert Riley" glassware. This latter, it is claimed, is the only glassware of British manufacture available at the present time.

THE GENERAL ELECTRIC CO., LTD. (Magnet House, Kingsway, London, W.C.2). The chief domestic exhibits here are "Cosy-Glow" fires, self-protective electric kettles, wash boilers, cooking equipment, irons, cleaners, etc. A new wash boiler is shown for the first time, together with a new range of pressed steel electric cookers. A special feature of the latter is the convenient position of the oven. This range of cookers has been designed for both the home and overseas markets and in almost every case the oven interior is withdrawable for cleaning. The exhibit also includes electric grillers, boiling and hot plates, electric gramophone motors, irons, immersion heaters, fires, etc. The industrial exhibits on this stand will be described next week.

YOUNG, OSMOND AND YOUNG, LTD. (Excelsior Works, The Broadway, Bexley Heath). The exhibits here comprise "Utility" tubular heaters for schools, churches, offices, factories, houses, etc.; electric towel airers for floor and wall mounting; four bar heaters for use where wall space is limited, available with or without 3-heat control; car bonnet heaters and linen cupboard heaters. In addition there is shown a model block of offices incorporating a typical layout of heaters throughout. Special tubular heaters for use in bow windows are shown, together with parts in their construction. Heaters for tar, crude oil and traction work are shown, the latter being available up to 600 and 1 600 V.

THE JACKSON ELECTRIC STOVE CO., LTD. (143, Sloane Street, London, S.W.1). A complete range of domestic appliances is again featured by this company, including a new cooker series. This latter comprises a range of cookers of sizes suitable for three and four persons up to fourteen persons, with loadings ranging from 4 200 W to 9 350 W. Another new exhibit is the "Junior" cooker, which, with a total loading of 3 160 W, has a

(*Continued on page* 194)

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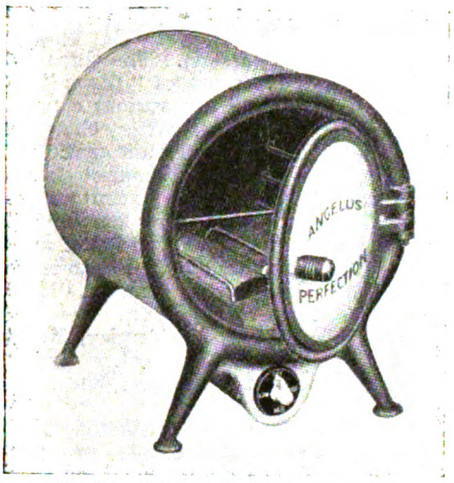
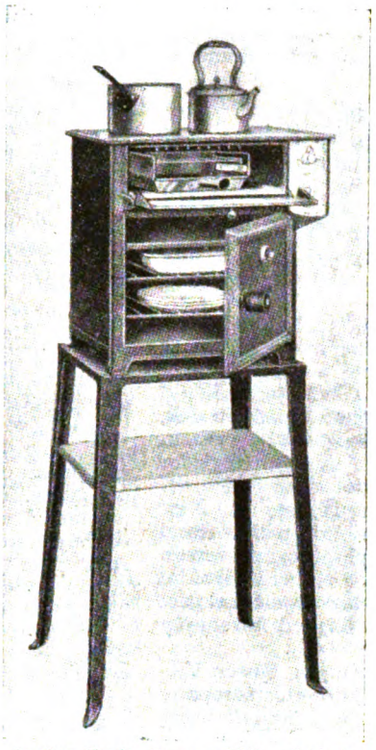
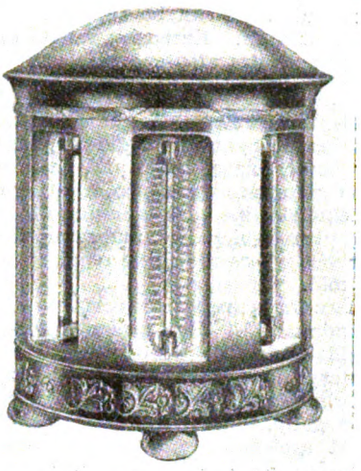


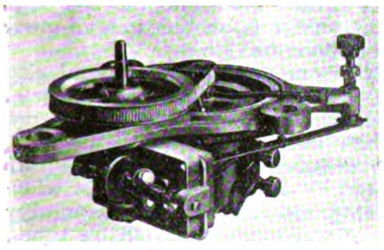
The "Angelus Perfection" oven, shown by Charles Joyner and Co.



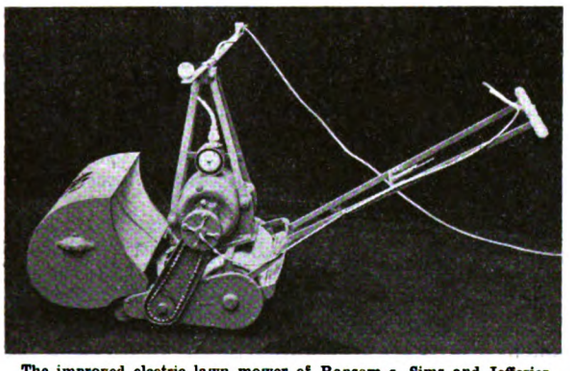
Another Charles Joyner exhibit, suitable for small family cooking requirements.



A vertical bar fire shown by the Thermo Path Co., Ltd.

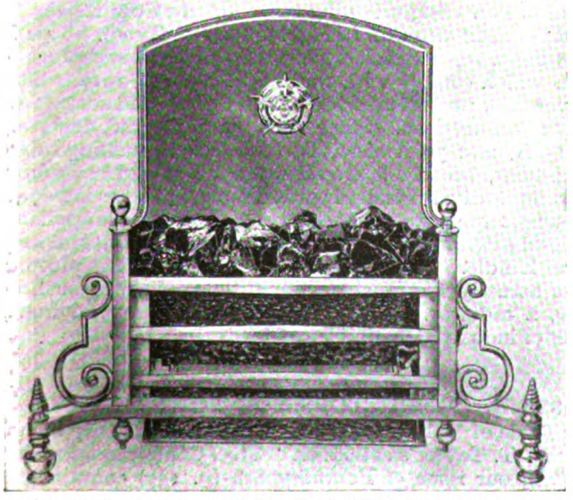


An electric gramophone motor, by the British Thomson-Houston Co., Ltd.



The improved electric lawn mower of Ransom s Sims and Jefferies, Ltd.

One of the lighting fittings shown by Metro-Vick Supplies, Ltd.



An attractive imitation coal-fire, also by Metro-Vick Supplies, Ltd.

A boiling-plate by A. Reyrolle & Co., Ltd., with three-heat elements.

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cooking space of 10 in. by 12 in. by 13 in. An interesting point in connection with the "Junior" is that the grill-boiler plate is independent of the oven, while another is that the equipment can be supplied with or without 18 in. legs and pot shelf. Extensive ranges of fires and other domestic appliances are also shown.

More Lighting Fittings.

HAILWOOD AND ACKROYD, LTD. (Morley, Leeds). The chief exhibits on this stand are glassware and fittings suitable for home, office, hotel and theatre lighting. Coloured and clear glassware are shown, together with a new ply glass. The exhibit also includes examples of the "Hailuxo" heat resisting glass which, we understand, is recommended for any purpose where it will be required to withstand extreme heat or cold.

THE GREGSON MANUFACTURING CO., LTD. (31, Tenby Street, Birmingham). This firm specialises in the manufacture of wood electric light fittings, and is showing a range of hall lanterns, lounge, dining and drawing room pendants, table and floor standards, etc. These fittings are made chiefly in oak, mahogany, and walnut. Some novel designs in silk and parchment are shown for the first time, while wood fittings for church and cinema lighting are another interesting line.

THE THERMO PATH CO., LTD. (Albion House, 59, New Oxford Street, London, W.C.1). The exhibits on this stand are mainly "Meracol" fires, cooking apparatus and screen fires. There is also to be seen a range of new model horizontal bar fires in black enamel sheet metal and vitreous enamel cast iron in colours, which has been specially designed for supply authorities who hire fires.

THE EDISON SWAN ELECTRIC CO., LTD. (123/5, Queen Victoria Street, London, E.C.4). The products of this company are shown to full advantage, including lamps and lighting accessories, domestic and heating appliances, cables, accumulators for house lighting and wireless, starter batteries, dry cells, meters, decorative fixtures, receiving and transmitting valves, battery eliminators and other radio products.

RANSOMES, SIMS AND JEFFERIES, LTD. (Orwell Works, Ipswich). Though a considerable number of electric motors are shown by this firm, the most interesting exhibit from the domestic point of view is the "Electra" electrically driven lawn mower.

BERKELEY AND YOUNG, LTD. (Hay Mills, Birmingham). This company specialises in fans for both a.c. and d.c. supply, and table, bracket and ceiling types form the main subject of the exhibit. Battery charging equipment of the type to interest wireless enthusiasts is shown, together with the "Ellipso" oscillating fan, and industrial fans.

THE STURTEVANT ENGINEERING CO., LTD. (147, Queen Victoria Street, London, E.C.4.). Apart from industrial vacuum cleaning equipment, the exhibits here include the "Croydon" vacuum cleaner. This latter is of the bag type, easily portable, and is made for all standard voltages. The industrial items of the exhibit will be described in a later issue.

THE REVO ELECTRIC CO., LTD. (Britannia Works, Tividale, Tipton). The complete range of cookers exhibited embraces models from the small "Breakfast" cooker to the "Maxima" (ten persons) model. Of overseas interest is the "Colonial" cooker, which we understand has been designed to compete with American cookers in the empire markets. A series of fires is shown incorporating the "Emitter" fire bar, the most popular fires of the series being the "Dinky," "Pearl," "Dainty," and "Ruby." Two and three-pint kettles with safety switches, electric irons, water heaters, wash boilers, etc., are also included. Electric fans of the table and bracket variety, ceiling fans and oscillating fans for a.c. and d.c. supply form another interest. The industrial exhibits will be dealt with separately.

STUART TURNER, LTD. (Henley-on-Thames, Oxon). The exhibits on this stand include 120 W sets for country house lighting, and for yachts and motor boats, 25 V ½ kW lighting plants, and 1½ and 3 kW plants. These are available for driving by petrol, paraffin or gas. A 12 V, 50 A battery is supplied with the 120 W set, while either a 25 V or 50 V battery is used with the ½ kW plant. The 1½ and 3 kW sets are available with either 50 or 100 V batteries with capacities up to 150 Ah in the case of the smaller set and up to 300 Ah in the case of the 3 kW plant.

HENRY WIGGIN AND CO., LTD. (Wiggin Street, Birmingham). Electric fires of various types incorporating "Brightray" elements are shown here, together with a range of sample reels of nickel-chromium electrical resistance wires. Domestic type resistances and rheostats are shown, together with a material called "Silveroid," for use in fire surrounds. The items of industrial interest will be the subject of a separate review.

R. A. LISTER AND CO., LTD. (Dursley). The three plants exhibited are representative of the range of "Lister" house lighting plants which can be obtained in various capacities. On view there are 1 kW and 1½ kW sets for battery charging, as well as a 1½ kW "Lister-Brunton" fully automatic plant. The power for all plants is supplied by a four-stroke, slow speed, vertical, water-cooled engine. The generators are of open protected construction, shunt wound for battery charging. The dynamos are of the four-pole type, fan ventilated, and are designed with a powerful starting winding. Plants are supplied with switchboard and instruments, mounted direct on the plant or as a separate wall type arrangement.

C. H. PARSONS, LTD. (Britannia Works, Tyseley, Birmingham). This firm is displaying, among other lines, an extensive range of switches and lamp-holders, and bakelite switchplates and rings.

S. G. BROWN, LTD. (Western Avenue, North Acton, London, N.). The domestic side of this exhibit is made up of radio equipment comprising loud speakers of the reed and moving coil types. The latter are not supplied complete, but are already assembled suitably for mounting on a baffle board. They are of the electro-magnetic type and are wound for 6 V as standard. A suitable transformer is already fitted into the box casting. A new low-frequency transformer is another item of interest. The marine exhibits will be described later.

SPERRYN AND CO. (Moorsom Street Works, Birmingham). Samples of "Sperrynwood" switches, fuses, and other electrical equipment, including "Sperson" and "Sperryn" models are shown in great variety.

THE CHLORIDE ELECTRICAL STORAGE CO., LTD. (Clifton Junction, near Manchester). "Exide" batteries for wireless, house lighting, car starting, etc., are shown in a number of capacities and voltages. A new range of unspillable types, in celluloid boxes, for portable wireless sets and a selection of h.t. and l.t. batteries suitable for medical purposes are also shown. Specimens of the "Lux" battery, specially designed for heavy loads, together with batteries for portable lamps, are included in the exhibit. Industrial items will be included in our next issue.

Pumps for Country Houses.

THE UNIFLO PUMP CO., LTD. (Fordhouses, near Wolverhampton). This exhibit includes a number of electrically-driven pumps suitable for country houses, motor boats and yachts. These are available in a variety of sizes for both a.c. and d.c. supply. Exhibits of industrial interest will be the subject of a separate review.

THE BRITISH THOMSON-HOUSTON CO., LTD. (Rugby). In addition to industrial equipment, which will be dealt with in our next issue, this firm is showing "Mazda" lamps, lighting fittings, radio apparatus, valves, and moving coil loud speakers. Among the exhibits is an electric gramophone motor suitable for supply from 50 to 250 V d.c. and 100 to 200 a.c., 25 to 60 cyles, fitted with an adjustable graduated resistance. In this section of the exhibit there is also a display of "Tungar" battery charging equipment and trickle chargers. The lighting fittings shown include practically every type, a number of new designs having been added to the range.

A. REYROLLE AND CO., LTD. (Hebburn-on-Tyne). This firm is showing a representative collection of domestic plugs and sockets which comply with the B.S.S. No. 196–1927, which is for reversible, protected type, two-pin plugs and sockets with earthing connections. Since this specification deals with 5 A, 15 A, and 30 A sizes, it marks an interesting stage in development, because it provides for metal-clad enclosure of these comparatively small plugs and sockets, and so introduces, for domestic apparatus, a safe connector for portable appliances. The metal earthing of the enclosure makes the plug and socket safer to handle. In addition to examples of their plugs and sockets actually mounted on domestic appliances, such as a washer, a radiator, a kettle, a toaster, and several irons, a number of industrial exhibits are shown.

(To be continued.)

STEEL CONDUCTORS FOR POWER LINES.

The Table of Values for the Same Current Density included in Mr. W. T. Taylor's article on "Steel Conductors for Power Lines" in our issue of February 8th (p. 157) contained two printers' errors. In column four referring to three-phase four-wire conductors $\sqrt{3}E$ should in each case have been $\sqrt{3}E$.

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THE GRID AND "SHODDY" WIRING.

Parasites of the Electrical Contracting Industry—The Domestic and Industrial Position Compared—Compulsory Registration Necessary—An Electrical Leader Wanted—Further Examples of Bad Work.

By HARRY MOSS. A.M.I.E.E.

FOR some considerable time, by means of the written and spoken word, and with the aid of photographs, I have been trying to draw the attention of the whole electrical world to the disease of "shoddy" wiring which has attacked the electrical installation contracting industry. With the development of the grid and the additional facilities for electricity supply, it is to be feared that there will be a considerable growth in the number of these parasites of what would otherwise be a healthy industry.

These parasites, consisting of a variety of "shoddy" wiring men and "contractors" of very doubtful quality, the usual odd man and handy man, the country mechanic, who claims himself to be an "electrical engineer," the "clever" boy from school who just knows the difference between a conductor and an insulator, the wireless "fan" who knows quite a bit about his set, but nothing about the dangers of 230 V a.c. supply, are fast preparing traps for the unsuspecting low-price loving public, and a series of electrical fires is almost inevitable.

A Public Danger.

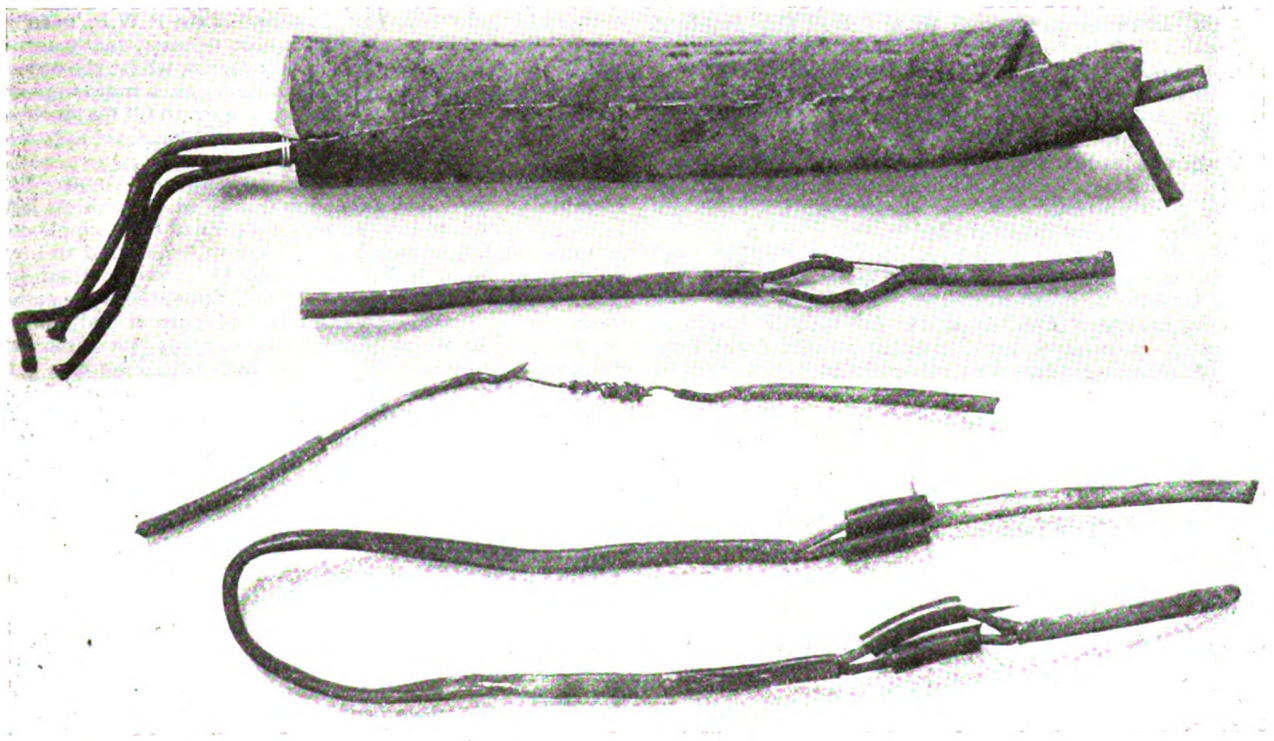
A comparison of the conditions applicable to the domestic and industrial sides of the electrical wiring position is of interest, and may be explained in the imaginary picture of work being done on two sides of a fence: on one side skilful men are operating a system of electrical distribution incorporating the latest and improved methods, ironclad and foolproof gear to guard trained technical operatives, and safeguards of every description; while on the other side we have an electrical system which can be, and is, often highly dangerous to the user, the ordinary everyday cottager or householder with no knowledge of electricity. In many cases the installation is put in by one of the previously mentioned parasites of the trade, at the lowest possible price, with "shocking" lamp-holders and switches, unbonded and non-continuous metal sheathed wiring systems, loose arcing and fire-raising joints, uncovered connections, overloaded wires and flexibles, and traps and risks of every conceivable description.

How can the two be reconciled? Is it reasonable to protect the skilled and competent men, who know better than to handle dangerous equipment, with all the scientific gadgets it is possible to produce, and then leave the "ignorant" domestic user with a house full of death-dealing wiring and appliances? Surely not. Some steps must be taken quickly, either by compulsory registration of *all* who are allowed to carry out electrical installation work, or other similar measure. That the "shoddy" and highly dangerous work now being carried out must cease every one agrees, but where and who is the electrical leader capable of calling a halt?

A Wireless Expert.

A few days ago a wireless enthusiast and electrical "dabbler" went to a wholesaler and arranged to purchase a length of flimsy twin flex, similar to that used for extending or connecting up loud speakers, also a length of close joint conduit through which to run this flex. His purpose was to supply a h.t. eliminator from the Corporation 230 V a.c. supply mains, and the odd length of tube was to "protect" the flex from the wet walls of a cellar. It requires little or no imagination to realise what might have happened if this man had been allowed to carry out his plan, which was only prevented by the alertness of the assistant in the store who was executing the order, and had entered into conversation with him at the same time. In any case, it can be assumed that some kind of "shoddy" wiring job has been done to connect the Corporation supply to the input side of this particular eliminator, which is only one of many thousands now in use. Supply authorities do not know when such equipment is added to their mains, and, in consequence, do not appreciate the "fire risks" that are being added to their supply daily. The point at issue is: when will they take drastic action to stop this risk of continuity of supply to users?

The illustrations accompanying this article are samples of work done on a metal sheathed system by one of the many handy chauffeur-electricians. Note the sheet lead covering to the joints. This was exposed to the elements, and was evidently the workman's idea of a lead-covered job.



SOME specimens of "shoddy" wiring on a metal sheathed system. At the top of the photograph is shown a bunch of wires wrapped round with sheet lead. This was situated in an exposed position subject to all sorts of weather.

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CORRESPONDENCE.

The Editor welcomes the free expression in these columns of genuine opinion on matters of public interest, although he disclaims responsibility alike for the opinions themselves and the manner of their expression.

Glass Insulators.

[To the Editor.]

Sir,—Mr. Goodlet's letter in your issue of February 1st justly criticises the article on glass insulators by Mr. North in the previous issue, and it is a pity so many statements should have been made which cannot be upheld.

We can confirm what Mr. Goodlet says regarding the flashover voltage of glazed and unglazed insulators, and we have never been able to detect any difference in the flashover voltage on insulators of the same design and size, whether glazed or unglazed.

Mr. North appears to be under some misapprehension regarding the test which, in the present B.E.S.A. specification, is called the " Inherent Stress Test." This title is really a misnomer, and we believe that in the revised B.E.S.A. specification it will be referred to as the " Temperature Cycle Test." The object of the test is to find out whether the insulator is capable of withstanding sudden changes in temperature, and, as such, the test (contrary to the statement in this article) is perfectly satisfactory.

The polarised light test is very interesting, but any argument that it can be used to enable the temperature cycle test to be avoided cannot be admitted.

The remarks about cement come as a surprise to those who have used Portland cement for many years with perfect success. It is well known that trouble has been experienced in the past, more especially in America and Germany, but we are inclined to think that this must have been due to the use of a different quality of cement. The use of Portland cement to the B.E.S.A. specification can certainly be recommended, but of course it may not be suitable for use with glass insulators. —We are, etc.,

Taylor, Tunnicliff and Co., Ltd.

Eastwood, Hanley,
Staffs.
February 5th.

Electrical Firms and the B.I.F.

[To the Editor.]

Sir,—The British Industries Fair which opens its doors in London and Birmingham on February 18th will again be larger and more representative than ever. The buildings have again had to be considerably extended to accommodate more than 2 000 exhibiting firms. At Birmingham this year's extensions have given the Fair a building under one roof, and without an intervening wall, of approximately, 12 acres, with a stand frontage estimated at 15 miles.

The electrical trade makes a bigger show than ever this year. Visits of various associations and official luncheons have been arranged, as in previous years, and more electrical men will visit the Fair this year than ever before.

A new feature this time is the provision of a Conference Hall to enable the various industries to hold conferences, and it is going to be fully occupied during the run of the Fair. The South Midland Area Committee of the British Electrical Development Association are arranging an Electrical Conference on February 22nd, and other trades and industries are arranging similar meetings.

Intending visitors to Birmingham who have not already secured accommodation, or who are finding it difficult to obtain accommodation, should communicate with the Accommodation Department, British Industries Fair, Chamber of Commerce, New Street, Birmingham, where a register of suitable accommodation is kept; officers of the Department will be glad to make the necessary arrangements.

Questions have at different times been raised as to whether the time at which the Fair is held is really the most suitable—and on this there is undoubtedly much to be said from the point of view of overseas visitors—whether its being held partly in London and partly in Birmingham is advantageous or otherwise, and so on.

Assuming for a moment that everything connected with the Fair is at present not ideal—including the fact that the buildings themselves are perhaps hardly worthy of the examples of British industry that they house—and bearing in mind its comparatively humble beginnings and that it has had no subsidy or grant, but has had to erect its own buildings and generally pay its own way, is not its continuous expansion all the more remarkable ?

Whatever shortcomings, if any, and in whatever respect, the Fair may have, its continued definite and steady growth, the ever increasing number of manufacturers and different trades participating, and the steadily rising number of visitors year by year cannot be without significance. It would appear as justifying the belief of its organisers that in an annual co-operative display of British products, such as this Fair is, British manufacturers would find a powerful instrument to help them in the expansion of their overseas trade and influence—whilst definitely strengthening it at home.

If the ten years' persistent success of the Fair has established or is establishing that fact, then has the time not come for the industries of the country themselves to assist in perfecting the instrument or any details thereof that may still require perfecting ?

I suggest that manufacturers generally, manufacturers' associations and federations in particular, might, during its run, take the opportunity of carefully considering the question of this annual Fair in all its bearings, and formulate plans and suggestions in regard to its future.

At the Leipzig Fair, for instance, many of the principal German industries, such as the electrical industry and the machine tool industry, have each erected their own permanent building in which every year their own products are exclusively shown, such buildings, needless to say, being all that they should be for the purpose.—I am, etc.,

T. R. Martin,
Member of the Fair Management Committee.

Birmingham.
February 5th.

Electrical Firms and Radio Retailing.

[To the Editor.]

Sir,—That part of the " reciprocal understanding " between the R.W.F. and the W.R.A. which provides for the circulation amongst members of the former of " the names of applicants for trade terms, who, in its view, do not comply with recognised trading requirements," reveals a somewhat ludicrous situation.

The chief " recognised trading requirement " of the R.W.F. appears to be that the person or firm entitled to trade terms for radio apparatus from its members must hold a representative stock of these articles and display them in a shop window. The trade of the applicant is not stipulated; in other words, anyone who is willing to buy a stock of radio components and display this in his shop window is presumably entitled to trade terms from members of the R.W.F., even if his normal line of business is that of boot repairer, gent's outfitter or fishmonger, and his radio knowledge nil, whilst the orders of the qualified electrical engineer, who requires radio apparatus for resale to his clients but does not want to fill his stockroom with them or allocate a window for their display, are apparently not wanted by R.W.F. members.

As a case in point—during the extension of a country house installation, my client asked me to look at his wireless installation which would not function. This had been supplied and installed by a firm included amongst those entitled to buy at trade terms from R.W.F. members by virtue of their stock and window. Amongst other things I found totally unsuitable valves in every stage, an inadequate supply of plate current, an aerial of the Heath Robinson type, a gas pipe earth and a so-called battery charging arrangement consisting of a generator coupled to a very old single phase squirrel-cage induction motor, the running coils of which had been connected in some extraordinary manner *through a thermionic rectifier to the d.c. house supply*, doubtless on the assumption that since the rectifier had been advertised as being capable of converting a.c. to d.c. it should behave vice-versa when required, and so run the motor !

I have also come across several examples of battery eliminators installed by similar firms of " radio retailers " which have come very nearly up (or rather, down) to the standard of those examples of horrid wiring which Mr. Moss shows us in his articles.

Recently my moderate, but sustained, stream of orders for radio apparatus has been diverted from a member of the R.W.F. direct to the manufacturers in some cases, and to non-members of the R.W.F. in other cases, by reason of a communication received from this R.W.F. member informing me that, since I do not display a stock of radio components in a shop window, they can no longer supply me ! ! ! The fact

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that I carry a stock of engineering and electrical plant and accessories apparently cuts no ice !

The inconvenience thus caused is admittedly negligible, and there are undoubtedly many other electrical engineers in a similar position, but does it not seem curious that the R.W.F. should thus restrict its member's sales, and also that it should thus encourage all and sundry shopkeepers to dabble in radio apparatus in preference to electrical engineers ?—I am, etc.,

"AMUSED."

Steel Conductors for Power Lines.

[TO THE EDITOR.]

SIR,—Having erected a considerable amount of 11 000 V steel wire transmission lines in Buckinghamshire, the article by Mr. Taylor in your issue of February 8th was much appreciated.

With regard to the life of the wire, I am expecting this to be between 10 and 15 years, which is satisfactory considering the cost of the conductors.

A favourable point is that aluminium steel conductors, having the same characteristics as the existing steel conductors, can be put on the existing poles when the load develops or the steel becomes obsolete.

Mr. Taylor mentions that the inductive reactance may reach very serious proportions. I do not agree. If the current is heavy then the load will warrant a copper conductor, but for light loads the external and internal reactance is negligible ; for instance, with 10 A (190 kW, 11 000 V) the impedance for a 7/12 S.W.G. steel wire is only increased from a d.c. resistance of 3·6 to 3·7 Ω. The point is, that for low resistance copper, the reactance is comparatively large, but for a high resistance steel conductor, the reactance is comparatively small.

Mr. Walton's paper on Steel Conductors in the "I.E.E. Journal" of October, 1928, gives details on this reactance problem.—I am, etc.,

W. A. TURNBULL,
Borough Electrical Engineer.

Aylesbury.
February 11th.

SIR,—In your issue of February 8th a paper by W. T. Taylor on "Steel Conductors for Overhead Power Lines" is published.

It may be of interest to draw the attention of your readers to a paper recently published in the Proceedings of the Institution of Electrical Engineers, by Mr. E. C. Walton, B.E., volume 66, page 1065, on "The Electrical Properties of Galvanised Steel Conductors for Overhead Transmission Lines."

This paper records the results of a large number of observations on four kinds of material suitable for overhead lines, and it is shown that the best of the four grades of material tested is a hard drawn steel having a tensile strength of 45 tons per square inch. As Mr. Taylor states in his paper, the electrical resistance for alternating currents does not correspond at all with that for direct currents and varies very considerably with the current which is passing through the conductor.—I am, etc.

E. W. MARCHANT.

Liverpool.
February 12th.

BOOKS RECEIVED.

"Underground Cable Systems." By G. W. Stubbings. (London Chapman and Hall). Pp. 215. 15s. net.

"A.E.F. Verhandlungen des Ausschusses für Einheiten und Formelgrössen in den Jahren 1907 bis 1927." By J. Wallot. (Berlin : Julius Springer.) Pp. 48. 5 marks.

"Every Inventor His Own Patent Agent." A Handy Book of the Principles of the Patent Law. By W. H. Baraclough. (London : Effingham Wilson.) Pp. xxvii×418. 20s. net.

"Science Abstracts." Secs. A and B. Vol. 31, No. 372. (December 25th.) Issued by the Institution of Electrical Engineers. (London : E. and F. N. Spon.) Single numbers, 3s. Annual subscription, 30s., or 50s. for both sections.

"Science Abstracts." Secs. A and B. Vol. 31, Part 9, No. 369. September 25th.) Issued by the Institution of Electrical Engineers. (London : E. and F. N. Spon.) Single Numbers, 3s. ; annual subscription 30s., or 50s. for both sections.

"Definitions and Formulæ for Students." (1) "Applied Mechanics," By E. H. Lewitt. (London : Sir Isaac Pitman and Sons.) Pp. iv+36. 6d. net. (2) "Practical Mathematics." By L. Toft. (London : Sir Isaac Pitman and Sons.) Pp. iv+28. 6d. net.

ELECTRICAL RESEARCH.

Association's Work Represents Large Savings to Supply Undertakings.

THE British Electrical and Allied Industries Research Association held a luncheon at the Savoy Hotel, London, on February 8th, in connection with the Association's eighth annual general meeting.

Col. KENELM EDGCUMBE, proposing the toast of "The Electrical Research Association," said he had unbounded faith in research. It was a really safe investment, as money spent in this direction was bound to come back. The industry stood to gain enormously from research, the supply side, perhaps, more than others.

Mr. C. P. SPARKS (the President), in responding, recalled that prior to the formation of the E.R.A. both the B.E.A.M.A. and the Institution of Electrical Engineers had started co-operative work on a small scale, and, while valuable work was done on one or two researches, it was soon recognised that the funds available from this source were quite inadequate to handle the many problems requiring investigation.

The E.R.A. owed its existence chiefly to three sources : First and foremost to the manufacturers, in guaranteeing £8 000 a year for the first five years of its existence ; secondly, to the Department of Scientific and Industrial Research, who contributed pound for pound during the initial period ; and thirdly, to the large body of voluntary workers controlling the ndividual researches under the supervision of the director.

Object of the Association.

The main object of the Association was to undertake co-operative research in all matters affecting the electrical industry, including problems affecting both the manufacture of plant and the supply of electricity which lay outside the capacity of individual undertakings.

It was important to note that co-operative research undertaken to benefit the community as a whole was entirely distinct from, and not in any way meant to replace, independent research carried out by individual firms ; in the opinion of the Department of Scientific and Industrial Research, the general trend of co-operative research had been to encourage independent private research.

In round figures, £160 000 has been expended by the E.R.A. during the last eight years—an average of £20 000 a year, the present rate of expenditure being some £25 000 per annum. The real investment was represented by a much larger figure, as it was supplemented by the valuable services of some three hundred voluntary workers, the use of plant, etc.

The annual saving arising out of the work of the E.R.A. from the seven specific researches—on underground cables ; insulating material ; insulating oil ; dielectrics ; overhead transmission ; switchgear and control apparatus ; and steam turbine nozzles—was estimated as already saving a figure approaching £1 000 000 per annum.

The last report of the Department of Scientific and Industrial Research recorded that certain researches of the E.R.A. had been "curtailed or suspended for lack of the necessary funds."

This had been the position for the last two years, and the 1928/29 programme, involving an expenditure of £36 000, and which the staff organisation was well able to handle, had been curtailed to some £25 000.

To meet the whole position, an important conference held last June recommended—(*a*) Extension of the present scale of expenditure (£25 000 per annum) and to double it within five years ; and (*b*) to widen the articles of association to give adequate representation to all contributing interests. The whole matter was now under consideration by a committee representative of all the interests concerned.

From the conference of last June £50 000 per annum should be found within the next five years. In 1928 some £5 000 (one-fifth of the income) had been derived from the supply section of the industry. While the proportion which should be found by each section of the industry was now the subject of inquiry by the committee appointed last June, he could not but feel that the supply section—subject to adequate representation on the Council—should find a much greater proportion in future.

The investment in the electricity supply industry at home was over £300 000 000, and the gross revenue some £45 000 000 per annum ; if only one-tenth of 1% of that sum were contributed to the E.R.A., all the funds necessary for a full programme would be available.

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RAILWAY ELECTRIFICATION.

A Critical Examination of Proposals for the Manchester Area—The "South Junction Line"—Third Rail and Overhead Systems.

By J. G. B. SAMS. A.M.Inst.M.E., M.Inst.Loco.E.

IT has been reported in the Press, and seems to be generally accepted in informed circles, that the length of railway extending from the back of the joint station at London Road (Manchester) to the Cheshire town of Altrincham, locally known as the "South Junction Line," and operated by a combination of the L.M.S. and L.N.E. Railways, is to be converted to electric traction on a 1 500 V d.c. system, with overhead transmission.

Existing Systems.

This, to put it mildly, is surprising. In the first place, let us consider the sections of railway already electrified in the immediate neighbourhood. In the Liverpool district we find the Mersey and the Overhead Railways together with the L.M.S. Liverpool-Southport lines, all using 600 V d.c. with third rail transmission.

In the Manchester district, there are the Manchester-Bury etc., lines recently converted to electric traction on a 1 200 V d.c. third rail system. The small length of railway between Tottington and Holcombe Brook was experimentally electrified with an overhead transmission system many years ago, and, being only a very short length of railway, can still be considered something of an experiment.

There are, no doubt, many excellent technical reasons for the application of the suggested installation to the South Junction Line, but let us carry our minds back a little; first to the "Broad Gauge" of the G.W.R., which, although superior to the narrow gauge, had to be altered at great cost to the narrow gauge in the interests of standardisation. Next, let us recall that the original installation schemed for the London suburban electrification of the ex-S.E. and C.R. was one of 1 500 V d.c. third rail on a "three-wire" system, giving 3 000 V across the outers, but the approaching amalgamation of the Southern group compelled them to modify their ideas and to fall into line with the ex-L.S.W.R. system of 600 V d.c. third rail; this system being what might be termed the London standard, observing that it is also in use by the L.M.S., the Underground and the Metropolitan Railways. In addition, the Southern Railway, in order to secure final standardisation, have been compelled to convert the ex-L.B. and S.C.R. section from its original a.c. overhead transmission to the London standard. All this, then, may be taken as proving the necessity for standardisation at the *outset*.

Returning to Lancashire, as it is possible to run 600 V motors two in series using a 1 200 V supply, the difference in pressure can easily be overcome if necessary, but the South Junction proposal represents a hopeless departure from the standard of the existing majority.

We have seen that out-of-standard railways cannot finally exist, and have to be converted sooner or later at great (and unnecessary) expense, and, bearing in mind that in the immediate future the present electrified sections will be extended until they practically cover all North Cheshire and South Lancashire, the time would appear to be ripe for evolving a definite electrification standard to be applied to all railways in this district; and financial reasons will, in all probability, compel this standard to be in consonance with the existing electrified portions.

Opponents claim that standardisation prevents the use of the latest and most economical plant and methods, and point to the continual advance of electrical science. But is it not better to determine upon a definite system and to centre on improving that system, remembering the considerable advantages of standardised production and repairs, and of through running which must eventually take place if the traffic offering is to be handled properly.

Given, then, a complete electrified Manchester suburban system, what would be needed to make it fully convenient to the public, and consequently of the greatest earning power to its owners, is a link between the three Manchester terminals, London Road, Victoria cum Exchange and Central. This might well take the shape of an overhead railway extending from London Road to Central via Victoria, with possible intermediate stations at Oldham Road and Deansgate. Overhead is preferable to underground, as the connecting railways are both well above street level, and no architectural or civic features would be interfered with to their disadvantage; in fact, the station serving Victoria cum Exchange might well be built to cover in some more of the River Irwell, which informed parties would allow to be an advantage.

The provision of the suggested link would enable the suburban services now terminating at London Road and Central stations to run right across Manchester into the suburban area at the far side. (This idea might advantageously be applied as far as possible to similar services now terminating at Exchange and Victoria stations). Passengers between all suburban stations would be able to travel frequently without change, and at most with one change; traffic into the City itself would also be stimulated by the offer of a greater range of stations, some of them right in the shopping area, and others convenient for warehouses and offices.

In the same way, to stray from Manchester to Liverpool, the Mersey Railway might be converted from a very short and comparatively unimportant passenger-carrying line into a valuable through link across the Mersey for both passengers and goods. In order to bring this about, it would be necessary to extend the Railway from its present terminus under the Central station to the L.M.S. at Edge Hill, and to build a branch from (say) James Street Station to the ex-L. and Y. line somewhere between Exchange and Sandhills stations. This might well be considered by the railway companies concerned (who stand to lose yet further traffic to the road when the new Mersey Tunnel is complete), as a method of conserving and increasing their trade between the north and south sides of the river.

CANADIAN ELECTRICAL CODE.

Wide Acceptance of Standard Rules—No Major Revisions for at Least Two Years.

THE following statement relative to the present position in regard to the acceptance of the Canadian Electrical Code, published by the Canadian Engineering Standards Association in 1927, is contained in a recent Bulletin of the Ontario Hydro-Electric Power Commission:—

The matter of legislating regarding electrical inspection is within the jurisdiction of the provinces and municipalities, and the situation when the Code work was undertaken was that many different sets of rules were in operation in the various provinces, and in many cases in different cities within the same province. This condition imposed hardship and inconvenience upon manufacturers of electrical equipment and upon inspectors and contractors, and was therefore highly undesirable. The Canadian Engineering Standards Association undertook the work of preparing a code, and after several years of effort the first draft of the Canadian Electrical Code was adopted at a meeting in Winnipeg in June, 1927.

After the adoption of the Code at the Winnipeg meeting it was published and distributed to all parts of the country. It was, within a year, adopted by the provinces of British Columbia, Saskatchewan, Ontario, Quebec and Nova Scotia. In Ontario the Hydro-Electric Power Commission was empowered by legislation to administer such rules for many years. In British Columbia and Nova Scotia the conditions were somewhat similar, but in the other provinces it was necessary to enact legislation before the code could be adopted. As has just been stated, legislation was enacted in Quebec and Saskatchewan in 1928, and it is expected that several provinces will follow suit in 1929. The progress of the Canadian Electrical Code has thus been very satisfactory, and it may be stated that the work has been very successful, since the most populous provinces have adopted the code.

It is expected that no major revisions will be required for at least two years, and the next meeting of the main code committee is tentatively arranged for 1930. In the meantime the provincial committees will meet regularly, and exchange views on the suitability of the rules and suggestions for revision.

The Code, as its name implies, is a set of rules governing inside electrical installations. Its preparation was undertaken by the Canadian Engineering Standards Association several years ago in answer to a practically universal demand from many sources for rules which would be uniform throughout Canada.

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NEWS IN BRIEF.

Faraday House Old Students' Dance—Finsbury Technical College Old Students' Dinner—Electrical Wages—The Batti-Wallahs—Callender's Hospital and Distress Fund—Faraday and Maxwell Scholarships.

AN effort is being made in Tewkesbury to provide funds for the installation of X-ray apparatus at Tewkesbury Hospital.

Electric lighting is to be installed at the Merry Hill School, Bushey, at a cost of £120.

Ultra-violet ray equipment is to be installed at Dudley Clinic at a cost of £80.

The Faraday House Old Students' Association will hold a dance at the Victoria Halls, Southampton Row, London, W.C., on March 5th.

Past students are reminded that the Finsbury Technical College Old Students' Association are holding their annual dinner at the Trocadero, London, on March 1st.

The annual festival of the National Advertising Benevolent Society will be held on March 22nd. Sir Ernest Benn will preside.

According to "Telephony," the organ of the industry in the United States, 860 000 telephones were added to the American systems during 1928, making the total now in service 19 380 000.

Imports of electrical apparatus and machinery into the Irish Free State during December last amounted to £69 752, as compared with £35 665 for the same month of 1927.

Renfrew County Council is installing fourteen police telephones in public places for connection with Giffnock police station. They will be available for public use in emergencies.

At a joint meeting of the E.P.E.A., Sheffield and District Section, and the Sheffield Illumination Society at Sheffield on February 4th, Mr. R. G. Williams delivered a lecture entitled "Colour Lighting."

The annual dinner of the South Wales Branch of the Association of Mining Electrical Engineers will be held in the Wyndham Room, Cox's Café, Queen Street, Cardiff, on February 23rd.

At a meeting of the Institution of Mechanical Engineers, on March 8th, a collection of recent industrial cinematograph films of engineering subjects will be displayed, including one on "Electro-farming" by Mr. R. Borlase Matthews.

Estimates are being prepared for the new illumination scheme for the coming season now under consideration by Llandudno Electricity Committee. The promenade from the Pier to Craigside will be included, and the invalid shelter illuminations will be improved.

A meeting of the Institution of Welding Engineers will be held in the Assembly Room of the Birmingham Chamber of Commerce, on February 27th, when Mr. C. S. Milne will read a paper entitled "Welding and Cutting Practice with Low Pressure Plant."

Mr. William O'Brien, director of telegraph and telephone utilities, Boston, Mass., says, in the United States, under any other arrangement than private operation, it would have been impossible to extend telephone service to rural communities to anything like the same extent as has been done.

Marylebone (London) B.C. Salvage Committee, reports that the only a.c. motor now in use at the wharf is a 25 H.P. motor used for driving the hydraulic press for baling scrap metal. To obviate purchasing power from the Metropolitan Electric Supply Co., a new d.c. motor, estimated to cost £100, is to be installed.

The Industrial Court decided, in an award issued on Monday, that the wages paid to the staff employed in the electrical generating and sub-stations and on h.t. cables of the Metropolitan Railway, London, be reduced by 2½%. The Electrical Trades Union and the National Union of Railwaymen argued that the Metropolitan could not be regarded as a trunk railway and was more analagous to the London Electric Railways where no reduction had been put into operation.

At a meeting on January 25th, the Postal, Telephone and Telegraph Advisory Committee of Manchester adopted the annual report, which states that during 1928 the number of new telephones fitted was 8 999, the net increase, after allowing for cessations, being 5 091. Effective trunk calls and telegrams numbered 6 482 134, an increase of 264 028. Local calls for the year ended September 30th, 1928, were approximately 66 000 000, against 61 000 000 for the previous year. Street kiosks at December last numbered 386, increase 139, and 122 police telephone boxes were introduced during the year.

A police telephone system is being organised at Reading, with boxes at 26 points to completely encircle the borough.

At Warrington Corporation's Winwick pumping station an additional electrically-driven high-lift pump is to be installed.

The Banbury and District Electric Supply Co. is arranging an all-electric demonstration house to be opened on the Easington housing estate on February 19th.

At a meeting of the Paisley Association of Electrical Engineers on February 6th, Mr. G. Herbert, of the Craigpark Electric Cable Co., delivered a lecture on "Electric Cable Manufacture."

Glasgow Electricity Committee recommends that the annual subscription of £100 to the Electric Lighting Service Bureau be renewed for the current year, and that a supply of electricity be given, for demonstration purposes, free of charge.

In reference to the acceptance by Salford Corporation of the tender of a Dutch firm for supply of electric cable amounting to £9 358, it was stated by a councillor that the difference in price in tenders from British and foreign firms was £2 080.

Mr. E. E. Calvert, electrical engineer to Finchley U.D.C., is preparing an estimate of the cost of certain extensions to the rectifier plant which will be necessary during the present year.

A course of five lectures on high voltage cables will be given at the I.E.E. by Mr. L. Emanueli on February 20th, 22nd, 26th; March 1st, and 5th. At the first lecture, Prof. C. L. Fortescue will preside.

The next luncheon of the Batti-Wallahs' Society will be held at the Hotel Cecil on February 27th, when Lt.-Col. K. Edgcumbe will speak on "Prosperity." The Society's annual dinner and dance, fixed for March 1st at the Hotel Cecil, already promises to eclipse previous records.

Owing to the General Election, Blackpool Corporation has decided not to proceed with any special early season attractions in 1929. The usual illuminations are to be held in the autumn, however, the dates fixed being from September 21st to October 21st.

The annual examinations for a Faraday scholarship of fifty guineas per annum, tenable for two years in college and one year in manufacturing works, and for a Maxwell scholarship of fifty guineas per annum, tenable for one year in college and one year in works, will be held at Faraday House on April 9th, 10th and 11th.

Southport Council has had under consideration plans for the electrical illumination of Lord Street. The Electrical Engineer estimates that the cost of providing coloured electrical illuminations in the trees on the shop side of Lord Street on the basis of from 12 to 15 lamps per tree, including new mains, wiring and lamps, with necessary alterations to the existing switchboxes, transformers, etc., would be £1 077, and that the total number of lamps to be used in the scheme would be 1 378. It has been decided to provide lamps, as an experiment, in about 15 trees.

The Hull Medical Officer of Health reports that workers in departments for light treatment of patients have experienced difficulty owing to the fact that the output of ultra-violet light from certain lamps varies materially, and no simple and accurate method of measuring the output has yet been devised. He has suggested that the University College be asked to co-operate with his department in research work on the devising of a simple and efficient method of measuring the output of ultra-violet light from different sources, and the effect of light of different wavelengths on the human body. This suggestion has been adopted by the Corporation.

The report of Callender's Hospital and Distress Fund, approved at the recent general meeting, states that members' subscriptions, £947 12s. 4d., are lower than last year by £32 13s., but the awards to hospitals, etc., £885 15s., have not been decreased. Hospital letters issued were 668, and letters for special nursing at home 28. Surgical appliances were supplied in 78 cases, compared with 122, the number of convalescent home letters issued was 38, and spectacles were supplied to 128 applicants. Grants amounting to £92 7s. 6d., against £83, were made to members in distressed circumstances. Donations amounting to £158 3s. 10d. were received.

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PERSONAL.

MR. Thomas Alva Edison celebrated his 82nd birthday on Monday.

Mr. Owen Young, chairman of the General Electric Co., of New York, was on Monday, elected chairman of the Expert Committee on Reparations, now sitting in Paris.

Mr. V. W. Dale, business manager of the British Electrical Development Association, who has been suffering from pneumonia and empyema, following influenza, is now making very good progress, although it will be some time before he will be fit to return to his usual activities.

MR. Denis Ziani de Ferranti, youngest son of Dr. and Mrs. S. Z. de Ferranti, with his bride, Miss Elizabeth Esplin Thomson, photographed at the reception following their wedding at the Roman Catholic Church of All Saints, Hassop, on February 9th. The group includes Miss Yvonne de Ferranti and the Misses Yolande and Valeria de Ferranti, who acted as bridesmaids.

Mr. Harry Moss and Mr. A. Smith of Bradford, Mr. D. Green of Leeds and Mr. P. Hewitt of Sheffield, have been elected to represent the E.C.A. on the new North Midland Area Committee of the E.D.A. Mr. H. Rendall Baker, borough electrical engineer, Halifax, has been elected chairman.

Mr. R. Hoggard, manager of Lincoln Corporation Transport Department, who is leaving to take up a similar position at Chesterfield, has been presented by the employees with a silver tea and coffee service and a silver tray. From the city officials he received an electric lamp standard in oxidised silver.

The General Purposes Committee of the Bridlington Town Council on January 21st considered a recommendation by the Electricity Committee that the salary of the borough electrical engineer, Mr. A. J. Beckett, should be increased from £640 to £705 per annum. It was decided to defer the matter until the end of the financial year.

The Massachusetts Institute of Technology, Cambridge, Mass., has invited Prof. Dr. Ing. Reinhold Rudenberg, chief electrician of the Siemens-Schuckertwerke A.G., to deliver, at the Institute, before March 26th, 1929, a series of lectures on the latest progress in electrotechnics. Prof. Rudenberg has been an honorary professor at the Technical High School, Berlin, since 1926, and the degree of Dr. Ing. was conferred upon him by the Technical High School, Karlsruhe, in 1921.

The retirement is announced of Mr. R. Dumas, works manager at Rugby for the British Thomson-Houston Co., Ltd., a position he has filled since 1908. Mr. R. C. Clinker, chief of the engineering laboratory, has also relinquished his position, and is succeeded by Mr. H. W. Warren. Mr. Clinker joined the company in 1895 in London, and Mr. Warren joined the Rugby staff in 1911, and in 1913 went to Coventry and was responsible for the introduction of insulation manufacture, both at Rugby and Coventry.

At the Victoria Electrical Works, Huddersfield, of T. W. Broadbent, Ltd., on February 1, a presentation was made to Mr. Maurice Edward Broadbent, only son of the founder of the firm, the late Mr. T. W. Broadbent, on his coming-of-age. The workmen presented him with a suit case bearing his initials, the gift being handed over by Mr. Law Brook, the oldest employee. Mr. G. A. Broadbent, chairman of the company, presented each workman with a monetary gift, varying in amount according to length of service.

In connection with the retirement of Mr. W. A. Wilson at the end of last year, it is interesting to note that he joined the contract department of British Insulated Cables, Ltd., in April, 1901, as engineer. He supervised various contracts, including complete networks of h.t. cables in Amsterdam, and the laying and jointing of some 100 miles of 11 000 V feeders in connection with the electrification of the Underground Electric Railways. In 1905 he was transferred to the commercial side, being placed in charge of a new branch opened by the company in Birmingham; in 1906 he took over the management of the Scottish branch. He was appointed manager of the company's telephone instrument works at Liverpool in 1911, while in the following year he became commercial manager, involving the management of agencies and publicity. To these latter responsibilities were added, on his transfer to the general manager's office in London, in 1919, those of assistant to the general manager, duties which he continued up to the time of his retirement. Mr. Wilson's retirement and the death of Mr. James Taylor, the late chairman, in September, 1927, have of necessity caused various changes in the staff appointments. As so many of our subscribers are in personal touch with the chiefs of the various departments in British Insulated Cables, Ltd., we feel that it would be helpful to give a list of the new appointments. On the death of Mr. James Taylor, Mr. Dane Sinclair, director and general manager, became chairman of the company; Mr. G. H. Nisbett, chief engineer and director, was made managing director; Mr. B. Welbourn, contract manager, was appointed chief engineer; and Mr. N. K. Bunn, assistant contract manager, was appointed contract manager. On the retirement of Mr. Wilson, it was arranged that a committee should be appointed to take over his duties, the committee being constituted as follows: Mr. R. B. Paul (agency manager), Mr. A. J. Macphail (publicity manager), Mr. W. P. Ward, Mr. L. J. de Wynter, Mr. C. E. Newton, and Mr. E. A. Eaton (joint sales managers). Mr. C. E. Newton was, up to August, 1928, engineering representative at the London office. This appointment has now been taken over by Mr. N. H. Miller and Mr. E. A. Sayers. See page 207.

Obituary.

MR. FREDERICK BEARDMORE, aged 60 years. He was in business as an electrical contractor at Salford.

MR. JOSEPH GOBIN, aged 82 years. He was for many years associated with the old tramway company at Wigan, and was engineer prior to that undertaking being taken over by the Corporation.

MR. THOMAS C. STEPHENS, on February 2nd. He was superintendent at Weston for the Commercial Cable Co. He succeeded Mr. J. P. Gorton in this position in December, 1927, and was with the company for 40 years.

MR. A. H. ALLEN, on Wednesday, in his 57th year, from pneumonia following an attack of influenza. Mr. Allen, who had been a full member of the Institution of Electrical Engineers since 1913, and who was technical editor and a director of the "Electrical Review," which he joined in 1899, served his apprenticeship with Norman and Son, the Glasgow electrical engineers, and in 1889 became electrical assistant to the late Prof. A. Jamieson. After becoming the first Pender Gold Medallist in Electrical Engineering at the Glasgow Technical College, he joined Messrs. J. H. Holmes and Co. at Newcastle-on-Tyne, leaving them in 1894 to become lecturer and demonstrator on electrical design at the Central Technical College, London. Although a keen opponent of the Electricity Bill of 1926, he exerted every effort to assist the smooth working of the measure when it was placed on the Statute Book, and notable among his efforts in this direction was his work in the formation of the Overhead Lines Association in the face of formidable opposition. He took a keen interest in the work of the Electrical Trades Benevolent Institution, and had for some years been a member of the Council. To his journalistic acquaintances, as to others, his unfailing courtesy and dignity, and the kindliness behind a somewhat reserved and undemonstrative demeanour were notably evident qualities. Mr. Allen is survived by his widow and two daughters.

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OVERSEAS TRADE.

January Electrical Exports Exceed Imports by Over £1 000 000.

THE exports of electrical machinery, apparatus and material from the United Kingdom during January of this year, amounted to £1 614 301 as against £1 546 691 during the same month of 1928, representing an increase of £67 610. Imports of similar goods for January, 1929, amounted to £598 095, as compared with £572 754 for January, 1928, the increase being £25 341. Comparing exports for the month with imports shows a favourable balance of exports of £1 016 206, or an increase of £42 259 on the position at the same time last year.

Exports which show improvement for the month of January, 1929, when compared with the same period last year include motors and generators, other than railway and tramway motors, increase £60 889; rubber insulated wires and cables, other than telephone and telegraph, increase, £20 293; electric glow lamps, increase, £10 335; and various electrical goods and apparatus, increase £94 448. Exports which show a decline include submarine cables, £31 464; railway and tramway motors, £16 492; telegraph and telephone instruments and apparatus, excluding wireless valves, £40 691; batteries and accumulators, including parts, £19 674.

On the import side, electrical machinery increased by £8 558 when compared with the corresponding month of last year, while rubber insulated wires and cables also showed an increase, namely £2 066. Other import items which show increases are telegraph and telephone instruments and apparatus, £60 681; electric carbons, £2 278; and batteries and accumulators, £6 960. Imports which show decreases for the month include electric glow lamps, £58 371; and commercial electrical instruments other than telegraphic and telephonic but including house service meters, £5 632.

We give below detailed figures for the month of January, 1929, contrasted with those for the same period of last year:—

	Month of January. 1928 £	1929 £
IMPORTS.		
Electrical Machinery	148 096	156 654
Electric Wires and Cables, Insulated—		
Rubber Insulated (not being Telegraph or Telephone Wires or Cables)	15 725	17 791
Insulation other than rubber (not being Telegraph or Telephone Wires or Cables)	46 865	58 660
Telegraph and Telephone Wires and Cables (not being Submarine Cables)	11 834	3 781
Submarine Telegraph and Telephone Cables	—	—
Telegraph and Telephone Instruments and Apparatus (except wireless valves)	53 354	114 035
Carbons, Electric	10 893	13 171
Electric Lamps and parts thereof—		
Electric Glow Lamps	80 698	22 327
Arc Lamps and Electric Searchlights	420	2 198
Parts thereof (except carbon rods)	172	1 934
Batteries and Accumulators (including parts)	48 549	55 509
Electrical Instruments (other than telegraphic and telephonic): Commercial (including ammeters, voltmeters, etc.), house service meters, and scientific	27 171	21 539
Switchboards, other than Telegraph and Telephone	—	219
Electrical Goods and Apparatus, all other Sorts	128 977	130 277
Total of Electrical Goods and Apparatus	572 754	598 095
EXPORTS.	£	£
Electrical Machinery—		
Railway and Tramway Motors	42 120	25 628
Other Motors and Generators	225 911	286 800
All other sorts	333 049	351 011
Electric Wires and Cables, Insulated—		
Rubber Insulated (not being Telegraph or Telephone Wires or Cables)	119 617	139 910
Insulation other than rubber (not being Telegraph or Telephone Wires or Cables	124 896	133 395
Telegraph and Telephone Wires and Cables (not being Submarine Cables)	101 169	67 142
Submarine Telegraph and Telephone Cables	43 680	12 216
Telegraph and Telephone Instruments and Apparatus (except wireless valves)	215 344	174 653
Carbons, Electric	2 852	895
Electric Lamps and Parts—		
Electric Glow Lamps	43 027	53 362
Arc Lamps and Electric Searchlights	1 417	1 090
Parts thereof (except carbon rods)	108	736
Batteries and Accumulators (including parts)	87 742	68 068
Electrical Instruments (other than Telegraphic and Telephonic): Commercial (including ammeters, voltmeters, etc.), house service meters and scientific	31 588	30 819
Switchboards other than telegraph and telephone	11 705	11 722
Electrical Goods and Apparatus, all other sorts	162 406	256 854
Total of Electrical Goods and Apparatus	1 546 691	1 614 301

A petition signed by 118 shopkeepers in Prestatyn urban district has been presented to the U.D.C. protest ng against that body erecting shops and engaging in municipal trading. Members of the deputation which presented the petition said it was unfair that the Council should enter into competition with ratepayers as they had done in electric fittings.

LEGAL INTELLIGENCE.

India Rubber, Gutta Percha and Telegraph Works Co. in Patent Action Appeal.

IN the Court of Appeal, consisting of the Master of the Rolls and Lords Justices Lawrence and Russell, on February 1st. the India Rubber, Gutta Percha and Telegraph Works Co., Ltd., appealed from a judgment of Mr. Justice Eve in the Chancery Division, holding that they had infringed the letters patent of the plaintiffs, the Rose Street Foundry and Engineering Co., Ltd., of Inverness, for a welding machine.

The plaintiffs alleged that the defendants' (appellants) had caused to be altered a manually-operated electric resistance butt-welding machine so that it infringed their patent No. 190 734 of 1922 covering the automatic control of the welding operation.

The defendants pleaded that the plaintiffs' invention was insufficiently described in their specification, and alleged that it had been anticipated by prior publications, prior public user, and prior common general knowledge.

Mr. Justice Eve, however, held that the invention was sufficiently and accurately described in the plaintiffs' specification and drawings, and that the utility of the invention had been completely established. He further held that the defendants objections to the validity of the patent failed, and that they had been guilty of infringement.

He accordingly granted the plaintiffs the injunction claimed, an inquiry as to damages, the delivery up of the infringing machines, and the costs of the action. He also granted a certificate of validity. The defendants now appealed.

Mr. Whitehead, K.C., in support of the appeal, said the two issues on the appeal were as to the validity of the plaintiffs' patent and the question of infringement. He contended that the Judge had not come to a proper decision on the construction of the plaintiffs' patent, and finding that it was valid. He also submitted that the Judge was wrong in finding that there had been infringement, as the defendants' machine was enormously different from that of the plaintiffs.

On February 10th judgment was reserved.

IN PARLIAMENT.

New Scottish Bills—Replies to Questions of Electrical Interest.

THE Lord Chairman of Committees in the House of Lords and the Chairman of Ways and Means in the Commons have decided that the promoters of the West Highland Water Power, the Galloway Water Power and the Grampian Electric Supply schemes must proceed by Private Bill legislation and not by Provisional Order. It has accordingly been arranged that substituted Bills shall be deposited and the Bills first considered by the House of Lords.

The Postmaster-General does not propose to recommend a reduction of the cost of wireless licences from 10s. to 7s. 6d.

If no unforeseen difficulties arise the work of laying the submarine telephone cable between the Isle of Man and the mainland will be completed in July next.

The Minister of Transport states that he is informed that all the passenger rolling stock on the scheduled services between Glasgow and London on the L. and N.E. Railway is lighted by electricity, and that as regards the L.M. and S. Railway about 99 per cent. of the vehicles of express passenger trains between London and Scotland are at present electrically lighted. He has the whole matter under consideration.

Ducts and cables containing approximately 600 000 miles of telephone wire, were laid underground during 1928 at a cost of £4 280 000. About 40 000 miles of this represents diversion of overhead wire. Arrangements have been in operation for some time past for the exchange of information between the Post Office and other undertakers, including electricity supply companies, in regard to projected underground works, and every endeavour is made to secure co-ordination in this respect.

There has been a deficit on the telegraph service every year since the introduction of the sixpenny telegram in 1885. In the inland service there has been for years a continuous decline of traffic. Improvements of service are being effected by the introduction of machine telegraphy on a large scale, but the Postmaster-General fears that there is no prospect of making the service self-supporting so long as the present inland tariff (with a shilling minimum) remains in force, and any considerable increase of the tariff would tend further to accelerate the transfer of traffic to the telephone system.

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BUSINESS OPENINGS.

Latest Particulars of Electrical Engineering and Wiring Installation Contracts for which Tenders are being Invited at Home and Abroad.

WE give below the latest particulars of contracts for which tenders are invited. The closing date is given, when available.

AYLESBURY CORPORATION.—Supply of materials for 12 months to the electricity department, including cable, overhead material, meters, poles, joint and pole boxes, cut-outs, switches, etc. Specification from Mr. W. A. Turnbull, Electricity Works, Exchange Street, Aylesbury.

LIVERPOOL CORPORATION.—Supply and erection of electrically-driven pumping plant, at Aubrey Street pumping station. Specification from the Water Engineer, 55, Dale Street, Liverpool; deposit £2 2s.

Lighting of Bandstands, &c.

RAMSGATE CORPORATION.—Supply of electric lamps, cable strip lighting, material for switchboard, etc., for use at bandstands, concert halls, etc. Specifications, etc., from Mr. R. J. Costerton, entertainments manager, West Cliff Concert Hall, Ramsgate.

ST. HELENS EDUCATION COMMITTEE.—Electric light installation at new Boys' Secondary School. Persons desirous of tendering must send names to Secretary, Education Offices, St. Helens.

CENTRAL ELECTRICITY BOARD, February 15th.—Supply and laying of 66 000 V cables in London area, in connection with South-East England Electricity Scheme. Specification (S.E.E.-L.C.1) and form of tender from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

LEEDS CORPORATION, February 15th.—One year's supply of stores to the electricity department, including castings (section C.), i.r. covered cables, mains boxes and fittings, jointing and insulating materials, fittings and sundries (section N.). Forms of tender, etc., from Mr. C. N. Hefford, manager, 1, Whitehall Road, Leeds. State section for which it is desired to tender.

EASTBOURNE CORPORATION, February 15th.—Electric light installation in 250 small houses. Specification, etc., from Mr. J. K. Brydges, borough electrical engineer.

ST. THOMAS'S CHURCH, GOOLE, February 16th.—Electric light installation in church, presbytery, schools and club. Specifications from the Rev. J. J. O'Shea.

BELFAST CORPORATION, February 18th.—Twelve months' supply of stores for the electricity department, including electrical accessories (form No. 8), lamps (No. 9), carbon brushes (No. 10), bitite strip, prepared tape and rubber tape for joints and joint box compound (No. 12), c. i. street box frames and covers (No. 14), copper cable connectors and solder (No. 18), electricity meters and instrument transformers (No. 19), m.d. indicators (No. 20), automatic time switches (No. 21), cut-outs (No. 22), transformers (No. 23), cables and joint boxes (No. 24), v.i.r. cables, wires and flexibles (No. 26), etc. Forms of tender, etc., from Mr. F. H. Whysall, city electrical engineer and manager, East Bridge Street, Belfast.

BETHNAL GREEN (LONDON) BOROUGH COUNCIL, February 18th.—Six or 12 months' supply of electric lamps, lanterns, etc. Specifications from the Borough Engineer.

CENTRAL ELECTRICITY BOARD, February 18th.—Supply and erection of 132 000 V overhead transmission lines, in connection with the North-West England and North Wales Electricity Scheme. Specification (No. N.W.E.-P.L.1) and form of tender from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

CENTRAL ELECTRICITY BOARD, February 18th.—Supply and erection of 132 000 V overhead transmission lines, in connection with the Central England Electricity Scheme. Specification (No. C.E.-P.L.1) and form of tender from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

HULL CORPORATION, February 18th.—Twelve months' supply of stores to the tramways department, including controller parts, trolley parts, car truck parts, cables, lamps, lighting fittings, armature repairing material, overhead line material, etc. Forms of tender, etc., from the General Manager, Albion Street, Hull.

LANCASTER CORPORATION, February 18th.—Supply of 400–600 Ah battery (at one hour rate) booster, switchgear, cable connections, etc., for Caton Road generating station. Specifications, etc., from Mr. G. C. Milnes, borough electrical engineer; deposit £2.

STOKE AND WOLSTANTON GUARDIANS, February 18th.—Electric lighting installation at Relief Offices, 18, Church Street, Tunstall. Specification from Mr. W. Pendleton, Union offices, Stoke-on-Trent.

TYNE IMPROVEMENT COMMISSION, February 18th.—One 1½-ton portal, electric, travelling, level luffing crane, for Riverside Quay, Albert Edward Dock, North Shields. Specification, etc., from the Secretary, Bewick Street, Newcastle-on-Tyne; deposit £1 1s.

WEST HAM EDUCATION COMMITTEE, February 18th.—Electric light installation in South Hallsville New School, Agate Street, Tidal Basin. Specifications, etc., from Mr. J. H. Jacques, 61, West Ham Lane, Stratford, London, E.15; deposit £1.

BIRKENHEAD CORPORATION, February 19th.—One year's supply of stores to tramway depots, including overhead line material, copper bonds, trolley wire, traction lamps, tapes, etc. Forms of tender, etc., from the General Manager, Corporation Tramways and Motors, Laird Street, Birkenhead.

MANCHESTER GUARDIANS, February 19th.—Renewal of a 98-cell electric storage battery at the Colony for Epileptics, Langho, near Blackburn. Particulars from Mr. E. Hargreaves, superintendent of works, Union Offices, All Saints, Manchester.

BRISTOL GUARDIANS, February 20th.—Supply of electric fittings for six months. Particulars from Mr. Thomas S. Lamb, clerk to the Guardians.

HARROGATE CORPORATION, February 20th.—Twelve months' supply of stores, including electric lamps, c.i. lamp pillars, etc. Forms of tender, etc., from the Borough Engineer.

HOVE CORPORATION, February 20th.—Supply of electric lamps, etc. Forms of tender, etc., from the Borough Surveyor.

METROPOLITAN ASYLUMS BOARD, February 20th.—Electric lighting installation at Southwark Casual Ward, Guildford Street, London, S.E.1. Specification, etc., from the Board's office, Victoria Embankment, E.C.4; deposit £1 1s.

DUMFRIES CORPORATION, February 21st.—Supply and erection of one 1 500 kW turbo-alternator and condensing plant. General conditions, specification and form of tender from Mr. W. S. Johnston, engineer and manager, Electricity Works, Leafield Road, Dumfries; deposit £1 1s.

Annual Supplies of Underground Cables.

BEDFORD CORPORATION, February 22nd.—Supply of e.h.t h.t., and l.t. underground cables (section 1) and incandescent electric lamps (section 2) during year ending March 31st, 1930. Only British manufacturers in the U.K. are invited to tender. Specifications, etc., from the Borough Electrical Engineer, Prebend Street, Bedford.

BELFAST EDUCATION COMMITTEE, February 22nd.—Electric light installation, at Malone Public Elementary School, Balmoral Avenue, Belfast. Specifications, etc., from the Education Architect, Victoria Street, Belfast; deposit £1 1s.

BELFAST EDUCATION COMMITTEE, February 22nd.—Installation of electric lighting and heating system, in Riddell Memorial Public Elementary School, Malvern Street, Belfast. Specifications, etc., for the Education Architect, Victoria Street, Belfast; deposit £1 1s.

CENTRAL ELECTRICITY BOARD, February 22nd.—Supply of 132 kV outdoor switchgear, for transforming stations in area of Central England Electricity Scheme. Specification from Sir R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2.

BAKEWELL GUARDIANS, February 23rd.—Three-valve wireless apparatus, with three loud speakers (for connection to a.c. mains), for Haddon District Hospital. Tenders to the Clerk, Hospital Committee, Union Offices, Bakewell.

ORSETT GUARDIANS, February 23rd.—Electrical wiring and fitting of new infirmary block and poor law buildings. Particulars from the clerk, Mr. Chas. Asplin, Bank Buildings, Grays.

TYNEMOUTH GUARDIANS, February 23rd. Electric light and heating installation in Children's Scattered Homes, at North Shields, Earsdon, and Monkseaton. Specification from the Clerk, Guardians' Hall, North Shields.

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BROMLEY GUARDIANS, February 25th.—Installation of intercommunication telephone system (30 points) at the Farnborough Institution. Further particulars from Mr. P. J. D. Wiley, clerk to the Guardians, Bromley, Kent.

HASTINGS CORPORATION, February 25th.—Electrically-driven pumping plant, of British manufacture, for Kent Street pumping station. Specification, etc., from Mr. G. M. C. Taylor (J. Taylor and Sons), Caxton House, Westminster, S.W.1 ; deposit £5.

LONDON COUNTY COUNCIL, February 26th.—Provision and fixing of electric goods lift at Hammersmith Building Trade Schools, Lime Grove. Specification from the Chief Engineer, Old County Hall, Spring Gardens, S.W.1 ; deposit £1.

LINLITHGOW DISTRICT COMMITTEE, February 28th.—Erection of lamps and other electric lighting fittings in Winchburgh and Kirkliston special lighting districts. Specification, etc., from Mr. J. G. B. Henderson, district clerk, Linlithgow.

NEWTON ABBOT GUARDIANS, February 28th.—Electric lighting installation at the Institution. Forms of tender and specification from Messrs. Watson and Watson, 36, Torwood Street, Torquay ; deposit £2 2s.

CENTRAL ELECTRICITY BOARD, March 2nd.—Supply and erection of 33 000 V overhead line—Luton to Aylesbury—in connection with the South East England Electricity Scheme Specification (No. S.E.E.-S.L.2) and form of tender from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, Charing Cross, London, W.C.2 ; deposit £2 2s.

CENTRAL ELECTRICITY BOARD, March 2nd.—Supply and erection of 66 000 V and other transformers in the London area, in connection with the South-East England Electricity Scheme. Specification (No. S.E.E.-L.T.1) and form of tender from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2 ; deposit, £2 2s.

CENTRAL ELECTRICITY BOARD, March 4th.—Supply and erection of 132 000 V transformers in connection with the North-West England and North Wales Electricity Scheme. Specification (N.W.E.-P.T.1) from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2 ; deposit, £2 2s.

ERITH URBAN DISTRICT COUNCIL, March 4th.—Supply of h.t. and l.t. underground cables, joint boxes and other accessories during 12 months. Particulars and form of tender from the Electrical Engineer, Walnut Tree Road, Erith.

LEEDS CORPORATION, March 5th.—One year's supply of materials to the tramways and transport department, including electrical sundries, bitumen compound, electrodes, etc. Specification, etc., from Mr. R. L. Horsfield, general manager and engineer, 1, Swinegate, Leeds.

RACECOURSE BETTING CONTROL BOARD, March 5th.—Supply and erection of equipment for mechanical control of racecourse betting transactions in Great Britain. Specifications, etc., from Mr. J. R. Chambers, Secretary, 33, St. James's Street, London, S.W.1 ; deposit £2 2s.

CENTRAL ELECTRICITY BOARD, March 6th.—Supply and erection of 66 000 V switchgear, for South-East England Electricity Scheme (London area), and supply and erection of 132 000 V transformers. Specification from Sir R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2.

LEEDS CORPORATION, March 9th.—Supply of single-phase (2 000 and 6 600 V), three-phase (6 600 V) and Scott-connected transformers, as required over a period of two years ; and 11 000 V, three-phase transformers (10 500 kVA), for early delivery. Specification from Mr. C. N. Hefford, Electricity Department, 1, Whitehall Road, Leeds ; deposit £1 1s.

SHEFFIELD CORPORATION, March 14th.—Buildings, civil engineering works and constructional steel work (specification B.M. 64) ; transformers (B.M. 66) ; pipework and valves (B.M. 69) ; e.h.t. three-phase switchgear (B.M. 71) ; battery locomotive and accessories (B.M. 74). Specifications (deposit £3 3s. for each) from Mr. S. E. Fedden, general manager and engineer, Electric Supply Department, Commercial Street, Sheffield.

Overseas.

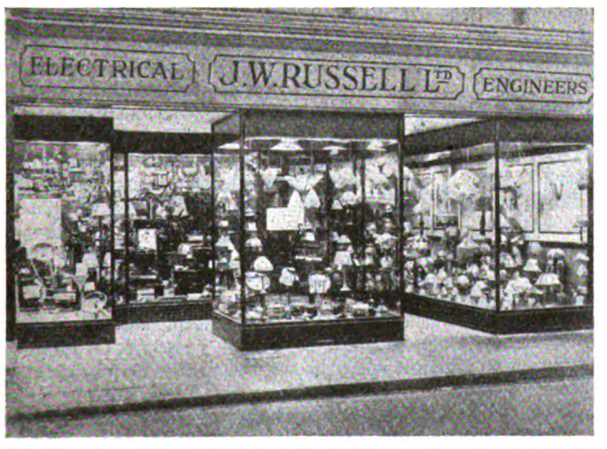
UNLESS otherwise stated, particulars of overseas contracts are to be had from the Department of Overseas Trade (Room 52), 35, Old Queen Street, Westminster, London, S.W.1. *Note.—An asterisk denotes that local representation is, in practice, essential.*

INDIA STORE DEPARTMENT, February 15th.—Supply of 62 248 metallic filament lamps, for train lighting. Form of tender (5s.) from the Director-General, Belvedere Road, London, S.E.1.

INDIA STORE DEPARTMENT, February 15th.—Supply of hydro-electric plant, comprising four 12 000 kW water-wheel driven alternator sets, auxiliaries and spares (schedule 4). Forms of tender (5s.) from the Director-General, Belvedere Road, London, S.E.1.

IXELLES MUNICIPALITY, February 16th.—Supply of armoured cables. (Reference B.X. 5 100.)

NEW SOUTH WALES DEPARTMENT OF PUBLIC WORKS. Extension of date.—February 18th.—Supply and erection of



CONTRACTORS' SHOWROOMS.

THE accompanying pictures illustrate the new showrooms opened by J. W. Russell, Ltd., electrical engineers and contractors, of Watford. The frontage of the premises is 34 ft., the showrooms having a depth of 80 ft. The windows are laid out on the island scheme, giving a window glass frontage of 84 ft. The ceiling layout is on the panel principle, having flush plug and fitting hooks fixed at the panel crossing, and each switched independently, thus permitting any of the 200 fittings to be demonstrated separately if necessary. The floor layout is such that different sections are arranged as dining room, drawing room, etc. At the rear of the main showrooms are rooms fitted out as demonstration kitchen, bathroom, etc., showing geysers, immersion heaters, reflectors, cookers, etc., working under actual conditions. Above the main showrooms are the offices and large stock rooms, as well as workshops for the repair of all classes of electrical equipment.

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hydro-electric generating plant for Burrinjuck development. (Reference 4 938.)

INDIAN STORES DEPARTMENT, February 19th.—Supply of Diesel engine, directly coupled to 115 kW, d.c. generator (Order No. N/9 322.) (Reference B.X. 5 097.)

NEW ZEALAND POSTS AND TELEGRAPHS, February 19th.—Supply of bronze wire and copper binding wire. (Reference A.X. 7 252.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, February 19th.—Supply of 120 000 galvanised steel spindles for insulators. (Reference B.X. 4 948.)

POSTMASTER - GENERAL'S DEPARTMENT, MELBOURNE, February 19th.—Dry cells and wet battery parts (schedule C. 404). (Reference B.X. 5 068.)

CAPE TOWN MUNICIPALITY, February 20th.—Pumping equipment for storm water, etc., for the electricity department (specification 445/28). (Reference A.X. 7 345.)

WHANGAREI (N.Z.) HARBOUR BOARD, February 28th.—Supply of one 15-ton electrically-operated level luffing gantry crane (contract No. 35). (Reference A.X. 7 263.)

JOHANNESBURG MUNICIPALITY, March 4th.—Supply of 6 600 V switchgear (Contract No. 126). (Reference B.X. 5 087.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, March 5th.—Supply of seven single-phase 5 500 kVA transformers, for Waitaki power scheme, section 4. (Reference B.X. 4 873.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, March 7th.—Supply of hydraulic accumulator, horizontal ram pump, electric motor, motor or belt driven air compressor, starter and control gear.

DUNEDIN, N.Z., CORPORATION, March 20th.—Supply of hand brake equipment, electrical equipment for magnetic brakes and bogie trucks, for tramcars.

CAPE TOWN MUNICIPALITY, March 21st.—Supply of 300 A fuses (specification 453/1928). (Reference B.X. 5080.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, March 26th.—Switchboard cords. (Reference B.X. 5 067.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, March 26th.—Supply of telephones and dials (schedule C. 401). (Reference B.X. 5 023.)

EGYPTIAN MINISTRY OF THE INTERIOR, March 27th.—Supply and installation of electric lighting system for the town of Fashn. (Reference B.X. 5 037.)

SOUTH AFRICAN POSTS AND TELEGRAPHS, March 28th.—Supply of telephone switchboard cords. (Tender No. 148.) (Reference B.X. 5 048.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, April 2nd.—Supply of jumper rings and terminal strips (schedule C. 405). (Reference B.X. 5 066.)

VICTORIAN ELECTRICITY COMMISSION, April 8th.—Supply of 22 000 V transformers (specification No. 29/17). (Reference B.X. 5 101.)

VICTORIAN ELECTRICITY COMMISSION, April 8th.—Galvanised steel transmission line towers (specification 29/13). (Reference A.X. 7 401.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, April 9th.—Supply of induction voltage regulators, for Lake Coleridge scheme (section 215). (Reference B.X. 5 018.)

VICTORIAN ELECTRICITY COMMISSION, April 29th.—Supply of two or three steam turbo generator sets, with condensers, etc., for Yallourn power station extension (specification 29/7). (Reference B.X. 5 062.)

VICTORIAN ELECTRICITY COMMISSION, April 29th.—Supply of two swing hammer mills, with electric motors, for brown coal (specification 29/9). (Reference A.X. 7 434.)

STATE ELECTRICITY WORKS, MONTEVIDEO, July 8th.—Construction and equipment of 50 000 kW power station.

Tenders Accepted.

EGYPTIAN STATE RAILWAYS.—Bellis and Morcom, supply of two generating sets, £1 275.

ADMIRALTY.—Edison Swan Electric Co., Ltd., supply of vacuum and gas-filled lamps.

DUBLIN CORPORATION.—General Electric Co., Ltd., maintenance of electricity meters for one year, £700.

GRIMSBY CORPORATION.—Metropolitan-Vickers Electrical Co., Ltd., supply of extra high pressure switchgear, £3 550.

BOOTH STEAMSHIP CO., LTD.—Siemens Electric Lamps and Supplies, Ltd., 12 months' supply of Siemens electric lamps.

TORQUAY CORPORATION.—Johnson and Phillips, Ltd., overhead 11 000 V three-phase line from Ipplepen to Dartington.

GLASGOW CORPORATION.—Kennedy, Stark and Co., electric lighting, bell and fire-alarm installations at Mearnskirk Sanatorium, £1 571.

SALFORD CORPORATION.—N. V. Nederlandsche Kabelfabriek, Delft, Holland, supply of cable to British standard specification, £9 358.

GILLINGHAM (KENT) CORPORATION.—Callender's Cable and Construction Co., Ltd., cable for extension to Rainham, Wigmore and Hempstead, £7 807.

MANCHESTER CORPORATION.—Cargo Fleet Iron Co., Ltd., supply of tramway rails for sidings at Hyde Road depot; G. Hill and Co., renewal of electric lighting cables at Baguley Sanatorium.

MANCHESTER CORPORATION. Seddon and Sons, alterations to electric light installation at Queen Street Central Municipal School; C. Churchill and Co., Ltd., shaping machine and electric drill.

MANCHESTER CORPORATION.—Forest City Electric Co., Ltd., and Messrs. Thos. Bolton and Sons, Ltd., tramway rail bends; J. Needham and Sons, Ltd., cast iron finials for tramway poles.

Electrically-Driven Pumping Plant.

METROPOLITAN WATER BOARD.—Worthington-Simpson, Ltd., two sets of centrifugal pumps, one turbine-driven and one electrically-driven, for Kempton Park Works, £542. (Recommended.)

BRADFORD CORPORATION.—E. Green and Son, Ltd., erection of certain apparatus in connection with scheme for increasing the economiser surface of a boiler at the Valley Road power station.

STEPNEY (LONDON) BOROUGH COUNCIL.—Reason Manufacturing Co., Ltd., replacement of about 850 old-type demand indicators, at £2 7s. per instrument, allowing the Council 7s. for each old instrument.

ROTHERHAM CORPORATION.—Vickers-Armstrong, Ltd., supply of pumping plant required in connection with river and canal pumping scheme, £1 295 (including allowance of £200 for switchgear and £100 for contingencies).

TORQUAY CORPORATION.—Switchgear and Cowans, Ltd., vertical shrouded ironclad switchgear, at Vicary Mills substation, £81[illegible]; Johnson and Phillips, Ltd., erection of overhead 11 000 V three-phase line from Ipplepen to Dartington, £2 880 13s. 11d.

VICTORIAN ELECTRICITY COMMISSION.—John Thompson Water Tube Boilers, Ltd., 8 boilers, each of overload capacity of 85 000 lb. of steam per hour, 275 lb. working pressure, with superheaters, air pre-heaters, fans, pupework, etc., for Yallourn power station, £223 288.

MANCHESTER CORPORATION.—Ferranti, Ltd., Measurement Ltd., and Metropolitan-Vickers Electrical Co., Ltd., supply of meters; Waygood-Otis, Ltd., provision of electric lift at High School of Commerce; Sudlow and Co., electric light installation at Apollo School Centre.

LEEDS CORPORATION.—Supply of cables: W. T. Henley's Telegraph Works Co., Ltd., £4 752 14s.; Enfield Cable Works, Ltd., £3 008; Macintosh Cable Co., Ltd., £20 776 10s.; Hackbridge Cable Co., Ltd., £1 865; and Greenwich Cable Works, Ltd., £4 118 10s. 4d.; Thos. Bolton and Sons, Ltd., two miles trolley wire, 12 $\frac{7}{16}$d. per lb.

SALFORD CORPORATION.—A. E. Dean and Co., installation of X-ray apparatus at Tuberculosis Dispensary, Regent Road, Salford, £347; J. Price and Sons, electric light installation at Trafford Road Girls' School, £196; Connolly's (Blackley), Ltd., supply of 4 200 yards of 2 sq. in., e.h.t., concentric, paper insulated, lead covered cable, £1 436; Greenwich Cable Works, Ltd., supply of l.t., paper insulated, lead covered and armoured cable, £2 633. (All recommended.)

GLASGOW CORPORATION.—A. Robertson, electrical installation work in houses in Scotstoun area, £2 361; D. Henderson, electrical installation work in houses under Gairbraid Avenue re-housing scheme, £1 618; Ferranti, Ltd., supply of seven single-phase 50 kVA transformers, £409; and 12 kVA portable a.c. testing equipment, £168; Lancashire Dynamo and Motor Co., Ltd., 50 H.P. motor, £143; British Electrical and Manufacturing Co., supply of 50 000 yards of cable, £562.

SHEFFIELD CORPORATION.—Steel, Peech and Tozer, Ltd., 1 000 tons of tram rails, £10 2s. 6d. per ton. Twin movable connected points—Edgar Allen and Co., Ltd., six at £118 per pair; Messrs. Hadfields, Ltd., 12 pairs at £120 a pair, 3 pairs at £127 per pair; Edgar Allen and Co., Ltd., 3 pairs at £141 per pair, and three pairs at £143 per pair; Titan Trackwork Co., Ltd., 10 manganese steel crossings, £27 15s. each; copper bonds: Thos. Bolton and Sons, Ltd., 1 000 24 in. at £8 4s. 3d. per 100 and 1 000 34 in. at £10 6s. 10d. per 100; A. Frost and Co., Ltd., 100 56 in. at £15 per 100, 200 60 in. at £16; 50 144 in. at £34; 50 192 in. at £45, and 25 204 in. at £47 10s.

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WORK IN PROSPECT.

BARNSLEY.—Technical college for the Borough Education Committee. Particulars from the architects, Briggs and Thornley.

BURTON-ON-TRENT.—Orthopædic Hospital wards, for Derbyshire County Council. Particulars from the architects, Martin and Martin and W. H. Ward, 106, Colmore Row, Birmingham.

BURNHAM (ESSEX).—Houses (18), for the Urban Council. Particulars from contractors, J. and F. Challis.

CARLISLE.—Technical school, two central schools, and library and museum extensions, for the City Council. Particulars from the City Surveyor.—Houses for the Town Council Particulars from the contractors, J. and R. Bell, Ltd. (159), John Laing and Son, Ltd. (108), and Border Engineering Contractors, Ltd., Whitehaven (32).

COULSDON AND PURLEY.—Houses (20), Sanderstead, for the Urban Council. Particulars from the surveyor, Mr. G. A. Ballard, 6, Brighton Road, Purley.

DURHAM.—Housing scheme (60), Cassop, for the Rural Council. Particulars from the Surveyor.

FARNBOROUGH (HANTS).—Housing scheme (20), for the Urban Council. Particulars from the architect, Mr. J. E. Hargreaves, Town Hall.

GRAYS.—Secondary school (350 places), for the Governors. Particulars from Mr. J. Stuart, county architect, Springfield Old Court, Chelmsford.

HARPENDEN.—School, Manland Common, for Herts Education Committee. Particulars from the Director of Education, Hertford.

ILFRACOMBE.—Housing scheme for the Urban Council. Particulars from the Surveyor.

LYMM.—Business premises for the Warrington Co-operative Society. Particulars from the C.W.S. Architect, 1, Balloon Street, Manchester.

OLDBURY.—Additional 28 houses for the Urban Council. Particulars from the Surveyor.

REPTON.—Bathrooms, etc., Etwall Isolation Hospital, for the Committee. Particulars from the architect, Mr. R. S. Litherland, 10, High Street, Burton-on-Trent.

RUGBY.—Houses (12), Clifton-on-Dunsmoore, for the Rural Council. Particulars from the surveyor, Mr. J. E. Weeks, Temple Street.

SALE.—Extensions to County High School for Girls, to cost £14 000, for Cheshire Education Committee. Particulars from the County Architect, Chester.

STOCKPORT.—Extensions, Central premises, for the Co-operative Society. Particulars from the general secretary, Mr. S. Lloyd.—Bowl-houses and shelters for the Town Council. Particulars from the borough surveyor, Mr. H. Hamer.

STOURPORT.—Practical subjects centre, etc., for Worcestershire Education Committee. Particulars from the Director of Education, Worcester.

SWADLINCOTE.—Housing scheme (80), for the Urban Council. Particulars from the architects, Baines, Provis and Cope, 22, Friar Lane, Leicester.

THORNE (DONCASTER).—Houses (36), Marshland Road, for Mr. W. Wilkinson.—Housing scheme (48), for the Rural Council. Particulars from the Surveyor.

WALSALL.—Houses (45), for the Town Council. Particulars from the contractors, T. Richards, Ltd., Chasetown.

"INTER NOS."

"Inter Nos," the journal of the Ex-British Westinghouse Association, self-described as a publication of variable frequency is full of the breezy good fellowship which is typical of this group of former members of the staff of the British Westinghouse Co. The latest issue of this literally "price-less" production worthily maintains the X.B.W. traditions, and provides reading matter which is interesting and amusing, even to those outside the charmed circle. Incidentally, "Inter Nos" gives the first intimation of the formation of a new electrical company, which will be known as the Assimilated Genmetenglishratusantipalinhouse, Ltd. This company, it is stated, will produce a lamp on an entirely new principle under the name of "Oscostungnanazda."

The next dinner and reunion of Ex-British Westinghouse men will be held at the Hotel Cecil, London, on March 8th, Mr. F. Massingberd Rogers presiding. Particulars and tickets (15s. each, including one year's subscription) may be had from the honorary treasurer, Mr. W. E. Warrilow, 40, Mildred Avenue, Watford.

TRADE PUBLICATIONS.

WE have received from KING'S PATENT AGENCY, LTD., of 146A, Queen Victoria Street, London, E.C.4, a pocket size diary for 1929.

Super tension cables are described in a new booklet sent to us by SIEMENS BROTHERS AND CO., LTD., Woolwich, London, S.E.18. Reference 155 A.

A new catalogue relative to standard ironclad switch and fusegear has been published by SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.

Leaflet No. X.2020, dealing with e.h.t. standard oil switches, has been issued by J. G. STATTER AND CO., of Queen Anne's Chambers, Westminster, London, S.W.1.

The MULLARD SERVICE WIRELESS CO., LTD., Denmark Street, London, W.C.2, has published leaflet W.A.17, dealing with the P.M. gridleak and condenser holder.

The GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, has issued booklet F. 4910, concerning industrial and street lighting fittings and accessories.

The new "Exide" poster described below.

The BRITISH THOMSON-HOUSTON CO., LTD., has published three new booklets, L 459 dealing with industrial lighting, L 451 concerning floodlighting, and L 460 devoted to shop lighting.

New lists published by A. H. HUNT, LTD., H.A.H. Works, Tunstall Road, Croydon, include catalogue No. 60 and leaflet No. 138 B, dealing with moving coil measuring instruments.

The BRITISH THOMSON-HOUSTON CO., LTD., Rugby, has published list No. 6845 dealing with d.c. circuit breakers, tramcar pattern, type K/R, and list No. 5270 A* dealing with hand-operated three-phase auto-transformer starters, types AHT and AHQ.

The GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, has issued leaflet B.C. 4911, describing the Gecophone portable screen grid four receiver. Leaflets F.4857, F.4858 and F.4859, dealing with Gecofix lighting fittings, have also been published.

We have received from GEORGE NOBBS, LTD., of 89, Cleveland Road, London, N.1, a calender in colours printed on satin. The subject of the picture is a picnic party climbing a hill with a girl as the central figure. The title of the picture is "At the Top," and in these dull days the sunny scene is distinctly pleasing.

We have received from Metro-Vick Supplies, Ltd., of Trafford Park, Manchester, a copy of list No. 150/12. This describes the whole of the company's electrical domestic appliances and certain industrial equipment. The list, comprising some 90 odd pages, is profusely illustrated, and each page is arranged with full details as to technicalities and price.

The CHLORIDE ELECTRICAL STORAGE CO., LTD., of Clifton Junction, near Manchester, has just issued a very attractive coloured poster (20 in. by 30 in.) dealing with the well-known series of Exide DTG, DFG, DHG and DMG 2 V cells for comparatively slow rates of discharge. The poster contains a clear and attractive illustration of a popular type of Exide wireless cell, and prominently sets forth a number of notable improvements which have been effected in the design.

ELECTRICAL ENGINEERS' BALL.

The Electrical Engineers' Ball was given at the Hotel Cecil, London, on February 8th, about 750 invitations having been sent out. The first of these balls was held on February 15th, 1904, and this year's function was made an opportunity for celebrating the 25 years which have passed. Mr. A. M. Sillar, who has acted in the capacity of hon. secretary since the first ball, was, during the course of the evening, presented with a silver inkstand, suitably inscribed.

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ELECTRICITY SUPPLY.

Additional Plant for Ashford—Electric Houses at Wakefield—Supply Wanted for Omagh—County of London Co.'s Scheme for Essex—Hackney Electricity Committee Disapproves J.E.A. Proposals—Plymouth Wiring Scheme.

ASHFORD (Kent) U.D.C. is to increase its generating plant, at a cost of £10 000.

Radcliffe-on-Trent P.C. seeks sanction for a loan of £500 for street lighting.

Carlisle Electricity Committee has authorised mains extensions at a cost of £3 175.

The Clyde Valley Electrical Power Company is to erect a sub-station near Ashfield Farm, Possil.

Cables are being laid in Forth Street, North Berwick, for the extension of the electricity supply system.

Newport (co. Fife) T.C. is anxious to obtain a supply of electricity, and has asked the Electricity Commissioners when a supply will be available.

Stretford U.D.C. has applied to the Electricity Commissioners for sanction to borrow £20 000 to meet prospective expenditure in respect of the provision of l.t. mains and services.

Wakefield Electricity Committee has authorised the Electrical Engineer to fit 50 houses on the Lupset estate with electrical appliances, on similar lines to the houses which have already been fitted on the estate.

Bristol Electricity Committee reports that it is necessary to replace e.h.t. switchgear at the Feeder Road station by larger and more up-to-date gear. The cost of the new works will be approximately £26 090, including £7 000 for building work.

London County Council has approved plans submitted by the County of London Electric Supply Co., the Kent Electric Power Co., and the West Kent Electric Co., Ltd., for laying a 33 000 V feeder cable and a control cable from Woolwich to Swanscombe.

The Town Clerk of Omagh has been instructed to communicate with certain towns where electrical plant has been installed and obtain details as to the working and cost of the undertakings. Local opinion is in favour of obtaining an electricity supply for the town.

The County of London Electric Supply Co. has informed Ongar R.D.C. that it has formulated a scheme for the supply of electricity throughout all parts of the county of Essex, not otherwise already supplied. The transmission system is to be mainly overhead.

The assessment authorities have proposed to increase the assessment of Hull Corporation's electricity department from just over £10 000 to £45 000. The Electricity Committee has confirmed the action of the City Treasurer in appealing against the assessment.

The Glasgow Lighting Inspector who recently attended a demonstration in London in connection with the Radiovisor automatic lighting unit, desires to make further experiments in his own laboratory in connection therewith. The Watch Committee recommends that he be authorised to expend a sum not exceeding £100 in connection with these experiments.

East Ham Electricity Committee has had under consideration the question of establishing an installation department in connection with the electricity undertaking and, having heard the report of the engineer and manager thereon, recommends that the matter be left in the hands of the chairman and the engineer and manager, who will prepare a further report.

Tonbridge U.D.C. has applied for a loan of £12 715, estimated expenditure to March, 1930, in connection with the alteration of the system of supply of electricity. The total applied for originally was £21 100, to be expended between 1929 and 1934, but the Commissioners intimated that they could only sanction the amount required for any one year.

Tavistock R.D.C. has been asked to consent to Messrs. W. G. Heath and Co.'s application for an Order to supply electricity in Tavistock rural district. Messrs. Heath and Co. already supply in Okehampton, and in the urban district of Tavistock and the parish of Yelverton. At a recent meeting of the R.D.C., a committee was appointed to consider the matter.

Canterbury Lighting Committee has offered to supply electricity to houses on the North Holmes site at a flat rate of 9d. per week, on the Housing Committee guaranteeing the weekly payments, but has declined to sell fittings to the tenants. The Council has given the guarantee, but has decided not to adopt the Electricity Commissioners' suggestion to provide the first lamps free of charge.

At a meeting of Kesteven Council last week a special committee, reporting on a suggested scheme for supplying Lincolnshire with electricity, recommended that of Mr. Borlase Matthews. The committee had pointed out that the areas around Grantham and Sleaford were being neglected, but on negotation, Mr. Matthews had agreed that those areas should be provided with electricity within five years. The report was adopted.

Gloucester Corporation has decided to apply for a loan of £90 345 5s. 5d. to cover past and prospective expenditure. The former includes extensions of buildings, £2 301 12s. 4d.; machinery, £12 756 12s. 1d.; mains, cables, and overhead lines, £43 891 7s. 11d.; electrical instruments, £160 5s.; public lamps, £1 717 9s. 1d.; sub-station buildings, £8 128 19s.; and sub-station equipment, £839. The prospective expenditure comprises £10 000 for rotary converters; mains and services, £10 000, and public lamps, £550.

Hackney (London) Electricity Committee recommends that the Central Electricity Board, the Electricity Commissioners, the London and Home Countries Joint Electricity Authority, and the Conference of Local Authorities owning Electricity undertakings in Greater London be informed that the B.C. does not approve of the proposals of the Joint Committee of the Joint Electricity Authority and the Conference of Local Authorities owning electricity undertakings for a combination of ownership and operation of local authority generating stations and main transmission lines by transferring them to the Joint Electricity Authority.

Arrangements have been made by Liverpool Power and Lighting Committee for the supply of energy for heavy and commercial cooking apparatus at ⅝d. per kWh, except between 4 p.m. and 6.30 p.m. from October 1st to March 31st. In this excepted period the lighting rate will be applicable. Tenants of Corporation houses are to be permitted to employ slot meters, with the option of a quarterly meter. The Electric Power and Lighting Committee proposes that £125 000 be voted from the funds of the electricity and tramway estates towards relief of rates. This represents £50 000 from the electricity undertaking, compared with £35 000 last year, whilst the tramways grant is £75 000 compared with £115 000.

Col. F. Gordon Tucker recently held a Ministry of Transport inquiry into an application by the North Somerset Electric Supply Co., Ltd., for compulsory wayleaves for overhead lines between Wells and Highbridge. The approximate length of the line is 12 miles, with 299 poles. The company has secured wayleaves from 88 per cent. of the owners of land for the erection of 276 poles, but the remaining owners have failed to make any satisfactory arrangement. Of the seven owners concerned only four attended the inquiry. It was suggested that an overhead line across a field would reduce its selling value, and an increase in the rent per pole was asked for.

Hastings Corporation is to lay cables in Baldslow Road, at a cost of £1 267, and to extend mains to the Guestling Hill area, at a cost of £1 045. The Electricity Committee will supply electricity to the pumping station of Battle U.D.C. at Starrs Green, and will lay cables for the purpose at a cost of £1 160.—The Committee has agreed to an application from Messrs. F. Strickland and Sons for a supply of electricity for power purposes at their works at Earl Street. It will be necessary to instal a three-phase transformer in the Earl Street sub-station, and to lay cable from the sub-station to Messrs. Strickland's premises, at a cost of £500.—The Committee seeks sanction to borrow a further £1 000 for transformers.

Mr. E. G. Okell, borough electrical engineer of Plymouth, and the chairman of the Electricity Committee have interviewed representatives of registered contractors with regard to the renewal of the agreement as to the prices to be charged for electrical installations under the Council's scheme, and they report that the contractors are prepared to renew the agreement on the price per point being increased from 16s. 6d. to 17s. 3d. for twelve months. The committee has decided that the quarterly payment for fittings by consumers shall be 3½d. per 5s. or fraction of 5s. of the cost of the installation. The Electricity Committee has asked a special sub-committee to report on (*a*) a scale of charges for sale of installations to consumers; and (*b*) a system for the hire-purchase of radiators.

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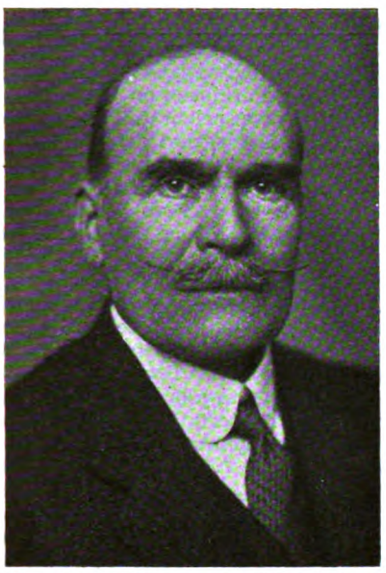
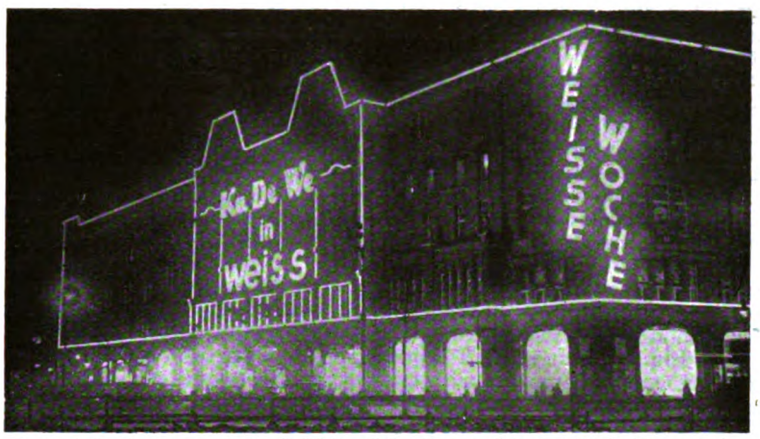
ELECTRICAL NEWS OF THE WEEK IN PICTURES.

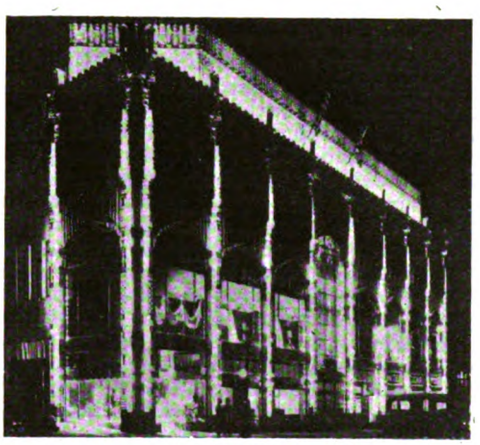


Mr. W. A. Wilson, who retired from British Insulated Cables, Ltd., at the end of last year. See page 200.



One of the features of the "White Sales" period in Berlin is the exterior illumination of the departmental stores, etc. These decorations are carried out in white light and a typical example is illustrated above.

An elaborate "street lighting" scheme which has been developed at Nice in connection with the Carnival. Many of the electrical decorations are particularly attractive and incorporate a number of new ideas.



A permanent outside illumination scheme which has just been installed at the McClatchey Building, Philadelphia.

Members of the Birmingham Branch of the Electrical Association for Women photographed on the occasion of their visit to the headquarters of the Shropshire, Worcestershire and Staffordshire Electric Power Co. In the centre is Mr. J. T. H. Legge, chief engineer and manager, and Lady Brooks, President of the Branch.

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ELECTRIC TRACTION.

ILFORD Corporation has lodged an objection against the new assessment of the tramways on the draft valuation list, on the ground that it is excessive, being increased from £1 800 to £3 000.

Leamington and Warwick Corporations are opposed to the Leamington and Warwick Electrical Co.'s proposal to introduce trolley vehicles in and between Warwick and Leamington.

Rotherham electricity department has received an offer of £1 000 for the purchase by the Mexborough and Swinton Tramways Co. of the Rawmarsh power station; and the Committee recommends that the offer be accepted.

A "Daily Telegraph" correspondent describes an electro-steam motor coach which is being constructed at Indianapolis, U.S.A. The vehicle has six wheels, and seats 40 persons. The electro-steam generating plant has a capacity of about 150 H.P., and oil fuel is used.

At last week's meeting of Glasgow Corporation, it was stated that the tramways department now had on the road 200 new and reconstructed cars. On the routes on which the new cars were travelling a larger number of passengers were being carried, compared with last year. The Tramways Committee has decided to enclose the upper seck seats at the front and rear of 300 tramcars at a cost of £19 500.

At the recent annual meeting of the South Wales branch of the Institution of Mechanical Engineers, Mr. J. W. Burr (Swansea) read a paper on "The Electrification of a Small Railway." He said the problems that arose today in regard to this subject were more of a financial than a technical character. It had been found, in connection with suburban electrification, that an increased frequency of service attracted a larger number of passengers. He gave details of the recent electrification of the Mumbles Railway.

At a meeting of the Wolverhampton Engineering Club recently, a debate between Mr. C. O. Silvers (Wolverhampton) and Mr. A. C. Baker (Birmingham) took place on the question, "Are Trams Obsolete?" Mr. Silvers argued that the modern trolley vehicle was the most suitable for transport in modern towns, because of its comfort, speed and greater mobility, and safety. Mr. Baker said a tramcar was most suitable for carrying masses of people quickly in densely populated areas. The majority of those present favoured an affirmative answer to the question.

Additions and improvements to the rolling stock of the tramway and motor 'bus sections of Aberdeen Corporation tramway department, at an estimated cost of about £50 000, are recommended by the Tramways Committee. The Committee recommends the Council to purchase 12 of the latest type of tramway cars, fitted with cushioned cross seats in the lower saloon and also on the upper deck. The cars will have high-speed motors, and their estimated cost is £27 168. It is further recommended that four tramcars of a similar type should be constructed in the department's own workshops, and that the cars at present in use be modernised by fitting them with new trucks and high-speed motors.

LOCHABER TUNNELLING COMPLETED.

Progress of British Aluminium Company's Hydro-Electric Scheme.

MRS. Halcrow, accompanied by Mr. W. T. Halcrow, consulting engineer, of C. S. Meik and Buchanan (Ltd.), fired, on February 9th, the last shot opening up the fifteen mile tunnel which has been driven through the Ben Nevis range between Fort-William and the valve shaft at Loch Treig, in connection with the British Aluminium Co.'s hydro-electric scheme. Tunneling through the rock has now been completed, with the exception of the break through at Loch Treig, which will be the final operation when all other work is completed and the power house ready for commercial use. The main tunnel driving at Lochaber was commenced early in 1926. In addition to the tunnel proper there are twelve shafts, intake dams, conduits, pipe lines, power house, factory and tail race, as well as 23 miles of access railways. The cost runs into several million pounds. The works are designed for a total development of 120 000 H.P. The company is erecting a new town near the base of Ben Nevis. The main purpose of the scheme is the manufacturing of aluminium, and the factory is expected to employ several thousand workmen. The contract has been carried out by Balfour, Beatty and Co. (Ltd.).

THE SOCIAL SIDE.

ON February 7th, there was celebrated the twenty-first birthday of F. and A. Parkinson, Ltd., Guiseley. This business, which recently amalgamated with Crompton and Co., Ltd., was founded by Mr. Frank Parkinson on February 7th, 1908. The twenty-first birthday was celebrated by a coming-of-age party held at Horsforth, Leeds, and attended by 450 members of the staff of the Guiseley works and offices. The party was preceded by a complimentary dinner at the Queen's Hotel, Leeds, to the employees of over 10 years' service. The chair was taken by Mr. Frank Parkinson, supported by the Lord Mayor of Leeds (Alderman D. B. Foster), the Lady Mayoress, and Mr. Albert Parkinson. The toast of "The Company" was proposed by the Lord Mayor and responded to by Mr. Frank Parkinson; the toast of "The Ladies" was proposed by Mr. Albert Parkinson, and responded to by Miss Doris Dawson. At the conclusion of the dinner, the company present were conveyed to Horsforth to join the party. Elaborate arrangements were made for entertainment and dancing. Immediately preceding supper, members of the Works' Dramatic Society, locally famed as "The A.C.'s," presented a play entitled: "A Pantomime Rehearsal." The presentation of this was of exceptionally high order, and it is difficult to single out any particular character for compliment, since all were good. At midnight Mr. Frank Parkinson, in a speech of congratulation, presented Miss N. Senior (office staff) with a gold wristlet watch and shares to the value of £50 in Crompton, Parkinson, Ltd.; to Mr. Joseph Ackroyd, works foreman, a gold cigarette case and shares to the value of £50; and to Mr. Fred Dixon (works staff) a gold watch. These gifts were suitably inscribed in commemoration of exceptionally long service with the company.

The annual gathering of the committees engaged in social or welfare work at the Trafford Park works of the Metropolitan-Vickers Electrical Co., Ltd. took place in the M-V. Club Hall on February 4th. This was the twelfth gathering, and the committees represented, numbering twenty-five, were:—Angling Club, Allotments Association, Apprentice Council, Approved Society, Benevolent Fund (Works), Benevolent Fund (Staff), Foremen's Association, Girls' Club, Golf Association, Hockey Club, Long Service Association, M-V. Club, Dramatic Society, Male Voice Choir, Orchestra, Overseas Association, Production Staff Association, Rugby Union Football Club, Safety First Committee, Social and Debating Union, Sports Committee, Staff Committee, War Relief Committee, Women Works Committee and Works Committee.

The chair was taken by Mr. G. E. Bailey (director) supported in the vice-chair by Mr. A. McKinstry (director), and the chairman of the company, Sir Philip Nash was also present. The orchestra, the Male Voice Choir and the Dramatic Society provided items of entertainment, and an abstract from the report of each committee was read. Mr. G. E. Bailey, in a short speech, thanked the members of the committees for the lated the work they were doing. Sir Philip Nash congratuvoluntary members of the committees on the good work of the past year. Among those present were Mr. Ritchie and Mr. Maling from Australia, and Mr. Ohlson from South Africa. Mr. Ritchie, as President of the M-V. Australia Works Welfare Association, compared conditions in Australia with those in this country. Mr. McKinstry, as vice-chairman, also congratulated the committees on their activities.

BUSINESS ITEMS.

VAMPIRES, LTD., announce that they will be exhibiting at the "Daily Mail" Ideal Home Exhibition, Olympia, at Stand No. 40, Gallery, New Hall.

Our attention has been drawn to the change of title of WAGNER ELECTRIC SUPPLIES, LTD., to WOLF AND MORGAN, LTD., sole distributors for the Wagner Electric Corporation.

In connection with the British Industries Fair at Castle Bromwich, Birmingham Corporation has prepared for distribution among visitors "The City of Birmingham Handbook, 1928–1929."

The GENERAL ELECTRIC CO., LTD. has opened a new branch at Blackpool, in Birley Street. The branch of the company at Singapore has been moved to 12, Battery Road, instead of 5, Battery Road as hitherto.

On February 6th a serious fire caused considerable damage to the premises of PHILIPS LAMPS, LTD., at 27, Womanby Street, Cardiff. We are informed that arrangements have been made whereby business will not be interrupted.

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COMPANY NEWS.

Increased Prices of Manufacturers' Shares—Supply Companies' Dividends—Fife Tramway Light and Power Co.'s Enhanced Profit—Improved Dividends of Companies in Underground Group—New Companies Registered.

A REACTION after the recent rise in General Electric shares has brought the price down to 67s. 6d., which is still a couple of pounds above the highest quotation of 1926, 1927 or 1928. British Insulated Cables are also making new records, another 3s. 9d. bringing the quotation up to 96s. 3d. Callender's and Henley's are each 1s. 3d. higher. Ever Readies have sagged a further 1s. 3d. to 24s. 3d. Easterns and Marconi's are respectively 5s. and 2s. 6d. down. Underground Electric Railways ordinary shares have given way 2s., to 25s. 6d. County of London Supply ordinary shares are 2s. better; Newcastle and District ordinary are lower to approximately the same extent.

Last Annl. Divd. %	Description.	This Week.	Last Week.	1926 to 1928. Highest.	Lowest.
	Electricity Supply.				
(d)	Brompton & Kensington Ord. ..	27/-	27/-	35/6	23/9
4	Central Elec. Sup. 4% Deb. ..	93	93	95½	88½
(a)	Charing Cross Elec. Ord. (£1) ..	26/-	26/-	51/-	24/3
4½	" " " 4½% C.P. (£1)	17/6*	17/6	18/3	16/6
(d)	Chelsea Elec. Sup. Ord.	27/-	27/-	45/3	24/-
10	City of Lond. Elec. L'ting Ord. ..	31/10½	31/10½	52/10½	26/-
6	" " " 6% C.P. ..	23/-	23/-	24/3	21/6
7½	County Lon. Elec. Sup. Ord. ..	51/6	49/6	68/6	25/9
6	" " " 6% C.P. ..	23/-	23/-	24/-	21/3
(g)	Kensington & K'bridge Ord. (£1) ..	27/-	27/6	27/6	23/9
(b)	Lon. Elec. Sup. Ord. (£1)	26/6	26/-	37/6	23/-
9	Metro. Elec. Sup. Ord.	46/3	46/3	53/-	24/9
4½	" " " 4½% C.P. ..	17/6	17/6	18/3	16/3
7½	N'castle & Dis. Elec. Ltg. Ord. ..	28/1½	30/-	31/9	17/6
6	N'castle-upon-Tyne Elec. Sup. Ord.	26/10½	26/10½	30/3	19/3
6	N. Metro. Elec. 6% C.P.	23/-	23/-	23/9	20/10
6	Notting Hill 6% C.P. (£10) ..	10½	10½	11½	9½
(d)	St. James & P.M. Ord. (£1) ..	27/6	27/6	28/6	23/6
1/4½	Shrops. Worcs. & Staffs. Power B. Or.	37/6	37/6	37/6	21/4
(f)	W'minster Elec. Sup. Ord. (£1) ..	27/-	27/-	32/9	24/-
4½	" " " 4½% C.P. (£1)	17/6	17/6	17/10½	16/7½
8	Yorks. Elec. Power Ord.	36/6	36/6	38/9	24/6
6	" " " 6% C.P. ..	24/6	24/6	26/9	20/7
	Railways and Tramways.				
8	Brit. Elec. Trac. Pfd. Ord. Stk. ..	126	126	152½	117
6	" " " 6% Pf. Stk...	127½	127½	133	103½
4	Cent. Lon. Ry. Ord. Stk. (asstd.) ..	73	73	72	54
4	" " " 4% Deb.	81	81	83	77½
4	City & S. Lon. 4% Perp. Deb. ..	79½	79½	81	76½
4	Lon. Elec. Rly. Cons. Ord. Stk. ..	75½	75½	75½	42½
4	" " " " 4% Pf. Stk.	75	75	77	68
4	" " " " 4% Deb. ..	80	81	83	76½
5	Lon. & Sub. Trac. A. Deb. ..	97½	97½	97½	74
4	Lon. Un. Trams, 1st Deb.	61	61	63	39
4½	Met. Elec. Trams, 4½% Deb. ..	70	70	73½	62
5	" " " 5% Deb... ..	67½	67½	70½	65½
3	Met. Rly. Cons. Ord. Stk.	65	65½	81	54½
3½	" " " 3½% Pf. Stk. ..	65	65	67	60½
3½	" " " 3½% Deb.	71	72	73½	67½
4	Met. Dis. Rly. Ord. Stk.	80½	80½	77½	52½
4½	" " " 4½% 1st Pref. ..	82½	82½	84	74½
6	" " " 6% Perp. Deb. ..	116½	116½	118½	110
4	S. Met. Elec. Trams, 4% Deb. ..	70	70	70	64½
5	Underground Electric Rlys. Ord.	25/6	27/6	28/2	11/-
—	Yorks. (W.R.) Trams, Ord. ..	5/-	5/-	16/-	3/-
4½	" " " 1st Deb. ..	59	59	78	60
	Electrical Manufacturing.				
7	Brit. Elec. Transformer 7% C.P. ..	15/-	15/-	19/10	4/6
15	Brit. Insulated Cables Ord. ..	96/3	92/6	86/3	56/-
6	" " " 6% C.P. ..	22/6	22/6	23/10	21/-
7	British Thomson-Houston Pref. ..	23/3	23/3	24/9	19/7
7	" " " 7% Deb.	104½	104½	109½	102½
10	Brush Electrical Ord.	28/9	28/9	30/9	24/-
15	Callender's Cable Ord.	86/3	85/-	91/3	66/-
6½	" " " 6½% C.P. ..	25/-	25/-	25/9	22/-
7½	" " " 7½% B. Pref. ..	27/6	27/6	28/3	25/-
8	Crompton-Parkinson 8% Cum. Pf.	25/7½	25/7½	27/-	14/-
6	" " 6% Cum. 2nd Pf.	19/-	19/-	19/6	9/7
7½	Edison Swan Elec. Ord. (1st Pref., ..	25/7½	25/7½	13/-	7/4½
5	" " " 1st Deb Stk...	86½	86½	92	81½
7½	Elec. Construction Ord.	25/9	23/9	32/6	23/6
7	" " 7% C.P. ..	22/6	22/6	22/9	21/-
—	English Elec. Ord.	8/9	8/9	15/9	5/-
6	" " " 6% C.P. ..	10/-	10/-	18/9	7/-
7	Ericsson Telephones 7% Pref. ..	18/9	18/9	22/7½	17/6
35	Ever Ready (Gt. Britain) Ord. ..	24/3	25/6	92/3	18/1
6	Ferranti 6% Pref.	19/-	19/-	19/4½	16/9
	" 7% 2nd Pref.	19/-	19/-	19/3	13/9
10	General Elec. Ord.	67/6	75/-	46/6	26/6
‡25	W. T. Henley's Ord.	122/6	121/3	120/-	69/3
12½	Johnson & Phillips Ord.	41/3	36/3	67/11	34/-
7½	Lon. Elec. Wire & Smith's Pref. ..	23/9	23/9	25/-	22/3
7½	Siemens Bros. & Co. Ord.	30/-	30/-	36/6	24/9
10	Telegraph Const. Ord. (£12) ..	25	25	30½	20
	Telegraph.				
3½	Anglo-Am. Tele. Ord. Stk... ..	61½	61½	63½	56½
10	Eastern Ord. Stk.	267½	272½	273	135
3½	" 3½% Pref. Stk.	68½	68½	70½	59
4	" 4% Deb.	79½	79½	81½	74
10	Eastern Extension Ord. (£10) ..	27	27½	27½	14
22	Gt. Northern Telegraph (£10) ..	33	34	43½	26
10	Indo-European (£25)	54½	54½	48½	30
20	Marconi's Wireless T. Ord. ..	78/9	81/3	84/4	12/-
12½	" Int. Mar.	72/6	72/6	90/-	16/6
20	Western Tel. Ord. (£1)	27	27½	27½	12½

(a) 1s. 7 ½d. per share. (b) £8 8s. 6·66d. per cent. (c) 1s. 6·949d. per share.
(d) 2s. 8·706d. per share. (e) 1s. 9·3d. (f) 1s. 0.912d. (g) 1s. 7·223d.
* Ex dividend. ‡ Including 1s. bonus.

LONDON AND SUBURBAN TRACTION CO., LTD.—Rev. for 1928 does not justify a div. on 5% cum. pref. shs.

STRICHEN ELECTRICITY SUPPLY CO., LTD.—Div. at rate of 6% for year ended Dec. 31, 1928, is recommended.

ELECTRIC SHOVEL COAL CORPORATION.—Qrtrly. div. of $1 p. sh. is payable on $4 cum. participatg. pfd. stk.

SIMM'S MOTOR UNITS, LTD.—Mtg. to consider proposal to increase cap. to £350 000 by creatg. 100 000 6% £1 cum. participatg. pref. shs. will take place to-day (Feb. 15) at Winchester House, London, E.C. The shs. will carry right to extra 1%, up to 9% for every 1% paid on ord. over 12%.

SINGAPORE TRACTION CO., LTD.—Net pfts. for year ended Sept. 30 £37 260, after provdg. for int. charges, and £2 367 bt. fwd. A div. of 5% proposed on the 7% pref. shs., appropriating £10 000 for mngrs., addg. £4 000 to redeptn. fund and £10 000 to renewals fund., writg. £3 000 off preliminary exes. and £87 off invstmts, and carryg. fwd. £2 539.

RUTHS STEAM STORAGE CO.—It is reported that this co. has just completed the formation and organisation of Ruths Steam Storage Inc., New York, authorised cap. $1 500 000, and of Ruths Steam Storage (Canada), with authorised cap. of $300 000, to operate Ruths patents in the United States and Canada respectively. The whole of the issued capital is owned by the parent company.

POWER SECURITIES CORPORATION, LTD.—Gross income for last year £123 159, compared with £111 796 for 1927. After makg. provisn. for taxatn., £19 482, agst. £9 772, and all exes., there is available £85 239, compared with £84 678. It is proposed to transfer £20 000, agst. £30 000, to res. and £10 000, agst. nil, to div. equalisatn. acct. Div. maintained at 7% less tax. Fwd. £14 869, compared with £15 630.

NORTH METROPOLITAN ELECTRIC POWER SUPPLY CO. Directors recommend payment of div. due on 6% pref. shs. and fin. div. on ord. shs. of 6%, makg., with intm. div. of 4% already paid, div. of 10% for year 1928, same as previous year. To res. £120 705, compared with £143 217, which includes £43 217 premium on shs. for previous year, leavg. £28 202 to carry fd., compared with £19 041 brt. in. Div. on ord. shs. will be payable March 5.

ST. JAMES' AND PALL MALL ELECTRIC LIGHT CO., LTD.—Net pft. for 1928, £103 852, plus blce. from 1927, £81 807. Intm. divs. paid in Aug., 1928, 8·4d. p. sh. (3½%) on £1 pref. shs., and 9d. p. sh. on £1 ord. shs., leavg. blce. £157 033. Directors propose div. of 8·4d. p. sh. (3½%) on £1 pref. shs. for second half-year, and blce. div. on £1 ord. shs. of 9·949d. p. sh., makg. standard div. or year of 1s. 6·949d. p. sh. To special res.—ord. shhldrs. benefit under sliding scale for years 1926, 1927 and 1928—£13 382; fwd. £112 377.

YORKSHIRE ELECTRIC POWER CO.—Net pft. for 1928, after paymt. of int. and deb. stk. disct. charges, £310 073, agst. £294 371 in 1927, plus £74 096, agst. £65 260, brt. in. Divs. recommended at rate of 6%, less tax, for 1928 (of which 3% was paid in Aug. 1928) on ord. cap. and at rate of 8%, less tax, for 1928 (of which 3% was paid in Aug., 1928) on shs. issued prior to 1928. To gen. res., £100 000; fwd. £78 233. Demand for electricity has again increased, notwithstandg. trade depressn., particularly that of coal industry.

FIFE TRAMWAY LIGHT AND POWER CO., LTD.—Rep. for year 1928 shows that tradg. pfts. amtd. to £127 004, against £104 386. Of this sum there was reserved in the accts. of the undertakg. an aggregate amt. of £35 544, against £26 508, blce. being paid over to co. After paymt. of administratn. exes., taxatn.; etc., there remains, including £5 253 bt. fwd., £85 451, against £76 748. Int. charges £26 634, against £21 589, div. on pref. shs. £24 000, deb. stk. redemptn. acct. £4 968, against £4 719, reserves £8 000, against £5 187, leavg. £21 848. Proposed div. on ordinary shs. of 4%, less tax, carrying forward £5 848.

TYNESIDE TRAMWAYS AND TRAMROADS CO.—Exes. during half year ended Dec., 1928, exceeded receipts by £1 049, to which is added int. on mtges., loan, etc., less int. received on invesmts, etc., makg. total deficit for half-year £2 530. An amount of £2 500 has been transferred from gen. res. and, after bringing in blce. of £60 from previous half-year, there remains £30 to be carried fwd. Traffic receipts show decrease of £2 126, and for whole year there is a decrease of £3 181. A Bill has been deposited with Parliament with the object of

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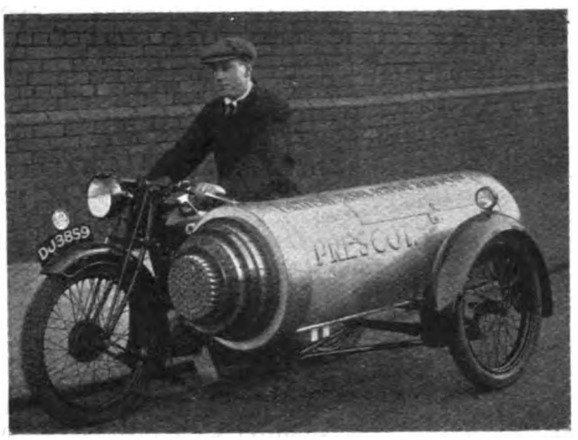
obtaining powers to abandon the whole or any part of the tramways, and to institute omnibus services.

ELECTRICAL AND INDUSTRIAL INVESTMENT CO., LTD.—Net pft. for 1928, £22 148, agst. £19 454. Divs., 6% on pref. shs., 7% on pfd. ord. shs. (both same as last year) and 6% on dfd. ord. shs. Fwd. £3 747, makg. undivided pfts. £17 939. A sum of £85 500, being blce. of £60 986 at credit of res. at Dec.



A NOVEL delivery combination recently designed by British Insulated Cables, Ltd., for express delivery of the smaller sizes of cables, wires and accessories. The sidecar, as will be observed, is made and finished in the form of a stepped down cable, with a hinged door at the top.

31, 1927, and £24 513 forming part of blce. of rev. acct. at same date, has been capitalised and distributed by way of bonus to dfd. ord. shhldrs. by issue of 1 710 000 fully paid dfd. ord. shs. of 1s. ea. Since close of year unissued 10 000 dfd. ord. shs. of 1s. ea. have been subscribed at par.

VERA CRUZ ELECTRIC LIGHT, POWER AND TRACTION, LTD.—Directors announce that by purchase of 223 632 fully paid £1 shs. out of 350 000 shs. of issued cap. American and Foreign Power Co., of New York, has obtained control of co. In due course managemt. will be transfrd. to New York and mtgs. of co. will shortly be held for purpose of makg. necessary alteratns. in articles of association. These meetgs. will be followed by resignatn. of present board. Directors have obtained from American and Foreign Power Co. an offer of 8s. per fully paid £1 sh. for all outstandg. shs. offered for sale by Feb. 20. Upwards of 46 000 shs. have already been offered for sale in accordance with offer.

TILLING AND BRITISH AUTOMOBILE TRACTION, LTD.—Accts. for 1928 show a total rev. £187 573, and net pfts. £167 206, after deductg. administratn. and gen. exes., income tax and deb. stk. int. Includg. blce. £21 456 brt. fwd., total of £188 662 is available for distributn. The sum of £10 000 is placed to res., and directors propose, in additn. to fixed div. of 8% on participatg. pref. shs., further div. of 2% (makg. 10% for year). Ord. shs. receive a fin. div. of 6%, makg. 10%. Co.'s name has been changed from British Automobile Traction Co., Ltd., to Tilling and British Automobile Traction, Ltd., and the authorised sh. cap. increased to £2 000 000. Fwd. £22 926. Total income, after provisn. for depreciatn., £187 573 agst. £99 110.

ATLAS LIGHT AND POWER CO., LTD.—An agreemt. providg. for sale of its holdings in electric supply and tramway undertakgs. in the Argentine for £8 500 000 has been entered into by the directors of the Atlas Light and Power Co. The purchasers are the American and Foreign Power Co., Inc., New York. Agreemt. provides that British mnfrs. will continue for at least ten years to be given pref. for bulk of orders for equipmt. for the operatg. co. transferred. Agreemt. will be submitted for shhldrs' approval at gen. mtg. to be called at an early date. The directors, in a circular, recommend shhldrs. to confirm sale, and point out that amt. to be realised can be reinvested over a wider field with advantage. Co. will retain its hldgs. outside the Argentine.

DUBLIN UNITED TRAMWAYS CO. (1896), LTD.—Total receipts on rev. acct. for 1928 amtd. to £574 621, and after provisn. for int. on bonds, debs. and deb. stk., deb. stk. disct. redemptn., wayleaves and paymt. to Howth Co., blce. was £138 826. Intm. divs. amtg. to £23 715 were paid on Aug. 17, 1928. It is recommended that div. at rate of 6% p.a., less tax, be paid on pref. stk. for half-year ending Dec. 31, 1928, and that a fin. div. at rate of 5% p.a., less tax (makg. 4% for year), be paid on the ord. stk. for same half-year; that £50 000 be set aside towards renewal of track, £7 000 towards renewal of overhead line standards and cables; and £15 000 for mtge. and deb. redemptn. fund. Divs. and sums set aside will absorb £125 040, leavg. £13 786 to carry fwd.

UNDERGROUND GROUP.—The following divs. are recommended for paymt. by the Underground Electric Railways Co., of London, Ltd., and its associated companies.—*Underground Electric Railways Co. of London, Ltd.:* Half year's int. to Dec. 31, 1928, on 6% 1st cum. income deb. stk., int. of 3%, subject to British tax, on 6% income bonds of 1948 for half year ended Dec. 31, 1928, makg. full rate for year; and fin. div. of 4% on ord. shs., makg., with intm. div. of 3% paid on Aug. 3, 1928, 7% for year, agst. 5%. Fwd. £262 504, agst. £169 762. *Metropolitan District Railway Co.:* Fin. div. for 1928 on ord stk. 2½%, makg. with intm. div. of 2½% paid on Aug. 3, 1928, 5% for year, agst. 4%. To res. £90 000; fwd. £44 768, agst. £38 161. *London Electric Railway Co.:* Fin. div. for 1928 on con. ord. stk., 2½%, makg. with intm. div. of 2½% paid on Aug. 3, 1928, 5% for year, agst. 4%. To res., £157 198; fwd. £177 152, agst. £158 101. *City and South London Railway Co.:* Fin. div. for 1928 on con. ord. stk., 2½%, makg. with intm. div. of 2½% paid on Aug. 3, 1928, div. for year of 5%, agst. 4%. To res., £25 000; fwd., £36 179, agst. £33 156. *Central London Railway Co.:* Fin. div. for 1928, on undivided ord. stk., 2½%, makg. with intm. div. of 2½% paid on Aug. 3, 1928, 5% for year, agst. 4%; fin. div. for 1928 on pfd. ord. stk., 2%, makg. with intm. div. of 2% paid on Aug. 3, 1928, 4% for year, agst. 4%; div. for year, on dfd. ord. stk. 6%, agst. 4%; to res., £40 000; fwd., £105 053, agst. £98 926. *Associated Equipment Co., Ltd.:* Fin. div. for 1928 on ord. shs., 4% tax free, makg., with intm. div. of 4%, tax free, paid on Aug. 3, 1928, 8%, tax free, for year, agst. 8%. Fwd. £201 261, agst. £178 978.

BAIRD TELEVISION DEVELOPMENT CO., LTD.—Directors' first report (to June 30, 1928) states that applicatn. of group of patents possessed by co. covers principles the applicatn. of which extends in many directns. Directors have, however, considered that of these varied applicatns. the one most interestg. and most likely to be productive of immediate results is that of televisn., and the energies of the co. have therefore been principally occupied since its formatn. in developing applicatn. of Mr. Baird's patents in this directn. Suitable premises havg. been secured at 133, Long Acre, London, W.C., the existing laboratory, with its equipmt., has been established there. During the period of about eighteen months which has elapsed since the statutory mtg. vast strides have been made in the developmt. of televisn. Great interest in the system has been evinced by radio mfrs. in various parts of world, and there is no doubt, so soon as broadcastg. facilities are granted, that televisors mfd. under licence from Baird Co. will form an immediate source of revenue. Application of co.'s patents in other directns. will be proceeded with at earliest opportunity. Co. has obtained further premises at Kingsbury, Middlesex, chiefly for purpose of enabling wireless transmissn and receptn. to take place between Long Acre and Kingsbury. Blce-sheet shows authorised and issued cap. to be £125 000. Cash at bankers and in hand is £61 572. Purchase price of patent rights, trade marks and other interests in Baird inventns. acquired on incorporatn. satisfied by issue of 400 000 dfd. ord. shs. of 1s., £20 000. Co. has certn. rights under contract entered into by Television, Ltd., in connectn. with exploration of various foreign and Colonial patents and patent applicatns., but value of such rights is not at present capable of ascertainmt.

Company Meetings.

WEST LONDON AND PROVINCIAL ELECTRIC AND GENERAL TRUST, LTD.—An extraordinary general meeting was held on January 30th to consider resolutions increasing the capital of the company to £390 000 by the creation of 18 000 new shares of £5 each and sub-dividing each of the 18 000 new shares into one pref. share of £4 and one ord. share of £1 and converting them into pref. and ord. stock. Mr. Harry Kahn, chairman of the company, presiding, stated that as soon as these resolutions become effective, it was intended forthwith to issue the new £5 shares at par, as of right, to the ordinary stockholders, in the proportion of one £5 share for every £10 ordinary stock held; and in cases where stockholders hold amounts of ordinary stock which are not a complete multiple of £10, stockholders would receive a payment in cash of 4s. for every odd

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£1 of such stock which remained. From the capital reserve fund it was intended to appropriate £36 000, which sum would be utilised in crediting £2 of the £5 payable for each share, the balance of £3 being payable on application. The ordinary stockholders were hereby receiving a valuable bonus, as a present holder of £100 of ordinary stock would receive eventually £40 5 % cumulative preference stock and £10 ordinary stock for a total payment of £30. The resolutions were adopted.

HALL TELEPHONE ACCESSORIES (1928), LTD.—Major Oscar M. Guest, presiding at the first ordinary general meeting on Monday, said the company's telephone coin collectors, which were entirely made at their factory at Willesden, and for which they owned world-wide patent rights, were of what was called the prepayment multi-coin type, as opposed to the former system of single denomination post payment, where the money was inserted after the operator had obtained the number asked for. The collector, besides dealing with local calls, had been the means of giving the public facilities to obtain long distance calls, including international calls, from any call office and also telegraph facilities, as telegrams could be sent from a telephone cabin so equipped. Besides having obtained from the British Post Office a satisfactory contract for their collectors, their stamp machine hiring business had approximately doubled in size since the formation of the company. The directors had reasonable grounds for assuming that 1929 should compare favourably with the period now under review. The report and accounts were unanimously adopted, and a final dividend of 6%, making 10%, less tax, for the year, was declared. At an extraordinary general meeting resolutions were passed increasing the capital to £175 000.

SINGAPORE TRACTION CO., LTD.—Mr. L. W. Hawkins, presiding at the meeting last week, said that it was satisfactory that they had re-entered in a modest way the list of dividend-paying companies, their position in which had been lost last year in consequence of the boycott and the resultant reduction of profits. The number of vehicles in use had risen from 60 to 90, passengers carried from 23 000 000 to 32 500 000, gross traffic receipts from £89 000 to £140 000 and operating profit, as far as traction alone was concerned, from £22 000 to £49 000. During the first sixteen weeks of the current year, the car miles run, the number of passengers and the receipts each showed an increase of about 25%. The steady augmentation of their rolling stock was not accompanied by any appreciable diminution in the earnings per car mile, which was evidence that they had not reached saturation point and that their policy of development was fully warranted. The introduction of petrol motor-buses was an experiment, and they believed that, as auxiliaries to their fleet of trolley buses, they contained considerable potentialities. The report and accounts presented a state of affairs which the directors regarded as completely justifying the reconstruction of the old company and the conversion of its almost derelict and insolvent tramway undertaking to its present form.

LONDON POWER CO., LTD.—Mr. W. F. Fladgate, presiding at the meeting last Friday, said during 1928, they had for the first time been operating all the stations which they proposed to take over, and they had, in effect, by laying down their 22 000 V interconnecting mains, completed the first portion of their programme. They were, naturally, desirous that the sales of their commmodity, which was current, should increase as much as possible, but it was not their wish that the cash which they received should proportionately increase with their sales. In the past year they sold to the constituent companies some 593 000 000 kWh, and, in respect of that sale, they had received £1 641 000. In 1927 they sold some 506 000 000 kWh and received £1 680 000, the result being that while they had delivered some 87 000 000 kWh in excess of the delivery of the previous year, they had received some £40 000 less. The actual cash benefit to the companies in respect of the generation of electricity for 1928 as against the cost of generation for 1927 was, after adjusting the coal figure to a common basis, no less than £152 000. Cost of coal decreased from £596 000 to £471 000. Salaries of engineers and officers increased by £15 000, but wages at generating stations were reduced from £123 000 to £93 000, consequent on the shutting down of the inefficient stations. All displaced employees had been compensated. During the flooding of the Thames in the early part of 1928, one of their generating stations was shut down, but, luckily, their interconnecting mains had been completed, and they were able to supply the whole of the district from other stations. The chairman then referred to the evidence given by Mr. J. M. Kennedy in support of their scheme before a House of Commons Committee, in which he stated that in 1924 the average operating cost of the ten companies was 0·55d. per kWh generated, and that if the scheme were adopted the result would be that by 1927 these costs would be reduced by 40 per cent., and by 1929 they would be reduced by a further 10 per cent., making a reduction of 50 per cent. Mr. Kennedy's figure of 0·55d. per kWh generated must be reduced to 0·45d., as it was based on coal at 27s. 6d. per ton, the then prevailing figure, for which 20s. per ton, which was now about the average price, must be substituted. Adopting his suggestion that in 1929 the cost should be reduced by 50 per cent., the cost for that year should be 0·225d. In 1928 their operating costs were 0·278d., or within 0·053d. of Mr. Kennedy's figure, and he (the chairman) predicted that before they came to the end of 1929, they would arrive at 0·225d., and thus justify Mr. Kennedy's evidence. The Deptford West station would be, at any rate, to some extent, in commission before the end of the year, and they would at once proceed with the work at the Battersea station, which had been commenced and which would give them a further ultimate capacity of 400 000 kW. The report and accounts were adopted and the dividend was approved.

New Companies.

SIDNEY HALL, LTD.—Cap., £2 000. Electrical engineers, etc. Reg. office: 49, Queen Street, Blackpool.

BASIL MARSH, LTD.—Cap., £100. Manufacturers of and dealers in wireless apparatus, etc. Solicitor: J. A. Bosley, 2, Palace Place, Brighton.

LEWIS MOTORS (FALMOUTH), LTD.—Cap., £2 000. Motor, electrical, wireless and general engineers, etc. Solicitors: Coulter, Hancock and Thrall, Truro.

SOUTH ESSEX SUPPLY CO., LTD.—Cap., £500. Electrical, mechanical and general engineers, sign makers, etc. Reg. office: 30, London Road, Romford, Essex.

H. PETRIE AND SONS, LTD.—Cap., £1 000. To acquire business of electrical engineer, etc., now carried on by H. Petrie at 107, Hamlet Court Road, Westcliff-on-Sea, Essex.

ELECTRIC NEWS PANELS, LTD.—Cap., £20 000. Manufacturers of and dealers in signs, electrical and mechanical engineers, etc. Reg. office: 31/33, Bishopsgate, London, E.C.

ROTOR ELECTRIC, LTD.—Cap., £500. Manufacturers, importers and exporters of and dealers in wireless, television and electrical apparatus, etc. Reg. office: 34, Kingsway, London, W.C.2.

A. WRIGHT AND SON (BIRMINGHAM), LTD.—Cap., £10 000. Electrical and mechanical engineers, etc. Reg. office: The office of Lancaster King and Co., Queen's College, Paradise Street, Birmingham.

PREMIER BATTERY AND MAGNETO CO., LTD.—Cap., £1 600. To acquire business of battery and magneto manufacturers and engineers now carried on at 118, Hampstead Road, London, N.W.1, as "Premier Battery and Magneto Co."

METEOR ELECTRIC LAMP CO., LTD.—Cap., £500. Manufacturers of and dealers in electric lamps, irons and kettles, machines, batteries and all other electric appliances, etc. Reg. office: 33/4, Sicilian House, Sicilian Avenue, London, W.C.1.

GODFREY AND LESTER, LTD.—Cap., £500. To acquire business now carried on at 1, Ridge Road, Hornsey, Middlesex, as "Godfrey and Lester," and to carry on the business of gas and electrical engineers, etc. Reg. office: 1, Ridge Road, Hornsey, London, N.

FLASH-ARROW INDICATOR CO., LTD.—Cap., £1 000. To carry on every business connected with motor accessories, electrical supplies and accessories, to manufacture accumulators, cables, wires, electric lamps, etc. Solicitors: Zeffertt and Heard, 17, Coleman Street, London, E.C.

JOHN WALLIS TITT AND CO., LTD.—Cap., £6 000. To acquire business of engineers now carried on by executors of will of A. J. B. Titt at Woodcock Ironworks, Warminster, Wilts, as "John Wallis Titt and Co.," and to carry on same and business of electrical and general engineers, etc.

GEORGE ELLISON, LTD.—Cap., £125 000. To acquire the business of engineer and maker of electric control switchgear carried on by G. Ellison at Perry Barr, Birmingham, with the branches and subsidiary businesses belonging thereto. Reg. office: Wellhead Lane, Perry Bar, Birmingham.

PIANO AND GRAMOPHONE CO., LTD.—Cap., £7 500. Manufacturers of pianofortes, electrically or mechanically operated; wireless, television and cinematograph apparatus; electrical and mechanical engineers, etc. Solicitors: Romer and Skan, 4, Copthall Chambers, London, E.C.2.

NEW ERA WIRELESS AND ELECTRICAL CO., LTD.—Cap., £500. To acquire from Gladys E. Green business known as New Era Wireless and Electrical Co., to carry on business of manufacturers, buyers, sellers and hirers of electrical and wireless apparatus, etc. Reg. office: 3, Hobmoor Road, Small Heath, Birmingham.

LONDON AND QUEBEC FINANCE CORPORATION, LTD.—Cap., £287 500. To initiate, purchase or deal with any undertakings, including railway construction and development, telegraph, wireless telegraph, telephone, wireless telephone or other wireless effects, engineering, electricity, etc.; electrical and general engineers, etc. Secretary: S. C. Ball, 33/36, King William Street, London, E.C.4. (Public co.)

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COMMERCIAL INFORMATION.

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debt. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

BARNETT (C.), LTD., 428, St. John's Street, Clerkenwell, electrical factors. £38 10s. 5d. November 29th.

BROWNING, T. E., 28, Pleydell Avenue, Stamford Brook, electrical wireless factor. £11 9s. 10d. October 26th.

BURTON, R. A., 51, London Road, Sawbridgeworth, wireless agent. £16 10s. 2d. December 31st.

HOWARD TERRY AND CO., 28, High Street, Birmingham, electrical contractor. £16 14s. 4d. January 3rd.

HUNTER, Mr. A., 33B and 35, Shacklewell Lane, Dalston, wireless goods manufacturer. £14 17s. 5d. August 3rd.

PARMAN, Sidney, 412, Coventry Road, Small Heath, electric sign manufacturer. £12 17s. 11d. November 7th.

ROCKALL, Francis G., 7-8, Ham Yard, Great Windmill Street, W., electrical contractor. £53 15s. November 8th.

Receiverships.

GREENWOOD (A. I.), LTD. B. Armitage, C.A., 99, Albion Street, Leeds, was appointed receiver on January 31st, 1929, under powers contained in debentures dated March 30th, 1926.

MARPLE AND FRISBY, LTD. F. S. Wilks, 31, Lombard Street, E.C.3, was appointed receiver on January 28th, 1929, under powers contained in a debenture dated June 3rd, 1927.

Private Meetings, etc.

[***Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.***]

EAVES, Reginald Ernest Allen, and CAMERON, Harold Douglas trading as THE EMPRESS RADIO AND ELECTRICAL CO., at Manor Works, Stonehouse, Plymouth, and as THE WESTMINSTER RADIO CO., at Plymouth, Bridgwater, Taunton and Newquay. A meeting of the creditors in this matter was held last week at the Great Western Hotel, Paddington, when the debtors' accountant stated that the liabilities amounted to £4 965, of which £2 423 was due to the trade, while there were partly secured creditors for £1 392, who held security valued at £1 200, leaving £192 to rank as unsecured. The balance of the liabilities was due to cash creditors. The assets totalled £1 437, from which had to be deducted £137 for preferential claims, leaving net assets of £1 300, or a deficiency of £3 666. The assets consisted of cash in hand £62; stock in trade estimated to produce £600, plant and machinery £100, fixtures and fittings £225, motor car and van £75, two sailing boats valued at £20, life policy £5, and book debts £350. The accountant said that the stock was a very difficult item to value. The cost price of it was £1 277. With regard to the plant and machinery that was very limited. A circular letter had been issued to the creditors stating that the debtors had consulted their relatives with regard to their position and if it were the wish of the unsecured creditors, sufficient cash would be forthcoming to pay the preferential claims in full, the costs of the deed of assignment and the unsecured creditors 6s. in the £. The business was started in July, 1922, with a capital of £50 and tools. The accounts prepared showed that for the year to March 10th, 1927, the sales were £14 227, and there was a net profit of £236. The next year the sales were £18 065, and there was a profit of £28. Mr. White added that in April, 1928, the firm suffered a severe blow through a fire which occurred. The result was that being under-insured, they did not receive sufficient compensation. Soon after that date the debtors opened branch shops. Replying to questions Mr. White stated that he understood that the debtors received about £2 700 from the insurance co. in respect of the fire. After a long discussion it was decided to accept the debtors' offer of 6s. in the £, and the creditors, after hearing Mr. Stoneman's explanation of his position in the Western Radio Co., a vote of sympathy was passed for him. It was also decided to confirm the deed of assignment already executed.

London Gazette, etc.

Companies Winding-up Voluntarily.

ATTAIX, LTD. By reason of its liabilities, January 31st K. M. Scott, A.C.A., 32, Finsbury Square, London, of Merrett Son and Street, Chartered Accountants, appointed as liquidator Meeting of creditor at the Institute of Chartered Accountants Moorgate Place, E.C.2, on Tuesday, February 19th, 11 a.m.

EPOCH ELECTRICAL SOCIETY, LTD. By reason of its liabilities, February 8th. C. Hughes, 24, Ironmonger Lane, London, E.C., chartered accountant, appointed as liquidator.

Bankruptcy Information.

JACOB, William Thomas, 14, Meyrick Street, Pembroke Dock, Pembroke, wireless engineer. First meeting, February 15th, 1.30 a.m., Official Receiver's Office, 4, Queen Street, Carmarthen. Public examination, February 18th, 11.30 a.m., Shirehall, Haverfordwest.

JENKINS, Edward Charles, 124, Cheltenham Road, Bristol, wireless dealer. First meeting, February 20th, 12 noon, Official Receiver's Office, 26, Baldwin Street, Bristol. Public examination, February 22nd, 11 a.m., Guildhall, Bristol.

JOLIVARD, K., AND CO., 66, Victoria Street, London, S.W., electrical engineers. Receiving order, February 6th, creditor's petition. First meeting, February 18th, 11.30 a.m., and public examination, March 15th, 11 a.m., Bankruptcy Buildings, Carey Street, London, W.C.2.

RADCLIFFE, Harold Howe Delmé, and HADDLETON, Frank, 51, Islington Row, Birmingham, trading as CITY ELECTRIC SERVICES, electrical engineers. Receiving order, February 4th, debtor's petition.

Notice of Intended Dividend.

WESTNUTT, Josiah (known as JOHN VICTOR WESTNUTT), High Street North, Dunstable, electrical engineer. Last day for receiving proofs, February 22nd. Trustee, A. J. Rogers, The Parade, Northampton, Official Receiver.

Bankruptcy Proceedings.

KAY (T. L.) AND CO., LTD., 6, Blake Street, York, wireless factors, etc. The creditors were called together, on February 11th, at the Royal Station Hotel, York. Mr. D. S. Mackay, the Official Receiver, reported that a compulsory winding-up order had been made against the company. The company was registered in June, 1926, and took over an existing business as from January 1st of that year. Last September, a resolution for voluntary liquidation was passed, and a statement of affairs was then prepared which showed liabilities of £4 031, against net assets of £988. The assets then consisted of cash in hand 16s. 1d.; stock at cost £1 277, expected to produce £458; fixtures, tools, etc., £83; motor car, £95; good book debts, £618; and bad and doubtful debts, £152, valued at £40. One creditor objected to the voluntary liquidation being continued and filed a petition upon which the winding-up order was made. The Official Receiver pointed out that the matter was somewhat involved, and certain items called for explanation. In December, 1927, the total assets were valued in the company's balance sheet at £9 100, whilst in the voluntary liquidation the assets were estimated at £1 294, and were subject to preferential claims of £305. A resolution was passed appointing Mr. R. Crampton, accountant, of York, as liquidator with a committee.

METAL AND CHEMICAL PRICES.

TUESDAY, February 12th.

		Price.	Inc.	Dec.
Copper—				
Best Selected ..	per ton	£82 0 0	1 5 0	—
Electro Wirebars	,,	£84 10 0	3 5 0	—
H.C. Wires, basis	per lb.	11⅝d.	1/16d.	—
Sheet	,,	11⅝d.	1/16d.	
Phosphor Bronze—				
Wire (Telephone) basis	per lb.	1s. 2⅛d.	1/16d.	—
Brass 60/40—				
Rod, basis ..	per lb.	8½d.	—	—
Sheet ,, ..	,,	10½d.	—	—
Wire ,, ..	,,	11d.	¼d.	—
Pig Iron—				
Cleveland Warrants	per ton	£3 8 6	—	—
Galvanised Steel Wire, basis 8.S.W.G. ..	,,	£14 15 0	—	—
Lead Pig—				
English	per ton	£24 15 0	1 0 0	—
Foreign or Colonial	,,	£23 5 6	17s. 6d.	—
Tin—				
Ingot	per ton	£224 12 6	1 7 6	—
Wire, basis ..	per lb.	2s. 11d.	—	—
Aluminium Ingots	per ton	£95 0 0	—	—
Spelter	,,	£26 2 6	—	7s. 6d.
Mercury	per bottle	£22 5 0	—	3s. 6d.

Sulphur—Flowers, Ton £12 0 0 *Sulphuric Acid*—
,, Roll ,, £10 15 0 (Pyrites, 168°) Ton £6 15 0
Copper Sulphate ,, £25 to £25 10 0 *Sodium Chlorate* per lb. 2¾d.
Boric Acid (Crystals),, £30 0 0 *Sodium Bichromate* ,, 3¼d.
Rubber—Para fine, 1s. 0½d.; plantation, 1st latex, 11d.

∴ The metal prices are supplied by British Insulated Cables, Ltd., and the rubber prices by W. T. Henley's Telegraph Works Co., Ltd.

LEAD MARKET REPORT.

The lead market last week was, according to James Forster and Co., of a firm tone, prices registering a daily advance. Conditions in America have also remained firm, the leading interests advancing their price on February 6th to 6·75 cents.

Closing prices on February 8th were £23 2s. 6d. for February and March, £23 1s. 3d. for April and May, showing a rise of 17s. 6d. to 11s. 3d. on the week according to position.

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PATENT RECORD.

The following information is prepared from the Illustrated Official Journal (Patents) by permission of the Controller of H.M. Stationery Office. Printed copies of full Patent Specifications, when accepted, may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at 1s. each.

Specifications Accepted.

303 926 British Thomson-Houston Co., Ltd., and J. G. Wellings. Switching devices for potential transformers. (17/10/27.)
303 933 H. Wade (N.V. Philips' Gloeilampenfabrieken). Devices for supplying direct voltage, and more particularly a grid bias to the grids of the valve or valves of a radio installation. (17/10/27.)
303 936 British Thomson-Houston Co., Ltd., H. W. H. Warren, and A. T. Ward. Insulating enamels, varnishes, or the like coatings. (22/10/27.)
303 951 R. T. Norton and E. Long. Electric switch fuses. (5/11/27.)
303 952 J. H. Runbaken. Electric battery testers. (5/11/27.)
303 954 Coventry Automatic Telephones, Ltd., and C. C. Puckette. Electric selective switches. (7/11/27.)
303 973 General Electric Co., Ltd., H. C. Turner, and A. Sherwin. Electrical protective or alarm arrangements. (24/11/27.)
303 976 J. A. Crabtree, Electric switches. (29/11/27.)
303 977 E. Morel. Magneto-electric machines. (29/11/27.)
303 984 H. Wade (Soc. Anon. Trefileries et Laminoirs du Havre, Anc. Etab. L. Weiller, Soc. Cooperative de Rugles, et la Canalisation Electrique Reunis). Electrolytic manufacture of metallic powders. (3/12/27.)
303 986 Graham Amplion, Ltd., and J. D. Dunthorne. Electromagnetic gramophone reproducers. (5/12/27.)
303 992 J. T. Irwin. Electrical instrument for indicating instantaneous pressures or currents. (9/12/27.)
303 996 Alloy Welding Processes, Ltd., and E. H. Jones. Arc welding electrodes. (13/12/27.)
282 750 Eisen u. Stahlwerk Horsch Akt.-Ges., and Dr. W. Heidenhain. Method and apparatus for hardening substances of iron, steel, and other ferromagnetic materials. (28/12/26.)
304 006 J. W. Coldman and Scruttons, Ltd. Construction of overhead electric travelling hoist. (24/12/27.)
288 232 F. Quast and A. F. V. Eichert (trading as Berko-Werke Quast and Co., (firm of)). Magnets or magnet systems for magneto-electric machines. (8/4/27.)
304 007 T. Yamanouchi. Anchoring connection or dead-end clamp for electric cables. (29/12/27.)
304 016 Evershed and Vignoles, Ltd., and C. Midworth. Dial reading measuring instruments. 6/1/28.)
283 856 Berliner Batterie-Fabrik Ges. Anode batteries. (17/1/27.)
304 031 J. Collier. Electrical conductors. (21/1/28.)
284 225 Egyesult Issolampa es Villamossagi Reszveny-Tarsasag. Process for the determination of voltage equivalents of electric currents at varying potentials. (24/1/27.)
304 035 British Thomson-Houston Co., Ltd., C. J. Morton, and L. M. T. Bell. Ignition devices for internal combustion engines. (25/1/28.)
284 635 Metropolitan-Vickers Electrical Co., Ltd. Lightning arresters. (1/2/27.)
285 039 Allgemeine Elektricitats-Ges. Excess consumption electricity meter with direct current motor. (9/2/27.)
285 496 International General Electric Co., Inc. Electric motors, suitable more particularly for electric meters. (18/2/27.)
289 395 Siemens-Schuckertwerke Akt.-Ges. Electric switches. (26/4/27.)
304 057 Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric and Manufacturing Co.). Electrical insulators. (17/2/28.)
304 058 P. Rosenkaimer. Protecting glasses and globes for electric lamps. (18/2/28.)
287 520 W. Schott. Electric liquid heaters. (23/3/27.)
287 524 British Thomson-Houston Co., Ltd. Electric signalling systems. (23/3/27.)
287 142 International General Electric Co., Inc. Automatic reclosing circuit breaker systems. (16/3/27.)
287 462 Marconi's Wireless Telegraph Co., Ltd. Apparatus for use in radio and other high frequency installations. (19/3/27.)
287 926 Akt.-Ges. Brown, Boveri et Cie. Protective means for single or multiphase rectifiers operating in parallel with other direct current machines or apparatus. (30/3/27.)
288 152 Siemens-Schuckertwerke Akt.-Ges. Shades for incandescent electric lamps. (1/4/27.)
288 186 British Thomson-Houston Co., Ltd. Electric measuring instruments. (2/4/27.)
288 329 Electro-Transmission. Electric motors. (8/4/27.)
289 057 F. Kruckenberg and C. Stedefeld. Current collectors for high-speed railways. (21/4/27.)
289 882 N.V. Philips' Gloeilampenfabrieken. Installations for rectifying alternating current. (6/5/27.)
290 587 Associated Telephone and Telegraph Co. Automatic train control systems. (6/10/26.)
290 588 Associated Telephone and Telegraph Co. Automatic train control systems. (6/10/26.)
294 565 G. Main. Vacuum or gas-filled incandescent electric lamps. (26/7/27.)
293 386 Landis and Gyr Soc. Anon. Electricity meters. (5/7/27.)
293 420 Siemens-Schuckertwerke Akt.-Ges. Laminated core body for electric machines and apparatus. (5/7/27.)
293 313 General Electric Co., Ltd. Manufacture of electric incandescent lamps, thermionic valves, and the like. (2/7/27.)
293 426 British Thomson-Houston Co., Ltd. Variable ratio transformers. (6/7/27.)
293 431 Associated Telephone and Telegraph Co. Automatic train control systems. (6/10/26.)
293 432 Associated Telephone and Telegraph Co. Automatic train control systems. (6/10/26.)
294 242 General Electric Co., Ltd. Manufacture of electric incandescent lamps. (21/7/27.)
297 052 Falk, Stadelmann and Co., Ltd. Filaments for electric incandescent lamps. (13/9/27.)
294 938 Siemens-Schuckertwerke Akt.-Ges. Transformers with oil-filled terminals. (1/8/27.)
298 647 Telefunken Ges. fur Drahtlose Telegraphie. High-frequency signalling. (14/10/27.)
277 937 C. Hellyar and Anglo-Sphinx Engineering Co., Ltd. Electric switches. (24/10/27.)
304 380 Dubilier Condenser Co. (1925), Ltd. Rectifiers for alternating current. (24/9/26.)
304 336 L. H. Peter and Westinghouse Brake and Saxby Signal Co., Ltd. Electric current rectifying apparatus. (20/6/27.)
283 538 Dr. W. Kunze. Measurement of the transmission time of electrical oscillations. (13/8/27.)
304 162 D. F. Campbell. Construction of roofs of electric furnaces and the like. (15/9/27.)
291 069 Scintilla Akt.-Ges. Electric starters for engines. (28/5/27.)
304 175 J. A. Crabtree. Manufacture of the dollys or operating levers of electric switches. (12/10/27.)
304 165 E. W. Braendle and R. H. Billingsley. Means for converting mechanical, acoustic, or the like impulses into electrical impulses. (12/10/27.)
304 167 British Thomson-Houston Co., Ltd., A. P. Young and J. Hutt. Arrangements for supplying current for the operation of thermionic valve systems. (15/10/27.)
304 177 Dowell and Hanmer, Ltd., and W. J. Daniel. Illuminated direction indicators and signals for motor vehicles and the like. (13/10/27.)
304 169 Automatic Telephone Manufacturing Co., Ltd., F. Kessler, C. R. Woodland and J. C. McCrindle. Mounting arrangements for automatic switches and the like. (15/10/27.)
304 342 English Electric Co., Ltd., and G. Zweigbergk. Flexible couplings for transmitting rotary motion, adapted for electric locomotive drives. (17/10/27.)
304 347 S. G. S. Dicker (N.V. Philips' Gloeilampenfabrieken). Magnet systems for converting electric oscillations into acoustic ones, or *vice versa*. (17/10/27.)
304 259 S. G. S. Dicker (N.V. Philips' Gloeilampenfabrieken). Electrical devices such as wireless receiving sets. (17/10/27.)
304 222 S. G. S. Dicker (N.V. Philips' Gloeilampenfabrieken). Thermionic valve circuits. (17/10/27.)
304 348 W. Meacher. Electric contact seam-welding machines. (18/10/27.)
304 265 A. Browne. Electrical induction voltage regulating systems. (18/10/27.)
304 351 A. J. Wilkins. Wireless aerials. (19/10/27.)
304 352 Standard Telephones and Cables, Ltd., G. Hurford and N. V. Kipping. Automatic dial switches. (19/10/27.)
304 353 Standard Telephones and Cables, Ltd., B. B. Grace, G. Newton and C. P. Smith. Circuit interrupting mechanisms for telephone systems. (19/10/27.)
304 354 Standard Telephones and Cables, Ltd. (Western Electric Co., Inc.). Electrodeposition of alloys. (19/10/27.)
279 455 Standard Telephones and Cables, Ltd. Telephone and like repeater circuits. (19/10/26.)
304 356 British Thomson-Houston Co., Ltd., and H. S. Petch. Protection of electric transformers. (19/10/27.)
304 357 British Thomson-Houston Co., Ltd., and H. S. Petch. Protective devices. (19/10/27.)
304 359 A. Reyrolle and Co., Ltd., and H. C. Atkins. Balanced electric protective arrangements. (19/10/27.)
304 367 Standard Telephones and Cables, Ltd., and J. Collard. Method of balancing electric cables. (20/10/27.)
304 369 W. S. Smith and N. W. McLachlan. Electric oscillation generators. (20/10/27.)
304 382 J. K. Im Thurn, G. Shearing and C. Matthews. Transmitting apparatus for wireless telegraphy. (24/10/27.)
279 845 Radiofrequenz Ges., and H. Eberhard. Devices for generating electrical oscillations by means of piezo-electrical crystals. (26/10/26.)
279 510 Deutsche Telephonwerke und Kabelindustrie A.G. Apparatus for electrically transmitting to a distance the indications of a mesauring instrument or the like. (23/10/26.)
304 386 A. F. Harmer and Drake and Gorham, Ltd. High-tension electric circuit controlling devices. (25/10/27.)
304 390 General Electric Co., Ltd., and E. L. Randall. System of illumination. (27/10/27.)
304 396 S. G. S. Dicker (N.V. Philips' Gloeilampenfabrieken). Coating metallic or non-metallic bodies with rhodium, iridium and ruthenium. (31/10/27.)
279 910 Akt.-Ges. Brown, Boveri et Cie. Metal vapour rectifiers. (1/11/26.)
304 399 Callender's Cable and Construction Co., Ltd., and L. G. Brazier. Laying of electric cables and apparatus therefor. (3/11/27.)
280 560 Dr. S. Loewe. Method for obtaining a perfect high vacuum. (11/11/26.)
281 265 Magneta Suisse Soc. Anon. Electrical signalling apparatus. (27/11/26.)
304 417 K. L. Wood and Eastern Telegraph Co., Ltd. Synchronised electric telegraph systems. (15/11/27.)
304 423 S. G. S. Dicker (N.V. Philips' Gloeilampenfabrieken). Electric discharge tubes. (23/11/27.)
304 430 Graham Amplion, Ltd., and P. K. Turner. Apparatus suitable for the reception of wireless telephony. (5/12/27.)

Applications for Patents.

1929.

January 1st.

25, 26 Associated Telephone and Telegraph Co. Train control systems.
84, 85 H. H. Berry. Electric fires.
383 F. J. Breslee and British Insulated Cables, Ltd. Coating wire, etc.
8, 9 S. G. S. Dicker (N. V. Philips' Gloeilampenfabrieken). Arrangements for modulating frequency of electrical oscillations.
10, 12 S. G. S. Dicker (N. V. Philips' Gloeilampenfabrieken). Electric discharge tubes.
80 Electramonic Co., Ltd., D. W. Sayers, and L. N. and S. J. Tyrrell. Synchronising gramophones and kinematographs.
42 Electro Dynamic Construction Co., Ltd. Application of variable induction generators.
102 Ferranti, Ltd., and S. Z. de Ferranti. Alternating current motors.
116 F. Krupp Grusonwerk A.G. Magnetic separation of materials. (5/1/28. Germany.)
106 Scintilla A.G. Coils for battery ignition apparatus. (9/8/28, Germany.)
118 Siemens-Schuckertwerke A.G. Regulation of potential of electrical machines. (23/2/28, Germany.)
41 J. A. Smith. Means for holding electric conductors, etc.

January 2nd.

197 J. L. Baird and Television, Ltd. Thermionic valve apparatus.
183 Electroacustic Ges. Apparatus for directional transmission of wave energy. (14/1/28, Germany.)
189 Enn-Werke Neu, and Neuberger, J. Neu and J. Neuberger. Electric hand lamps.
181 Etablissements E. Belin. Variable speed for wireless, etc., transmissions. (26/1/28, France.)
193 H. C. M. Ingeberg and A. Vesterlid. Insulation material.
165 International General Electric Co., Inc. Vacuum cleaners. (3/1/28, U.S.)
187 Keller Mechanical Engineering Corporation. Electric tracer control for lathes. (27/7/28, U.S.)
199 H. Kirschfeldt. Methods of producing electric power.
167 Maschinenfabrik Oerlikon. Electric switches. (25/1/28, Switzerland.)
191 N. V. Technisch Handels-Bureau Thabur. Electric heating elements. (2/1/28, Holland.)
178 K. Nishimoto. Storage battery. (16/1/28, Japan.)
150 W. Guy-Pell. Light controlling means.
182 J. Schurmann. Electric igniting devices.
168 Soc. des Etablissements Ducretet. Electronic tubes. (13/1/28, France.)

January 3rd.

254 W. S. Adams, British Thomson-Houston Co., Ltd., and J. G. Wellings. Electric switchgear.
276 R. P. A. Andersson. Incandescent lamps.
255 British Thomson-Houston Co., Ltd. Transmission of pictures. (23/1/28, U.S.)
232 N. R. Campbell. Photoelectric cells.
241 Electroacustic Ges. Apparatus for directional transm ssion and reception of wave energy. (4/9/28, Germany.)
271, 272, 273 Ferranti, Ltd., and A. W. G. Tucker. Transformers.
274 Ferranti, Ltd., A. W. G. Tucker. Alternating current load-transferring switches.
277 Furukawa Denki Kogyo Kabushiki Kaisha. Manufacture of battery plates. (17/1/28, Japan.)
232 General Electric Co., Ltd. Photoelectric cells.

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240 G. Hager and A. Stuppöck. Electric switches. (3/1/28, Austria.)
221 W. Nicol. Electric lamp bulbs, etc.
218 F. H. Reeves and Revo Electric Co., Ltd. Electric lamp fittings.

January 4th.

399 Akt.-Ges. Brown, Boveri et Cie. Arrangement for commutation of continuous current. (28/1/28, Germany.)
375 Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. Telephone systems.
370 C. W. Bloomfield. Lead covered conductors, etc.
330 A. P. C. Collier, Radiovisor Parent, Ltd., and E. F. Stephenson. Electric relays.
364 Edison Swan Electric Co., Ltd., G. A. Percival, and H. Swithinbank. Electric lamps.
391 Ferranti, Ltd. and A. Hall. Electromagnetic gramophone pick-up devices.
392 Ferranti, Ltd., and A. Hall. Radio receiving systems.
328 V. H. Gilbert and Radiovisor Parent, Ltd. Forming electrodes of selenium bridge.
371 A. A. Greenslade. Means for indicating and recording telephone calls.
362 International General Electric Co., Inc. Electric protective devices. (4/1/28, Germany.)
334 J. Y. Johnson (I.G. Farbenindustrie A.G.) Production of electrodes for secondary cells.
311 A. E. Jones. Electrical switch plates, etc.
329 Radiovisor Parent, Ltd. Wheatstone bridge cricuits.
395 F. Reid. Fire alarm systems.
358 F. A. Robinson. Distribution of electric current.
290 J. R. Sinclair. Electron discharge devices.
403 Telefunken Ges. fur Drahtlose Telegraphie. Picture, etc., telegraph apparatus. (8/2/28, Germany.)
404 Telefunken Ges fur Drahtlose Telegraphie. Radio communication systems (10/2/28, Germany.)

January 5th.

480 Burdick Corporation. Therapeutic lamps. (6/1/28, U.S.)
454 H. L. Curtis. Loud-speaking telephones.
491 Fabrique d'Appareils Electriques. Favarger Soc. Anon. Apparatus for electrical transmission of information. (6/1/28, U.S.)
433 A. Fotheringhame. Means of obtaining energy from a magnetic field.
443 General Electric Co., Ltd. Devices sensitive to radiant energy.
477 W. O. Heyne and Plessey Co., Ltd. Thermionic valve holders, etc.
501 R. MacDonald. Electrical reproducing devices.
458 Maschinenfabrik Oerlikon. Switch for transformers. (17/1/28, Switzerland.)
457 E. H. Newman and L. C. Rudkin. Wireless receiving apparatus.
489 P. S. O'Donnell and M. de Wolfe. Electrical indicators.
478 J. Robinson. Transmission of pictures.
410 J. Swinburne. Recording sounds.

January 7th.

624 A.C. Spark Plug Co. Preparation of flexible cable. (5/1/28, U.S.)
616 W. H. Apthorpe and Cambridge Instrument Co., Ltd. Vibrating electrical devices.
634 Automatic Telephone Manufacturing Co., Ltd., and W. A. Duff. Telephone systems.
502 F. Blake. Driving tyre for dynamos, etc.
543 K. Bratel. Means for operating electric luminous tubes.
537 British Thomson-Houston Co., Ltd., C. J. Morton, and T. H. Woodfield. Lighting and ignition apparatus for vehicles.
635 British Thomson-Houston Co., Ltd. Variable condensers. (7/1/28, U.S.)
554 S. G. S. Dicker (N. V. Philips' Gloeilampenfabrieken). Transformers.
540 Electric Furnace Co., Ltd. Heating metals, etc.
608 Electrical Research Products, Inc. Electric regulators. (29/6/28, U.S.)
522 Electroflo Meters, Ltd., and G. E. Lloyd. Direct current measuring instruments.
615 Ferranti, Ltd., and G. L. Porter. Automatic voltage regulators.
558 W. Frianz. Incandescent lamps.
532 F. W. Golby (Red Spot Electric Co.). Electric fluid heaters.
535 International General Electric Co., Inc. Electric switching devices. (7/1/28, Germany.)
543 Patent-Treuhand Ges. fur Elektrische Gluhlampen and K. Wiegand. Means for operating electric luminous tubes.
557 Patent-Treuhand Ges. fur Elektrische Gluhlampen and K. Wiegand. Arrangement for treating liquid with ultra-violet rays.
517 H. A. Sims. Electrically actuated gongs, etc.

January 8th.

725 Bakelite, Ltd., and D. N. Davies. Earthed panels for wireless signalling.
674 British Thomson-Houston Co., Ltd., and L. J. Davies. Electron discharge devices.
716 C. E. Cornelius. Electric furnace. (9/1/28, Sweden.)
702 N. A. Davis and Metropolitan-Vickers Electrical Co., Ltd. Electric induction furnaces.
703 N. A. Davis and Metropolitan-Vickers Electrical Co., Ltd. Preparation of refractory linings, etc., for coreless induction furnaces.
733 T. C. Finnimore and Gramophone Co., Ltd., A. Whitaker, and J. White. Electromagnetic vibratory devices.
732 Gramophone Co., Ltd., and A. Whitaker. Apparatus for simultaneous reproduction of pictures and sounds.
734 Gramophone Co., Ltd., E. M. Payne, and A. Whitaker. Electromagnetic vibratory devices.
673 D. P. Long and Siemens Bros. and Co., Ltd. Automatic telephone systems.
709 D. C. Plyer and Rotax (Motor Accessories), Ltd. Voltage regulation of telephone systems, etc.
684 Siemens-Schuckertweke A.G. Producing thin insulating layers on wires. (16/1/28, Germany.)
690 Siemens-Schuckertwerke A.G. Producing thin insulating coatings on wires. (16/2/28, Germany.)
718 Soc. Anon des Etablissements Técalémit. Stoppers for accumulators. (9/1/28, France.)

January 9th.

801 A. Arcioni. Pressure regulation of a.c. lines. (9/1/28, Italy.)
844 C. E. G. Bailey and Gramophone Co., Ltd. Tuning devices for wireless receivers.
845 C. E. G. Bailey and Gramophone Co., Ltd. Heterodyne wireless receivers.
774 G. B. Bowell. Electric clocks.
810 British Thomson-Houston Co., Ltd., and C. J. Morton. Ignition devices. (6/1/28.)
775 R. O. Carter, E. K. Sandeman, and Standard Telephones and Cables, Ltd. Electric signalling system.
750 A. Dickinson. Means for preventing microphonic disturbances in wireless components.
784 J. Downs and Watts, Fincham and Co., Ltd. Electric hand lamps.
814 Ferguson, Pailin, Ltd., and G. Pailin. Electric switchgear.
815 Ferguson, Pailin, Ltd., and G. Pailin. Plug and socket connections.
789 General Electric Co., Ltd. Step-by-step mechanism.
811 International General Electric Co., Inc. Safety devices for power installations. (11/1/28, Germany.)
859 D. L. Lees, J. S. Murray, and P. K. Turner. Moving coil sound reproducers
850 Magneto Belge. Electric motors. (13/7/28, Belgium.)
831 Marconi's Wireless Telegraphs, Ltd. Picture telegraph apparatus. (9/1/28, U.S.)

January 10th.

865 H. C. Andrewartha and J. H. Needham. Electric switches, etc.
979 J. Bethenod. Electrically actuated musical instrument. (2/3/28, France.)
977 F. S. Clifford. Electric sound transmission.
961 E. Dunkel and Schall and Son, Ltd. Timing X-ray photographic exposures.
981 S. J. Eintracht and Universal and General Radio Co., Ltd. Converters for supplying radio apparatus from a.c. mains.
920 R. E. Henreich, Radiowerk E. Schrack, and E. Schrack. Loud speaking systems.
886 M. H. Goldstone. Inductance coils.
914 International General Electric Co., Inc. Electric switches. (10/1/28, Germany.)
867 G. Jones. Electric switches.
926 F. G. McDonald. Electric switch indicators for vehicles.
869, 870, 871, 872 W. G. Moore. Electrodes for obtaining therapeutic rays.
888 S. Moss. Wireless tuning devices.
877 C. Odolini. Electric ignition devices.
958 H. J. Round. Portable radio receivers, etc.
959 H. J. Round. Loud speakers, etc.
969 G. G. Schmidt. Electric switches, etc.
935 Scintilla Akt.-Ges. Electric reversing switches. (1/3/28, Germany.)
977 A. E. C. Snell. Electrical sound transmission, etc.

January 11th.

993 C. W. Cox and J. A. Welch. Electric fuses.
1 038 J. G. Daloz. Miners' electric lamps. (27/7/28, Belgium.)
1 106 R. Delpasse (née Foy) and A. Tasquin. System of electric railway signalling. (11/1/28, France.)
1 002 J. H. O. Harries. Television, etc. (16/11/28.)
1 023 R. Holloway. Galvanic primary cells.
1 087 Imperial Chemical Industries, Ltd. Arc welding.
1 066 International General Electric Co., Inc. Manufacture of insulated enamelled wire. (11/1/28, Germany.)

COMING EVENTS.

Friday, February 15th.

Institution of Mechanical Engineers.—Storey's Gate, Westminster. Annual general meeting. Paper by Mr. H. J. Ward on "Refrigeration on Ship-board." 6 *p.m.*

Electrical Development Association.—Royal Society of Arts, John Street, Adelphi, London. Conference on "Organising for Increased Sales—Spring Cleaning Season, 1929." Speaker, Mr. H. W. Roberts. 7.30 *p.m.*

Saturday, February 16th.

Association of Mining Electrical Engineers (Western Sub-Branch).—60, Wind Street, Swansea. Paper on "Fault Localisation," by Mr. S. T. Richards.

Monday, February 18th-Friday, March 1st.

British Industries Fair.—London and Birmingham.

Monday, February 18th.

Institution of Electrical Engineers (Western Centre).—South Wales Institute of Engineers, Park Place, Cardiff. Paper by Messrs. Johnstone Wright and C. W. Marshall on "The Construction of the Grid Transmission System in Great Britain." 6 *p.m.*

Institution of Electrical Engineers.—Institution, Savoy Place, Victoria Embankment, London. Informal meeting. Discussion on "Modern High Power Rectifiers: Their Development and Use." (Opened by Mr. R. L. Morrison.) 7 *p.m.*

Institution of Electrical Engineers (Mersey and North Wales-Liverpool-Centre).—Arts Theatre, The University, Liverpool. Faraday lecture by Mr. Ll. B. Atkinson on "How Electricity Does Things." 7.30 *p.m.*

Tuesday, February 19th.

Illuminating Engineering Society.—Home Office Industrial Museum, Horseferry Road, Westminster. Special general meeting for the purpose of considering certain amendments in the Constitution, followed by a discussion on "Various Problems in Illuminating Engineering." 6.45 *p.m.*

Institution of Electrical Engineers (North-Western Centre).—Engineers' Club, 17, Albert Square, Manchester. Paper by Mr. W. Cruickshank, on "Voice-Frequency Telegraphs." 7 *p.m.*

School of Engineering and Navigation.—High Street, Poplar. Lecture V (course of five lectures) by Mr. H. Brazil, on "Electrical Sub-Stations." 7 *p.m.*

Wednesday, February 20th.

Electrical Contractors' Association (Sussex Branch).—Midland Bank Chambers, Brighton. Ordinary meeting.

Polytechnic School of Electrical Engineers.—307-9, Regent Street, London. Lecture IV (course of eight lectures), by Mr. E. S. Ritter, on "Picture Telegraphy." 5 *p.m.*

University of London.—Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London. Lecture I (course of five lectures), by Mr. L. Emanueli, on "High Voltage Cables." 5.30 *p.m.*

Institution of Electrical Engineers (Sheffield Sub-Centre).—Royal Victoria Hotel. Address by the President, Lt.-Col. K. Edgcumbe. 7.30 *p.m.*

Thursday, February 21st.

Institution of Electrical Engineers (Irish Centre, Dublin).—Physical laboratory, Trinity College. Paper by Dr. K. Ott on "The Erection of the Mechanical and Electrical Part of the Shannon Scheme." 7.45 *p.m.*

Friday, February 22nd.

Physical Society.—Imperial College of Science, Imperial Institute Road, South Kensington. Papers by Mr. L. F. Stanley on "The Construction and Calibration of a Sensitive Form of Pirani Gauge for the measurement of High Vacua; Dr. C. H. Lees, F.R.S., on "The Free Periods of a Composite Elastic Column or Composite Stretched Wire" Messrs. A. Ferguson and J. A. Hakes on "A Capillary Tube Method for the Simultaneous Determination of Surface Tension and of Density"; and a demonstration of a standard electrostatic voltmeter and wattmeter, used for measurements of alternating currents at power frequencies at the National Physical Laboratory, by Dr. E. H. Rayner. 5 *p.m.*

University of London.—Institution of Electrical Engineers, Victoria Embankment, London. Lecture II (course of five lectures), by Mr. L. Emanueli, on "High Voltage Cables." 5.30 *p.m.*

Institution of Electrical Engineers (London Students' Section).—Institution, Savoy Place, Victoria Embankment, London. Paper by Mr. W. Ford on "Standardisation." 6.15 *p.m.*

Birmingham Electric Club.—Grand Hotel, Colmore Row, Birmingham. Paper by Mr. S. E. Britton on "Electricity in Agriculture." 7 *p.m.*

Institution of Electrical Engineers (North-Eastern Students' Section).—Paper by Mr. G. Waters on "The Progress of Electrical Installations on Ship-board." 7.15 *p.m.*

Saturday, February 23rd.

Association of Mining Electrical Engineers (South Wales Branch).—Cox's Café, Queen Street, Cardiff. Annual dinner. 6.30 *p.m.*

Association of Supervising Electrical Engineers.—Hotel Cecil, Strand, London. Annual dinner.

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[*Closed on Saturdays in accordance with the "Five-Day Week" plan adopted by Benn Brothers, Ltd., and its associated organisations.*]

No. 2647. [No. 8. Vol. CII.] Friday, February 22, 1929. Annual Subscription, 25s Overseas, 30s.

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Current Topics.

Exports and the B.I.F.

In spite of the fact that a large number of foreign buyers have already visited the British Industries Fair, there are many more who would not brave the rigours of an English February for all the trade fairs in existence. With full recognition of this fact we have made special arrangements whereby this issue of THE ELECTRICIAN, containing an extensive review of the electrical exhibits at the Fair, shall reach a large proportion of the absentees in the various Dominions and foreign countries, thus, so to speak, taking the Fair to those who are unable to visit it in person. So far as the Electrical Section is concerned the show this year is bigger and better than ever, and the new arrangement of the stands has greatly simplified the location of any particular exhibit. It was a mistake, we think, to decide once more to admit members of the general public to the Fair during certain hours, for at a time like this catering for the requirements of business visitors demands the unqualified attention of the exhibitors' staffs. The presence of large crowds of people on sightseeing bent may have some psychological effect on some of the overseas visitors, but it can hardly be said to facilitate the transaction of real business.

In view of the growing interest in the great possibilities inherent in the vigorous adoption of a policy of trading within the Empire one notes with interest the Canadian participation in this year's Fair in exhibits of storage batteries, electric washers and ironers, electric cookers and stoves, suction cleaners, etc. At the present time over 65% of our external trade is with foreign countries, the remaining 35% being with the British Empire, while the exports from this country to the British nations had declined from 49% of the whole of the exports in 1895 to 36% in 1923, the latest year of which complete figures are available. The per capita purchasing power of the populations of the British Dominions is very considerably greater than that of foreign countries, and as the populations increase this feature will become still more marked.

The export side of the British electrical industry is one of the comparatively few in this country which is exerting itself with success in making the most of export possibilities. Although, as we point out in a later note, our home trade is weak on the selling side, those responsible for the export side are increasingly aware of the need—so forcefully expressed by the PRINCE OF WALES on Monday—for up-to-date salesmanship. There is, as the Prince said, a very strong desire, not only in British communities overseas, but in foreign ones as well, to buy goods manufactured in Great Britain in preference to others if—but only if—those goods suit their requirements. Our facilities for meeting these requirements are unrivalled, for, as Sir PHILIP NASH has pointed out, our location for getting raw materials is unique, our labour is the most intelligent, and our financial system in size and integrity, is without equal in the world. Using these assets together with a greater measure of self-confidence and fuller co-operation, aided by careful organisation and hard work, we need have no fear for the future of British export trade.

Organising for Increased Sales.

DESPITE the deliberately intense provocation offered by Mr. H. W. ROBERTS, and the insistence of the chairman, Mr. F. W. PURSE, in reminding speakers that selling topics were in season, few of those who discussed "Organising for Increased Sales" at the E.D.A. Sales Conference last Friday seemed to be very concerned with selling. This apparent decline in interest in a subject which is of vital importance to the future progressive development of the electrical business is a tendency which has been noted before, but we cannot feel apologetic for dwelling again on a matter which means so much to the entire industry. Generally speaking, we have not yet begun to develop the home market, though a moment's thought shows that a flourishing home trade is a necessary corollary of big scale production for export. Curiously enough, our backwardness in salesmanship is not so much due to prevalence of the idea that electricity and electricity consuming apparatus are so good that people will demand them without encouragement from us, as a lack of vision regarding the possibilities, and the neglect to fix some sort of a goal to aim at. Too many of us are content to think of the cooker or other apparatus which has already sold itself, to bother about the greater number we might have sold, given efficient sales organisations, and about the still greater opportunities which lie ahead. The value of having a point upon which to march is so universally acknowledged that we cannot altogether agree with those who say that American sales methods will not work over here, when we hear from time to time of some con-

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tractor who decided to turn over 1 000 irons or 200 washers in a given period, and actually sold the desired number. The methods necessary for successful selling in the two countries may be, and probably are, very different. In the U.S.A. the methods are at least commonly understood and employed, whereas we do not seem to have begun to formulate anything better than a string of negatives. We are frequently told, by those who should know, how not to sell electricity and electrical appliances to the British public, but constructive views are markedly rare. It has been suggested to us that the E.D.A. Sales Conferences in their present form offer little hope of training up the younger members of the industry in the way they should go. If this view is generally endorsed, as we fear it must be, the task of organising something more practical and more comprehensive should be undertaken without delay. Beyond suggesting that some useful hints might be obtained from the organisers of the E.L.M.A. Lighting Service Bureau courses on illumination, we do not propose at this stage to offer definite suggestions. But we do invite the free use of our correspondence columns for proposals designed to assist in establishing suitable machinery for the dissemination and demonstration of sound sales methods. Some of the weak points in our export salesmanship was touched on by the PRINCE OF WALES at the B.I.F. Banquet, and many of his remarks apply with equal point to the home market.

An Omnibus Association.

THE plea put forward by Mr. T. STRETTON at the E.W.F. dinner for the establishment of one electrical trade association which would co-ordinate the functions of existing organisations has been advanced again and again, but with the same dearth of results, or even expressions of opinion, either for or against the proposal. The fear of a few short-sighted association officials that the operation of such a scheme would deprive them of their jobs does not seem to provide sufficient cause for the apparently general disinclination to discuss the project in a constructive manner. There is at least a *prima facie* case for consideration. Why, then, is the subject taboo ?

A Gas Scandal.

USED as we are to reading of the asphyxiation of whole families by escaping gas, we are apt to dilute our sympathy with the victims with reflections that people who choose to live in such dangerous company have expected too much of Providence. But a recent incident at Eastbourne, in which a husband, wife and two girls died from gas poisoning, suggests that even those who have no gas supply may fail to wake almost any morning due to the nocturnal ramblings of this " Spirit of Coal " In the Eastbourne tragedy it appears the vicitims lived in a flat which had no gas installation, but yet were found in a room full of gas, which had apparently forced a way under the premises from a leakage in the main outside. If electricity could have caused such a terrible tragedy there would have been a great outcry coupled with demands for safeguarding the public against a repetition. In the Eastbourne case, however, nobody seems to have been particularly perturbed by such a danger.

Lord Birkenhead and Electricity Supply.

" DESPITE a well-organised Spanish manufacturing industry and active competition from other European manufacturers, American electrical equipment is considered standard. This situation is partly accounted for because of the extensive investments of American capital in Spanish factories and utilities." Statements similar to this quotation from an American journal so frequently come to light, and practical knowledge of the advantages which British industrialists have gained in the past from investments in partially-developed foreign countries is so definite, that LORD BIRKENHEAD'S acceptance of the chairmanship of the American-financed Greater London and Counties Trust is a move demanding careful attention. Suggestions that this financial penetration would deprive the British industry of orders have been very definitely controverted ; not only by Lord BIRKENHEAD, but also by Sir PHILIP DAWSON and Mr. F. MASSINGBERD ROGERS, both of whom are prominently associated with the scheme. The benevolent motives of the Utility Power and Light Corporation in financing the development of electricity supply in this country must therefore be accepted, as well as the statement that the Trust is under entirely British control, and will work entirely to the advantage of Britain. What we fail to see at the moment is how, under these circumstances, American capital can derive much advantage from investment in distribution enterprises in areas which for the most part have shown little attraction to investors with full knowledge of local possibilities ; enterprises which must, moreover, purchase supplies from the Central Electricity Board and be subject, as the constituent companies now are, to the forms of control which apply to other supply undertakings in this country.

Electric Vehicle Law.

BY deciding on appeal that petrol-electric vehicles are electrically propelled vehicles, and chargeable as such with the preferential licence duty, the House of Lords has settled a knotty point. While on the one hand it had been contended that as the original source of energy is the internal combustion engine, it is not an electrically propelled vehicle, their Lordships hold that argument to be unsound, on the ground that a vehicle does not cease to be an electrically-propelled vehicle by reason of the fact that the electricity which drives the wheels is generated by a petrol engine. This decision will probably have an important bearing on the immediate future of electric vehicle design.

The Commissioners' Report.

IN recent years the annual reports of the Electricity Commissioners have tended to come out later each year. Their seventh report, issued nine months after the end of the period to which it related, was just in time for Christmas reading. The eighth report, which has just been issued (H.M. Stationery Office: 3s. net) is nearly eleven months old. Although the extra work which has fallen upon the Commissioners is mainly, if not entirely, responsible for the widening time lag, the value of reports of this kind is greatly increased by topicality. To refer at this date to a " proposal " to establish a hydro-electric generating station at Maentwrog, and to state that one turbo-generator at Brimsdown " is practically ready for the initial run " is to expect of the reader a closer knowledge of the Einstein Theory than some of us possess. One is somewhat reconciled to the lateness of publication by the encouraging progress which the Commissioners record in various directions. The Returns bear evidence that there was a rapid recovery as regards output and operating results from the adverse effects of the coal stoppage, the total output of 9 927 850 630 kWh being 18·7% above the figure for 1926–27. The increased output, moreover, was obtained at the expense of the small advance of 5·4% in coal and coke consumption. Sales by authorised undertakers increased by about 19·6%, thus raising the average per capita consumption to 155 kWh. As there was installed in 1924 no less than 2 500 000 kW of industrial generating plant not included in the above returns, the real average consumption spread over the whole population is obviously much greater than the recorded figure. Viewing the statistics over several years, the production of electricity at the stations included within the scope of the Returns has practically doubled since 1920–21 ; there has been an all-round increase of about 54% in the amount of electricity produced per ton of fuel consumed, as compared with the technical practice in 1920-21 ; and the sales of electricity by authorised undertakers have increased by about 88% in five years. For a country which is supposed to be " lagging far behind " others, the results as disclosed by the Commissioners are, to say the least, encouraging.

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BRITISH TRADE.

Conditions Required for Industrial Revival—Six Vital Points—Our Future Policy—Output and Unemployment—Telling the World of Our Ability—Enormous Market for British Electrical Goods.

By R. H. SCHOFIELD, A.M.I.E.E.

THE inherent wealth of this island is very great after a century of progress as the leaders of the world in industrial production, and no small part of that wealth is the capacity of our people born and trained into respect for law and order.

Mr. R. H. Schofield.

Our accumulated wealth was poured out during the War by the thousand million, and positive wealth is still pouring away, thus our apparent inability to sell enough of our productions to keep our people fully employed.

Our productive capacity as a nation, both as regards people and factories, is working on a very poor load factor, and this is probably the real weakness of our present national condition.

Our potential wealth was reduced by the wholesale slaughter of men who were naturally of our best, both physically and mentally. Abstract wealth has been reduced very materially by the lethargic outlook of the masses and by the lack of guidance in economic perspective manifest in limited output per man-hour, both by brain and manual workers.

In such a condition it is necessary to review our assets and resources and to consider the best use of them for our immediate prosperity and the consolidation of the future of the country.

There is a very well-worn statement that "British goods are best," and this will probably continue to serve its purpose until such time as we shall not need to reiterate such a slogan, as others will do it for us.

In every industry there is a serious weakness of hoping that things will improve instead of fighting to improve them by real effort.

Those at the head of each industry should lead it well or get out, and, in my opinion, the following is a list of what has to be done:—

(1) We must acquire sufficient knowledge of the requirements of humanity. We cannot expect ever to relax our inquiry as to what is, and what will be, wanted. We should be able to know human needs as well as anyone, and it is urgently desirable that our youth should learn to understand and speak the principal languages of the world. It is futile for an Englishman to travel on the Continent for the purpose of broadening his mind, or even enjoying a holiday, unless he can understand the language and the psychology of the people of the countries visited. It is still more useless to spend good business-time and money when the spoken word has to be interpreted before it is understood.

We shall have to get out of the habit of satisfaction with a design, a type or a method, and to this end we have to get into a state of mind which compels us to inquire all the time.

(2) We must acquire the skill and technique to design commodities for these requirements. This is a very important factor, and although it is well known and appreciated that our technical men have high abilities, it is doubtful whether our designers meet the users frequently enough, and it is also doubtful whether this section of the work is made sufficiently attractive from the point of view of remuneration and general reward for industry.

(3) We must employ, and pay well, the industrial workers who are willing to sell their output at prices according to result. It is difficult to enlarge upon this feature without becoming political, but it is an undoubted fact that in Great Britain the output per man-hour is less than in other countries. The cause of this frame of mind is, in a great measure, the fear of unemployment. Every leader of industry knows that his workers can and do produce a greater output on a full order book, and every workshop foreman knows that workers very naturally hold back the finishing of a job unless there is another one in sight, because the fear of unemployment is a very real and serious dread.

The New Propaganda.

(4) We must bring to the knowledge of humanity the fact that our excellent commodities are available. This means advertising in the broadest sense of the word. For some years past we have been telling the world the onerous conditions of our national life, and we have shown them in many ways that we are temporarily below par. The result of this world-wide depression of the opinion of Great Britain is that in general we are trying to cultivate trade by sentimentality rather than by value for money. It is necessary to look as if we want the orders, but not as if we need them. Let us begin early a new kind of propaganda showing our national ability and capacity rather than the continual exposure of our difficulties.

(5) We must cut out ruthlessly the costly non-productive portion of our overhead charges.

(6) We must study international and empire trade relationships from our own business angle, and not from the political party standpoint.

The outstanding bright spot of British export trade at the moment is in the electrical industry. This success is very largely due to the comparative newness and vigour of the people in the trade.

The world market for British electrical commodities is tremendous, and there is profitable trade to be done by those who will first take the trouble to find out what is wanted, design it skilfully, sell it with enthusiasm and deliver it punctually.

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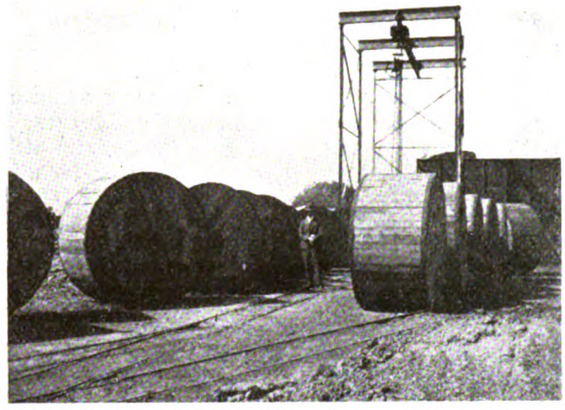
BRITISH EXPORTS PICTURED.

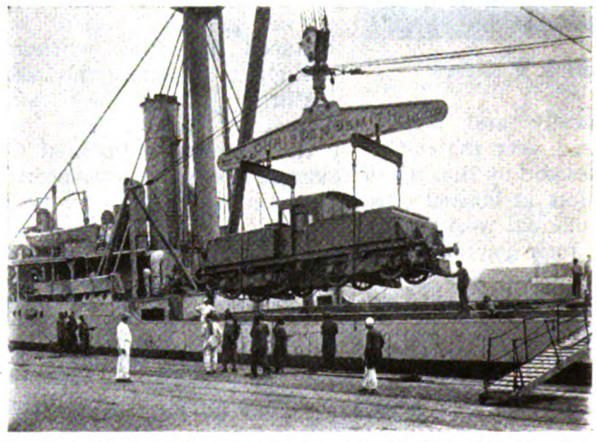
A 61-ton Parsons alternator stator unloading at Sydney, Australia, by floating crane.



Part of a big consignment of J. and P. cables, at Pretoria power station.

Unloading a 53-ton Parsons stator, for Witbank, at Lourenço Marques, Portuguese East Africa.

A 600-H.P. Metropolitan-Vickers electric locomotive on the Oeste de Mines Railway, Brazil, with some of the railway staff.



A 57-ton electric locomotive made by the English Electric Co., for the B.B. and C.I. Railway, unloading at the Alexandra Docks, Bombay.

Reminiscent of one of the "Old Masters" is this picture of a half condenser shell made by the Metropolitan-Vickers Electrical Co., being hauled to site at Bunnerong, Australia.

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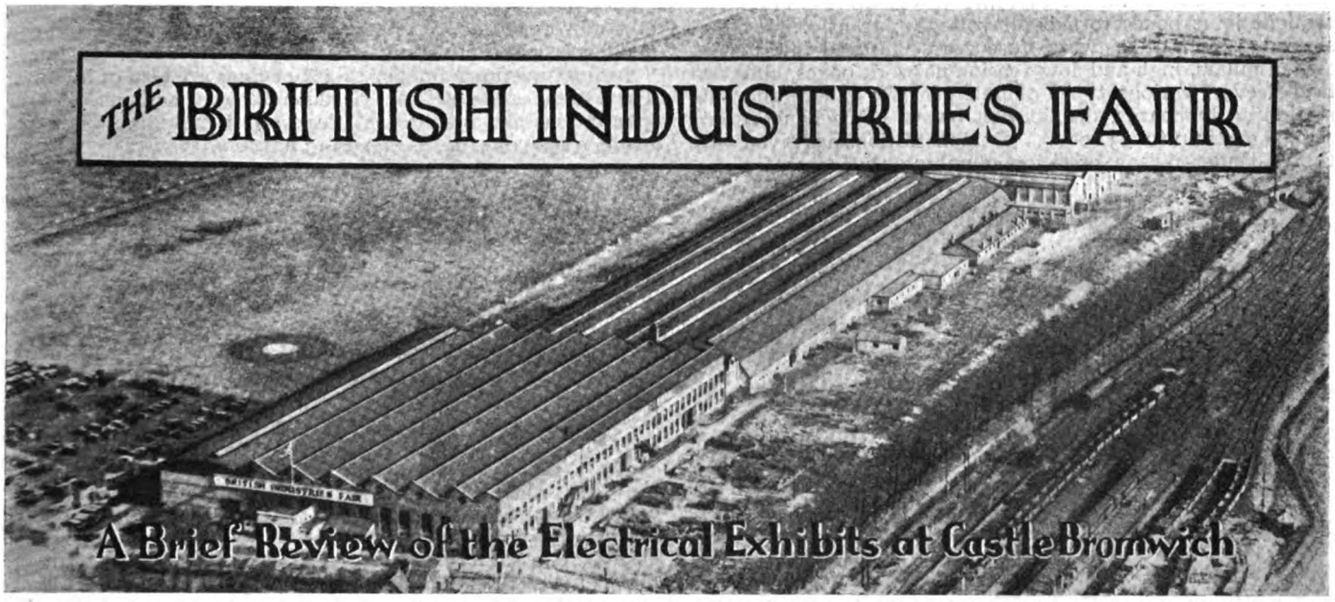
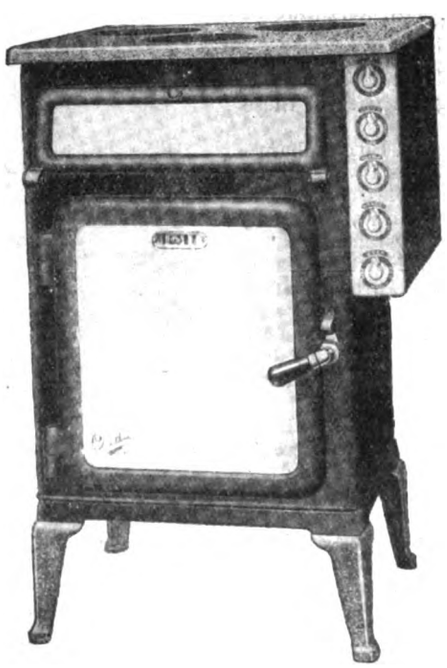


WE continue below our review of the exhibits of electrical interest at the Birmingham Section of the British Industries Fair. Our remarks last week were chiefly in relation to domestic equipment, and below will be found descriptions of some of the industrial interests.

THE WESTINGHOUSE BRAKE AND SAXBY SIGNAL CO., LTD. (82, York Road, King's Cross, London, N.1). The exhibits here include several complete battery charging sets; a 1 000 V rectifier set, suitable for power supply for transmitters; all types of radio units; a representative display of eliminators and chargers made by well-known manufacturers, which incorporate Westinghouse rectifiers, and a four-circuit charging set for garage and service station use, giving various outputs.

J. H. TUCKER AND CO., LTD. (King's Road, Tyseley). Prominence is given to the lines which have been introduced since the last Fair, including a new range of combined switches and sockets, some particulars of which have already appeared in the electrical Press. This new range has been specially designed to eliminate erection difficulties, especially in sunk boxes. The unit consists of a single base of porcelain with corner feet, with the switch and socket mounted thereon. The fixing of the whole unit in either iron or teak boxes is accomplished by two screws and does away with any form of mounting brackets. In the surface pattern of this range the unit is entirely enclosed in a bakelite case secured to the case with one single screw. Another feature is a complete range of three-pin sockets and plugs made to the B.S.S. No. 317, which was issued late last year. This range consists of the 2 A, 5 A, and 15 A sizes in surface, floor, and switchplate mounting types. In addition to giving prominence to these lines J. H. Tucker and Co. also have ranges of complete switchboards for country house lighting, knife switches and fuses up to 1 000 A. A novelty is provided in an endless belt system, which shows the extensive nature of "Tucker" products. Other exhibits are ranges of insulated products in telacite and bakelite, interlocked heavy duty switch-plugs, bakelite lamp holders (both of the ordinary and Home Office types) and similar lamp holders, incorporating a quick-make-and-quick-break switch action with push-bar method of operation. The miniature 5/15 A range of H.O. fuseboards, which made its first appearance at last year's Fair in teak cases, is shown for the first time in iron cases. Special wiring facilities have been incorporated in this new range, including detachable end plates for drilling. A new range of ironclad switches and switch-fuses with quick-make-and-quick-break action in double, triple, and four pole types is also to be seen, as well as single and double pole service cut-outs incorporating a fuse unit of new design.

PRITCHETT AND GOLD AND E.P.S., CO., LTD. (50, Grosvenor Gardens, Victoria, London, S.W.1). This exhibit is made up of batteries for central stations, house lighting, yachts, automatic telephone exchanges, train lighting, etc. The chief feature is the closed top cells. These have found favour with contractors and lighting set manufacturers, in view of the ease with which the lid may be removed to allow for internal inspection. There is no sealing to be cut away, as the cells are sealed by means of a rubber flange fitted to a wooden lid. These cells can be sent out fully charged complete with acid.



ONE of the electric cookers to be seen at Birmingham on the stand of Credenda Conduits, Ltd.

CREDENDA CONDUITS, LTD. (Oldbury, Birmingham). Here is shown a wide selection of apparatus sold under the name of "Creda." Foremost in interest are the new automatic electric hot water storage heaters. These are made in four sizes and are automatic in action. A full range of cookers is shown, together with kettles and other small domestic appliances. Another interesting section is that devoted to "Credalux" reflector lighting fittings.

CALLENDER'S CABLE AND CONSTRUCTION CO., LTD. (Hamilton House, Victoria Embankment, London, E.C.4). Here is shown a complete range of l.t., h.t., and super-tension cables, up to and including 66 000 V. The range covers paper, rubber and cambric insulated cables, lead sheathed, armoured, taped and braided; special cables for ship lighting and colliery work; patent rubber cab tyre sheathed cables, and "Ancalite" cables for railway signalling work, etc.; insulating tapes and compound, and jointing accessories; also Callender-Kay poles and accessories for overhead transmission. On this stand there are also found specimens of outdoor type dividing boxes up to and in-

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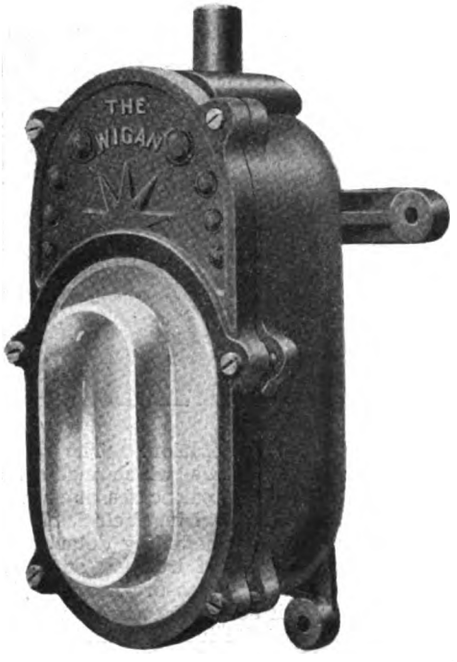
cluding 66 000 V, indoor dividing boxes up to 11 000 V, straight joint boxes to suit all voltages; transformer pillars showing standard c.s.w. l.t. fuse gear, high and low tension switch pillars, high and low tension network boxes, chill cast lead sleeves, various types of unit gear for pillars and sub-station switchboards, distribution boxes, cable hangers, and sealing ends up to 33 000 V. Demonstrations are given with the Callender-Wilson precision plumbing apparatus, for electrical and mechanical plumbing for fiery mines or for ordinary outdoor use. Callender's also exhibit the "Kalibond" system of wiring.



One of the industrial equipments shown by Heyes and Co., Ltd.

The Gutta Percha Co. (Wharf Road, London, N.1). The exhibits here are divided, broadly, into two classes, the first, magnetic alloys, and the second, electrical resistance alloys. Within the first group are the patented alloys, "Mumetal" and "Rhometal." These, it is claimed, possess high magnetic permeabilities in feeble magnetic fields. A third magnetic alloy exhibited is "Radiometal." This has been primarily developed for use in the cores of audio-frequency transformers. It is characterised by high incremental permeability and, we are informed, enables designers to produce audio-frequency transformers which will give a uniform amplification over the musical scale. The second group of alloys (nickel-chromium resistance) are sold under the registered name "Pyromic," Pyromic No. 1 being characterised by its strength at high temperatures, and its long life at temperatures of the order of 1 100° C. Pyromic No. 2 is a binary alloy consisting of 80% nickel and 20% chromium. This, it is claimed, is the purest nickel-chromium alloy on the market; the whole of these alloys are, we are informed, prepared in high frequency induction furnaces. Examples illustrating the uses of these metals are also shown.

Earle, Bourne and Co., Ltd. (Heath Street, Birmingham). This firm manufactures rolled metals and tubes in brass and copper, the exhibit comprising various examples of work of interest to both general and electrical engineering, including tubes incorporated in domestic water heating systems.

Rd. Johnson, Clapham and Morris, Ltd. (Newton Heath, Manchester). The exhibits staged by this firm include examples of bar and tinned copper conductors in rod, strip, and wire, and in cotton covered and braided rod, strip, laminated strip, and instrument wires in all standard sizes and finishes designed to meet the general requirements of every department of electrical construction and service.

The Record Electrical Co., Ltd. (Broadheath, Altrincham). Here is exhibited a complete range of ammeters, voltmeters, insulation testers, cut-in and cut-out switches for accumulators, and automatic circuit breakers for power circuits. Amongst the instruments worthy of note are the change-coil ammeter which can be used for testing various loads over a wide range without the use of current transformers. The line of circuit breakers manufactured by this company has been redesigned and many outstanding features have been incorporated.

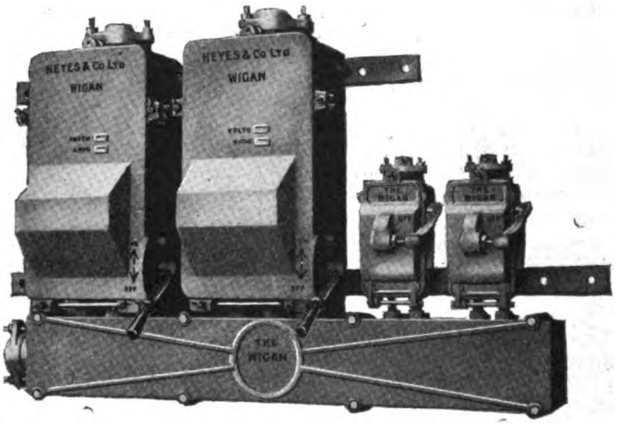
Blackstone and Co., Ltd. (Stamford). Outstanding exhibits of this firm include two-cylinder high speed engines of 1½ B.H.P. coupled to a dynamo, and new petrol-electric plants with outputs of 1 to 3½ kW suitable for supplying light and power for country houses, farms, estates, small workshops, shop lighting, etc. Other exhibits are "Spring Injection" heavy-fuel-oil engines, by means of which, so it is claimed, electricity can be produced at a cost of between ½d. and 1d. per unit, according to the size of the engine and the delivered price of fuel-oil. To small power users, the latest "Spring Injection" hopper-cooled engines are also of interest. These engines are self-contained small power units needing no foundations and operate on Diesel oil or paraffin. They are made in sizes of 5, 6½, 8, 10, and 13 B.H.P.

Burovox, Ltd. (Craven House, Kingsway, London, W.C.2). The exhibits shown by this firm comprise a wide range of inter-telephone systems for offices, factories, ships, the home, etc. Public address systems are also included.

Heyes and Co., Ltd. (Water-Heyes Electrical Works, Wigan). This company exhibits an extensive range of "Wigan" flameproof and industrial type specialities, including mine signalling equipment, lamp fittings, prismatic bulkhead fittings, telephones, flameproof and watertight air-break switchgear, bells, keys, pushes, and armour glands, etc. A modern type of luminous indicator for mines shaft signalling is shown in operation, together with suitable bells and keys.

Thor Lamps and Supplies, Ltd. (53–55, Tredegar Street, Cardiff) exhibit all their types of lamps, including standard colliers' lamps, both in the pillar and pillarless types. These latter are fitted with various forms of wellglass, including clear glass, opaque glass, tinted glass, and a special form of Holophane glass which is being developed. The cells fitted in the miners' lamps are of the non-spillable variety, filled with "Sollyte" jelly electrolyte, and they can be supplied with cases of flexible vulcanite, or of celluloid. There is also exhibited a charging stand of the usual type with special features, such as resistance cut-out, circuit breakers in place of fuses, and unbreakable trays. A patent magnet opener, which includes the provision of an automatic switch-on device, is also shown.

Ringsdorff Carbons (England), Ltd. (Colindale Avenue, Hendon, London, N.W.9). Carbon brushes for stationary motors and generators, rotary converters, turbo-generators, railway motors, and automobile starting motors and lighting generators are shown in all sizes, while carbon rings for steam turbines, carbon rods for electric welding, carbon plates and rods for electrolytic work, carbon contacts for circuit breakers, carbon discs for telephone equipment, etc., are also included. There is also an interesting exhibit consisting of a working model of various designs of brush holders demonstrating how one design permits the whole surface of the brush to be continuously in contact with the surface of the commutator, while other designs allow the brush to be in contact only at its edges.



Another exhibit to be seen on the stand of Heyes and Co., Ltd.

Dexine, Ltd. (Abbey Lane, Stratford, London, E.15). The stand of this firm includes various exhibits in rubber and ebonite. Among those of electrical interest may be mentioned wireless panels, insulating bushes and cylinders measuring 2 ft. long by 20 in. diameter, ⅛ in. thick. Among the claims made for these cylinders may be mentioned the following: specific gravity at 60° Fah., 1·2765; tensile strength per square inch at maximum load, 6765 lb.; electrical test: sheeting, ¼ in. stood 21 000 V twenty-five periods for six mins. without breaking down; insulation resistance: 3 000 megohms; water absorption after 48 hours very small i.e., 339 grm. weight before immersion, 339·23 grm. weight after immersion; insulation resistance after immersion, 3 000 megohms.

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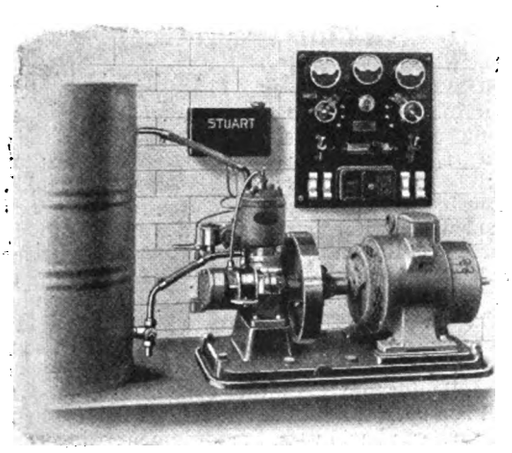
THE DIAMOND FIBRE CO., LTD. (75A, Queen Victoria Street, London, E.C.4), shows red, black and grey vulcanised fibre sheet, rods and tubes, machined parts, i.e., rings, washers, noiseless gears, bobbins, bushes, cleats, switch handles, etc., as used for various purposes in the electrical and mechanical industries.

DAVIES AND TIMMINS, LTD. (York Road, King's Cross, London, N.1). This exhibit includes metal thread screws, bolts, nuts, and terminals turned from the solid rod, examples of repetition work in all metals for electrical and general engineering.

BEATL SALES, LTD. (49, Wellington Street, London, W.C.2). On this stand is shown, in conjunction with the British Cyanides Co., Ltd., and The Beetle Products Co., Ltd., demonstration moulding plant, illustrating the production of finished mouldings from beetle moulding powders.

HOLDEN AND HUNT (Cox's Lane Works, Old Hill, Staffs). A representative range of electric resistance welding machines, including spot, butt, wire and chain welders, as well as an electric rivet heater and an electric heater for soldering irons are shown. All the machines are in operation, including a new and improved 12 kW spot welder and a 4 kW wire butt welder. A large size double-headed rivet heater incorporating several unique features is shown. The machine has an electrical capacity of 25 kW and is capable of heating 220 $\frac{3}{4}$ in. by 3 in. rivets per hour, the time for other sizes being in proportion. In addition to the No. 3 and No. 4 size spot welders, Messrs. Holden and Hunt exhibit their No. 2 size, which has an electrical capacity of 8 kW, and is capable of welding iron and mild steel up to $\frac{1}{8}$ in. added thickness on repetition work or $\frac{5}{16}$ in. added thickness occasionally. An example of a hand-operated butt welding machine, intended primarily for heavy jobbing work and capable of welding up to one square inch section, is another feature. This is rated at 30 kW, and is designed for undertaking a wide variety of work, with accuracy of alignment under the heavy "upsetting" pressure required. The machine is water cooled throughout, and the "upsetting" pressure is applied by means of a powerful eccentric cam, designed to give the pressure in a direct line with the required "upset" and to prevent any twisting or unbalanced force from acting on the slide. The



A ½ kW lighting set by Turner Stuart, Ltd.

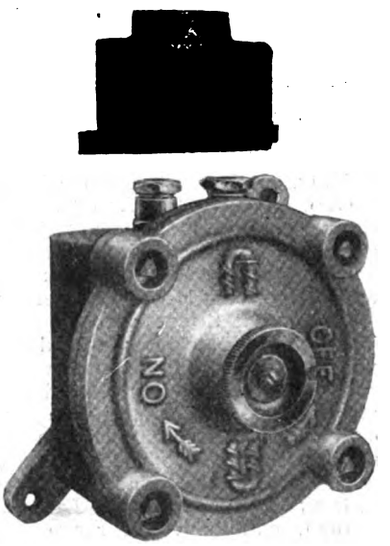
switch is foot-operated and the heating speed controlled by means of a three-way regulator. Besides the No. 2 size of wire welder an interesting bench type is on view. The machine has an aluminium body and as it weighs only 30 lb., it can easily be carried about. The electrical capacity is $\frac{1}{2}$ kW, and it will weld up to $\frac{1}{8}$ in. diameter steel, $\frac{1}{16}$ in. diameter brass, and $\frac{1}{32}$ in. diameter copper.

F. GILMAN (B.S.T.), LTD. (Skatoskalo Works, Regent Street, Smethwick). This firm, the sole manufacturers of "Skatoskalo" tools, exhibits various mechanical devices for carrying out every type of tube and surface scaling work. Standard machines of various types, including electrical and pneumatic tools, are also shown on this stand, the electrical tools being in operation.

THE MIDLAND FAN CO., LTD. (212, Acton Road, Birmingham), displays all kinds of spraying equipment for the application of paints, enamels, varnishes, lacquers and all types of cellulose enamels and polishes for wood or metal. The exhibit includes a working demonstration plant complete with air compressor, air receiving tank, exhaust fan, air filter, various types of spraying pistols, gravity feed and pressure feed paint containers, etc.

THE LIVERPOOL ELECTRIC CABLE CO., LTD. (Linacre Lane, Bootle). This firm, in conjunction with the London Electric Wire and Smiths, Ltd., exhibits paper insulated mains cables, of which a full range of samples of various types for the transmission of electric power up to and including 11 000 V working pressure, are shown, together with representative types of pure and V.I.R. insulated wires, cables, and flexible cords, and the well-known specialities of the company, "Lecite" V.I.R. insulated cables, and the patented 'Lecite" wiring system which, it is claimed, has been evolved in order to meet the demand for a system which will prove universal in its application.

HOLLINGS AND GUEST, LTD. (Thimble Mill Lane, Birmingham). This stand is mainly devoted to hydraulic machinery, the most interesting from an electrical point of view being a vertical four column press with steam heated platens specially designed for the manufacture of insulating materials for the electrical industry. This press is fitted with two hot plates, made of cast-iron, in which the steam heating coil is cast solid in the plate, making it practically impossible for a fracture to occur at any steam pressure which may be reached. The hot plates in this press are 15 in. square, machined on both faces, and polished on their working surfaces. The top hot plate is firmly fixed to the press head, and the bottom hot plate is attached to the press table. The cylinder of the press is of cast iron, bored and faced for the columns, machined to receive the ram, and fitted with hydraulic packing. The ram is of mild steel machined and polished on its working surface, and spigotted into the table. The four columns are of mild steel, machined all over, screwed and fitted with steel nuts. A number of electrically-driven pumps are also shown, together with examples of "Ellmar" insulating mouldings.



A 5 A flame-proof switch by the General Electric Co., Ltd.

GENT AND CO., LTD. (Faraday Works, Leicester). On this stand are displayed improved mining bells and relays, suitable for working in parallel on bare wire signalling, also improved tapper keys, mining pushes, heavy-duty power pushes, telephones, all incombustible and flame-proof. A new "Tangent" high and low liquid level alarm with diversion relay suitable for a.c. or d.c. circuits, is shown, together with motor syrens a.c. and d.c. in sizes ranging from 1/10th to 4 H.P., a new electric motor bell operated by a 1/10th H.P. motor, while an interesting display is made of "Pul-synetic" electric clocks.

SILVERTOWN LUBRICANTS, LTD. (Minoco Wharf, West Silvertown, London, E.16). This firm has a comprehensive display of electrical oils, such as cable impregnating oil, insulating oil for ironclad switchgear, cable inlet and outlet boxes, etc., transformer oils, switch oils, electrical condenser oils, insulating oils, radio valve cooling oils, etc.

THE BROMFORD TUBE CO., LTD., (Eddington, Birmingham), who are manufacturers of hot rolled weldless steel tubes of every description, exhibit boiler tubes, steam mains, superheater tubes and elements, cable and telephone ducts, coils and manipulated tubing, etc. This firm also exhibit seamless steel standards for electric lighting, and have recently introduced new types with fluted columns.

LACY-HULBERT AND CO., LTD. (Boreas Works, Beddington, Surrey). On this stand are displayed samples of high speed compressors especially designed for direct-coupling to electric motors, petrol engines and other high speed prime movers. These machines are also exhibited as fixed and portable sets direct coupled to d.c. motors. The range of these machines includes sizes from 2½ cu. ft. to 80 cu. ft. of free air per min. for any pressure up to 150 lb. per square inch. Other exhibits include combined electric-driven compressors mounted on air receivers, a portable electric air blast for cleaning electrical machinery and similar purposes, also larger sets for the same purpose as used in generating stations, workshops, mills and shipyards.

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C. C. WAKEFIELD AND CO., LTD. (30/32, Cheapside, London, E.C.2), are exhibiting lubricants and cutting oils, together with lubricating appliances.

PETTERS, LTD. (Yeovil). As in the past, this firm has again made country house lighting plants an outstanding feature of their exhibit, the various sets including a 5 B.H.P. "S" type surface ignition oil engine direct coupled to a G.E.C. generator, a 1½ kW "Petter-Light" plant for use with storage batteries, and an "Alpha-Petter" switchboard fitted with a button for starting the engine similar to a car self-starter being shown. Another exhibit is the "Auto-Petter" lighting set which was described in our issue of December 28th last.

Welding Plant.

ALLEN-LIVERSIDGE, LTD. (Victoria Station House, London, S.W.1), exhibit a complete set of all types of welding equipment, including "Alda" electric arc welders, and "Pontelec" resistance welding machines, one for spot welding, one for butt, and one for seam.

GEO. BRAY AND CO., LTD. (Leeds). This firm is exhibiting a full range of the well-known "Chromalox" heating units and appliances, porcelain insulators and electrical refractories. With regard to the heating units these include automatic and non-automatic water heaters from 500 to 6 000 W.

FREDERICK SMITH AND CO. (Anaconda Works, Salford). The exhibits here include hard drawn H.C. copper trolley wire, hard drawn H.C. copper wire for all electrical purposes, soft copper wire and strip, hard copper strip, sectional copper strip, tinned soft copper wire and strip, bare hard drawn copper strand for transmission lines, copper plating wire, silicium bronze telephone wire, cadmium copper telephone wire, aluminium wire, and steel cored aluminium strand.

JOHN HARPER AND CO., LTD. (Albion Works, Willenhall, Staffs.), exhibit a full range of sand-blasted castings for electrical instruments, meters, radiators, switchgear, motors, resistances, etc. They also show heat-treated iron of special analysis to meet the need for magnet castings of high permeability, and since they are also licensees for the production of "No-mag" castings, interesting samples of these are also displayed.

BULL MOTORS, LTD. (Ipswich). An exhibit of particular interest is a special motor-driven high frequency alternator, typical of a number which have been supplied to the British Post Office and leading wireless telegraph companies. The alternator delivers a single-phase output of 2 kVA at 450 cycles. Another exhibit is a motor generator set consisting of a squirrel cage induction motor direct-coupled to a shunt wound generator. The set is shown in operation at full load and the generator supplies current at 500 V to a series wound motor direct-coupled to a tramway brake compressor. This series wound machine is of a type developed for this class of work and so constructed as to form one unit with the compressor.

CROSSLEY BROS., LTD. (Openshaw, Manchester). Here is shown a vertical 4-cylinder type heavy oil engine of new design coupled to a Crompton 72 kW, 440 V d.c. dynamo. The engine is totally enclosed, with all moving parts protected, and self-lubricated by oil supplies under a pressure system. Another new engine is a 2-cylinder horizontal type.

SPAULDINGS, LTD. (40, Gloucester Street, London, E.C.1). This firm exhibits a range of bakelite and fibre machined parts and bakelite mouldings.

Fuse Equipment.

THE CASTLE FUSE AND ENGINEERING CO., LTD. (Castle Works, 33, Chester Street, Liverpool). Among the many items to be seen here may be mentioned a 3-unit fuse equipment for 2-wire d.c. supply, made up of three standardised unit type boxes. The equipment consists of a switch box with sealing chambers for two sets of incoming mains at the bottom, metering equipment mounted on the top of the box, and inside, a 500 A d.p. change over switch on a 1 in. thick panel; two distribution boxes containing a number of "Triumph" power fuses in sizes from 60 to 350 A. These boxes are of gas tight construction, having lids with machined face and spring loaded hinges; they have removable panels on each side, so that any number of boxes may be coupled together side by side. The fuse assemblies are mounted on a new combined fuse bar and support bar, a simple form of interconnection is made between the bus bars in adjoining boxes. Other exhibits are balanced 3-wire and 2-wire service distribution boxes having four 60 A ways, switch and metering equipment, made up in a large and small standardised boxes, respectively; two new larger unit boxes with removable panels, for three-phase distribution or to house circuit breakers; a feeder pillar; fuse assemblies mounted on a new divided bus bar; ironclad fuse boards in double pole and triple pole types, in ratings from 15 to 100 A., and teak distribution boards in sizes from 5 to 30 A for lighting purposes.

THE GENERAL ELECTRIC CO., LTD. (Magnet House, Kingsway, London, W.C.2). On the industrial side the G.E.C. shows 8 and 30 kW electric furnaces, electric japanning ovens, electrical apparatus for the production of distilled water, electric water heaters, lighting fittings and supplies, Osram lamps and valves, bells and telephones, etc. The cable factories of the Pirelli-General Cable Works are represented by a large cable drum on which are mounted samples of the company's products. A large replica of an electro-magnet, made up of conduit and conduit accessories, is also shown. The Witton display includes an old Byng-Hawkins motor which has been in continuous use since 1898, and this forms the background of a display of eight new standard "Witton" motors, four of which are of the drip-proof squirrel cage type, while the remaining four are of the d.c. shunt wound protected type. The squirrel cage motors are intended for general industrial purposes, and comply with B.S.S. 168/1926. High torque starting characteristics are a feature of these motors, the sizes shown being 1, 7½, 12½ and 25 H.P., running at 1 400, 1 500, 1 000 and 750 r.p.m. at 400/440 V. respectively. Interesting features of the d.c. machines include the louvre covers over the commutator openings, and the impregnation of the windings so that the motors are capable of withstanding tropical conditions. The range of motors displayed is of 1, 5, 20 and 10 H.P., to run at speeds varying between 950 and 1 350 r.p.m. at 440 V. Some interesting examples of ironclad switchgear are shown, including dwarf circuit breakers for controlling small domestic appliances, cookers, testing and change circuits, etc.; counter e.m.f. starters for d.c. motors (push button or pilot switch control), and a 5 A flame-proof s.p. quick-make-and-break switch. A triple-pole 50 A quick-make-and-break switch with fuse known as the "D.B. Major" is also shown.

Lifting Magnets.

THE RAPID MAGNETTING MACHINE CO., LTD. (Magnet Works, Lombard Street, Birmingham). This year's exhibit includes a number of new equipments. Demonstrations are given with lifting magnets, separating machines, while the exhibits include a self-contained, portable motor blower; magnetic clutches; rotary separators, etc. Another exhibit is a high intensity electro-magnetic chute, interconnected and interlocked with switchgear in such a way that in the event of the current failing, not only does a collapsible bridge divert the iron adhering to the poles, but also the feed is automatically shut off, the switch is cut out, and a bell rings, giving the alarm. Such a chute is, we understand, being used in dealing with coal prior to being powdered for fuel, and is also used for extracting tramp iron from powders, granular material, semi-solids, liquids, etc. Another type of equipment recently developed is a special light electro-magnet for use in conjunction with pickle and acid vats, the equipment being used for the purpose of getting small pieces of iron or steel that have dropped from the hangers to the bottom of the vats.

DAVEY, PAXMAN AND CO., LTD. (Aldwych House, Aldwych, London, W.C.2). This exhibit includes various sizes of the "Paxman" all-steel, sectional boiler, an illustration of which is given on another page.

THE HACKBRIDGE ELECTRIC CONSTRUCTION CO., LTD. (Hersham, Walton-on-Thames)). Here are shown drawings and photographs of all types and sizes of transformers and sections of high voltage coils for voltages up to 132 kV. There is also a pole mounting type transformer complete with its associated switchgear, while transformers of the company's manufacture are to be seen operating under load, in the exhibition sub-station.

THE HEWITTIC ELECTRIC CO. (Walton-on-Thames, Surrey), shows a range of medical lamps for general and local treatment on direct and alternating current supplies; battery charging rectifiers, water sterilisers, and service lighting for photographic and cinema studio purposes. A 200 kV lighting and power mercury arc sub-station supplies the exhibition.

ACCLES AND POLLOCK, LTD. (Oldbury, Birmingham). Here are shown the possibilities of weldless steel tube drawing processes for general manufacturing purposes. Examples are

(Continued on page 224.)

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SEEN AT CASTLE BROMWICH.

(1) *A two-equipment metal-clad vertical plugging switchboard, for* 600 *A*, 11 000 *V, by the British Thomson-Houston Co., Ltd.*; (2) *A new electrically-driven compressor shown by Lacy Hulbert and Co., Ltd.*; (3) *An electric syren for factory and workshop use by Gent and Co., Ltd.*; (4) *Another new compressor by Lacy Hulbert and Co., Ltd.*; (5) *One of the new milli-voltmeters incorporating the "Resilia" construction, exhibited by the Foster Instrument Co., Ltd.*; (6) *A new plant seen on the stand of Davey, Paxman and Co., Ltd.*; *and* (7) *a unit type three-phase, double circuit distribution switchboard by A. Reyrolle and Co., Ltd. The units comprise a* 200 *A switch and fuse unit at the left-hand end to control the incoming supply: two pairs of* 60 *A switch-fuse distributing units and two pairs of* 100 *A switch-fuse distributing units.*

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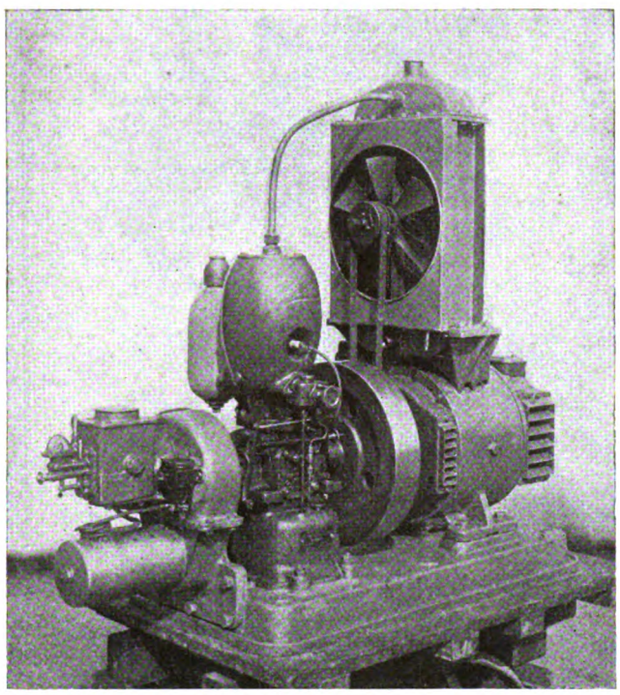
shown of special sections selected from over 700 different shapes.

REAVELL AND CO., LTD. (Ranelagh Works, Ipswich). Among a large variety of electrically driven compressors shown by this firm is a special sub-station set designed for cleaning electrical machinery and consisting of a small rotary compressor



The "Auto-Petter" lighting set exhibited by Petters, Ltd.

directly connected to an electric motor. The plant is in operation.

BIRKBYS, LTD. (Liversedge, Yorkshire) exhibit "Elo," a synthetic resin product, comprising mouldings, moulding powders, insulating varnish, and resin. This is claimed to be superior to ebonite, hard rubber, shellac compounds, bitumen, pitch, soft plastics, and many other products used for mouldings in numerous respects.

CLEAR HOOTERS, LTD. (79-81, Lombard Street, Birmingham). The chief exhibits of this firm are electric horns, syrens, and hooters. The accessories for these appliances are also shown.

BAKELITE, LTD. (68, Victoria Street, London, S.W.1). On this stand is exhibited a range of bakelite products of particular interest to the electrical world. These include moulding materials and examples of mouldings produced; bakelite sheet and bakelite silent gear material; bakelite impregnating varnish for insulation purposes.

W. AND T. AVERY, LTD. (Soho Foundry, Birmingham). On this stand is featured a wide range of industrial visible weighers, including those suitable for the electrical industry.

TANGYES, LTD. (Cornwall Works, Birmingham). The exhibits here include 144 B.H.P. heavy fuel oil engines, 19 H.P. fuel oil engines driving dynamos for lighting purposes, 6 H.P. fuel oil engines driving vertical treble ram pumps, "Tan-Gyro" centrifugal pumps of various sizes, six-stage turbine pumps, vertical treble ram pumps, vertical single ram pumps, horizontal duplex boiler feeders, and a collection of pulley blocks, lifting jacks, etc.

TURNER BROTHERS ASBESTOS CO., LTD. (Rochdale). This exhibit is devoted to asbestos products of special interest to the electrical and electro-chemical industries. Foremost among these are the ad ... well-known "Sindanyo" boards in their two forms: the insulating grade, designated "Ebony 'Sindanyo,'" and the arc-resisting grade, known as "Natural 'Sindanyo.'" The former of these is a non-hygroscopic electrical insulating board, possessing mechanical strength and other s ... properties. An interesting portion of this exhibit is a range of "Sindanyo" switchboards carrying typical gear, lent by electrical manufacturers.

CITY OF BIRMINGHAM ELECTRIC SUPPLY DEPT. (14, Dale Road, Birmingham). Here are seen demonstrations of soap manufacturing plant, consisting of electrically-driven mill, plodder, stamper, etc.; electric butt welding machines of 50 kVA capacity; electric spot welding machines of 10 kW capacity; 10 kW rivet heaters. Another exhibit is a range of electric furnaces of 23 kW, 11·9 kW, 7·9 kW and 4 kW capacity for hardening, tempering, enamelling, etc., while small electrically-driven portable tools, ultra-violet ray medical apparatus, and industrial lighting fittings and heating units are also shown.

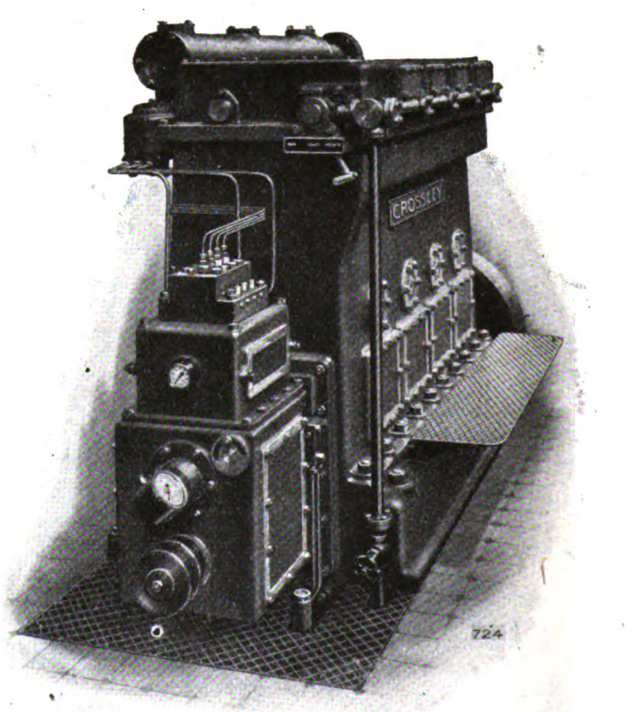
BROOK MOTORS, LTD. (Empress Works, Huddersfield). On this stand are seen a.c. motors in sizes from 1 H.P. to 50 H.P. of crane, pipe ventilated, totally enclosed and protected types. Interchangeable d.c. motors with the company's a.c. motors are shown, as are also special motors made for driving woodworking machinery, and motors built into woodworking machines to become part of the machine itself, whereby no belts or gears are required. Motors attached to pumps and fans are exhibited, as well as various types of switchgear and starters.

THE RAY ENGINEERING CO. (Waterdale Works, Southmead, Bristol). This exhibit, as last year, shows a complete range of "Ray" switchboards and switchgear. In addition, a new type of enclosed controller for electric lighting plants is shown. Resistance battery charging units, automatic cut-out switches, shunt regulators and instruments are included, together with a sample of the company's open type power switchboards.

W. AND C. PANTIN (147, Upper Thames Street, London, E.C.4). This exhibit includes an installation of overhead chain conveyors fitted at intervals with hangers and hooks on which various types of articles can be suspended.

THOMAS L. HALE (TIPTON), LTD. (Dudley Port, Tipton, Staffs). Here are shown examples of various castings as supplied to the electrical industry.

THE CROSTHWAITE ENGINEERING AND FURNACE CO., LTD. (York Street, Leeds) are showing improved type of patent mechanical stokers and self-cleaning furnaces which, it is claimed, give complete combustion of the fuel, elimination of smoke wthout the need for admitting excess air, and easy and simple working. The self-cleaning furnaces are designed for the economical burning of "slurry" and other waste fuels.



A vertical 4-cylinder type heavy oil engine of new design by Crossley Bros., Ltd.

MESSRS. BERTRAM THOMAS (Worsley Street, Hulme, Manchester) exhibit the "Tiltrack" method of keeping stores for spare parts. The virtues of which will be gathered from the illustration on another page.

THE CHLORIDE ELECTRICAL STORAGE CO., LTD. (Clifton Junction, near Manchester) shows, in addition to small capacity batteries, higher capacity batteries for inspection and types for marine wireless installations and lifeboat sets, together with others designed for emergency lighting and

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gyro compass operation on board ships. "Exide-Ironclad" batteries for traction purposes are included, together with cut-away sections showing details of the exclusive slotted tube construction of these cells. This type of cell has been specially designed for use on locomotives, trucks, vehicles, and all forms of transport using battery power. Specimens of the "Lux" battery, specially designed for train lighting, together with special cells for miners' hand lamps and portable batteries, are also among the exhibits.

THE ELECTRICAL POWER ENGINEERING CO. (BIRMINGHAM), LTD. (Ward End, Birmingham). Here are shown, in addition to a standard range of d.c. motors from $\frac{1}{8}$ H.P. to 100 H.P., an epicyclic geared motor and motor-driven air compressor, polishing and buffing motors, electric dynamos, etc. A special feature this year is a new range of fractional horse-power interchangeable a.c. and d.c. motors specially designed for driving domestic machinery. The "Warwick" lighting plant is again exhibited and this year a special model cut completely in two is on show.

RANSOMES, SIMS AND JEFFERIES, LTD. (Orwell Works, Ipswich). Besides domestic exhibits this firm is showing squirrel cage motors, motor induction machines, drip proof shunt wound motors, and shunt wound machines.

THE STURTEVANT ENGINEERING CO., LTD. (147, Queen Victoria Street, London, E.C.4). Various electrically-driven vacuum cleaners for industrial purposes are shown here, including models for cinemas, theatres, etc. These are made in a variety of types and have been installed in many of the latest theatres in the country. The equipment permits of various points being installed in the building, a common plant creating the vacuum.

THE REVO ELECTRIC CO., LTD. (Britannia Works, Tividale, Tipton). The domestic exhibits of this firm were dealt with in our last issue and, in addition, street lighting fittings, inverted switch and fuse gear for industrial applications are other prominent exhibits.

THE BRITISH THOMSON-HOUSTON CO., LTD. (Rugby). A considerable number of the exhibits are in operation here, including electric motors and control gear for industrial use, and in addition to a.c. and d.c. motors of the more standard types in fractional H.P. and higher ratings, the British Thomson Houston Co. shows single-phase reversing motors of the repulsion-induction type; vertical spindle motors; "built in" motors for the direct drive of machine tool cutters; motor-generators; "Fabroil" silent pinions, etc. The single-phase repulsion-induction motors are designed to start up as repulsion motors, and when up to speed to run as induction motors, there being an external or primary winding on the rotor which gives a high starting torque, and an internal or squirrel cage winding, which allows only a very small speed variation from "no-load" to "full-load," no centrifugal mechanism brush-raising gear, etc., being required. Suitable equipments for the control of a.c. and d.c. reversing and non-reversing motors of various sizes are shown, while included in these exhibits is the new thermal type oil-immersed circuit breaker and a.c. motor starter, which has been designed primarily for the direct starting of squirrel cage motors taking up to 100 A starting current on voltages up to 660. One of the exhibits made for the first time is the new metal-clad vertical plugging switchgear, known as Class Z. It is claimed that this switchgear is suitable for service under the most adverse climatic and other conditions, and its introduction makes the metal-clad construction commercially applicable for small as well as large circuits. The busbars are completely shut off from other chambers, but they can conveniently be rendered accessible. An automatically-operated shutter closes the contact socket holes when the breaker is withdrawn, and guide holes are provided for accommodating locating spears carried by the oil circuit breaker. The contacts are of a special self-aligning type, and the current transformers are housed in the circuit breaker top casing. Contact is made with the circuit connections below, through the medium of spring pins carried on porcelain insulators in the bottom of the transformer tank.

A 132 kV transformer terminal by The Micanite and Insulators Co., Ltd.

A. REYROLLE AND CO., LTD. (Hebburn-on-Tyne), are showing examples of their unit-type distribution gear designed for currents of from 30 to 350 A at pressures up to 660 V, which can be assembled to include switches or fuses or combined switches and fuses as may be required. It lends itself to easy extension, and should one wall become full, an extension can be carried on along the next wall at right angles, a right angle coupler being inserted to make the necessary connection. If automatic features have to be provided for the protection either of the incoming feeders or of one or more of the outgoing circuits, standard oil-break switchgear can be built into the complete arrangement in conjunction with the unit gear. A busbar chamber runs throughout the assembled switchboard. Dividing boxes are provided, as required, for the incoming cables feeding the busbars, and for the outgoing cables to the distribution circuits, and ammeters and voltmeters can be fitted. Metal-clad 60 A and 100 A switch type fuse boxes are also shown. These are used for a variety of purposes, both in domestic and in industrial service. The draw-out principle has been embodied in the design by mounting the fuse on the lid, and so providing a combined switch and fuse. When the lid of the box is open, the fuse and its terminals are dead. Messrs. Reyrolle are also showing an electrically-heated immersion-type water boiler. The sample shown is of 18 kW capacity, and is capable of raising steam in approximately 10 to 15 minutes. The steam pressure is 80 lb. per sq. inch, and the boiler evaporates 40 lb. of water per hour. The heating elements are built up of three 6 kW units, and the required selection is made by means of a standard Reyrolle earthed plug. Three sockets are provided, so arranged that either 1, 2, or 3 units are in circuit, giving 6, 12, or 18 kW respectively.

KELVIN, BOTTOMLEY AND BAIRD, LTD. (18, Cambridge Street, Glasgow). The K.B.B. fugitometer shown is the result of prolonged research by the British Association for the woollen and worsted industries. Samples for test are placed in closed swatch boxes arranged symmetrically around a special form of carbon arc lamp of intense actinic power A humidifying chamber and fan motor built into the apparatu

Two of the stands at the Birmingham Section of the British Industries Fair; that on the left is a picture of the display by Messrs. George Ellison, while on the right is part of the exhibit of Metro-Vick Supplies, Ltd.

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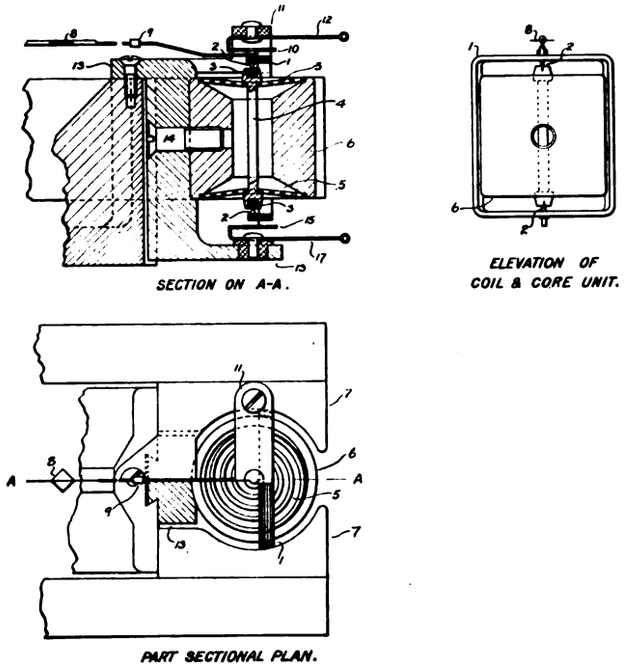
circulate a constant current of humidified air through the swatch boxes, and the latter are arranged for hinging down so that samples may be inspected during a test without disturbing or interrupting the humid air circulation. In addition to woollen, cotton and silk textiles, the fugitometer is also applicable for testing leathers, coloured papers, lithographic colours and printing inks, etc., and a simplified form



Diagrammatic sketch of the working of the "Resilia" movement in the instruments shown by the Foster Instrument Co., Ltd.

is made for testing the ageing of rubber, and rubberised fabrics, paints, varnishes, etc. The instrument can be operated off a.c. or d.c. supply mains, and is complete with double-pole main switch and cut outs. The fluorescence cabinets exhibited provide a new and rapid means of analysis for the analytical and industrial chemist, the physicist, biologist and inspection departments for examining materials in a beam of invisible ultra-violet radiation. The light source is a mercury vapour quartz lamp, the emission from which is filtered through a special glass screen so that invisible ultra-violet rays fall only upon the samples under test. By means of the characteristic fluorescences excited in the samples, defects and adulterations of all kinds are rendered visible to the eye. Other exhibits include shadowless operating lamps and quartz-mercury vapour lamps.

The Electric Furnace Co., Ltd. (17, Victoria Street, London, S.W.1) are exhibiting plant and photographs illustrating the various types of electric furnaces installed by them. The installations comprise furnaces of various types for melting and heat-treating all kinds of metals, their standard types of furnaces including the Héroult arc furnace for melting steel and nickel; the Ajax-Wyatt induction furnace for melting brass and nickel-silver; the Ajax-Northrup high frequency furnace for melting steel and non-ferrous alloys; resistance furnaces of the Efco, Efco-Doulton and Wild-Barfield types for heat treatment of steel and non-ferrous alloys, for core drying and enamelling; the Snead equipment for heat-treating tubes; furnaces for the manufacture of calcium carbide and ferro alloys; and amorphous and graphite electrode plants. Most of these furnaces are of such a large size that it is impossible to show them in operation in an exhibition, the working furnaces accordingly consist only of a small Ajax-Northrup high frequency furnace and an air heater. The body of a one ton Ajax-Northrup furnace is also shown, the furnace being identical with one now being erected in France. A metal liner, as used in the Efco process of formed linings, suitable for use in this furnace, is another feature. A number of electric furnace products are shown, which demonstrate the wide range of electric melting and heating. These include a fine exhibit by Doultons, Ltd., of pottery decorated in a 115 ft. double chamber Efco-Doulton kiln; samples of high speed steel made in an Ajax-Northrup furnace in Sheffield, and of small cobalt steel letters made in a similar furnace at Braintree; various articles made of "Silveroid" and other products of high frequency furnaces and samples of electrodes, ferro-alloys and various electrically treated materials.

Steatite and Porcelain Products, Ltd. (56, Victoria Street, London, S.W.1). This exhibit consists of four strings of standard insulators suspended from a tower erected by Braithwaite and Co. (Engineers), Ltd. The tower is one similar to that adopted by the Central Electricity Board. The special feature of the exhibit is to show that the insulator pins, though fixed by purely mechanical means, have an extremely high mechanical strength. The illustration of these facts takes the form of two full-size railway trucks, 19 ft. overall, weighing nearly 15 tons, hanging in the air on a single string of insulators. The carrying capacity of each insulator is 20 tons, thus offering a high margin of safety and security. The exhibitors point out that one of the difficulties of high tension transmission in the past has been the danger of interruption in the supply due to some failure on the line, caused perhaps by a heavy lightning stroke. The mechanically fixed spring ring insulator claims to protect the line from any such trouble, and is therefore of importance to power companies. A large works, with an area of over 5 acres, has been erected at Stourport in Worcestershire, for the production of these insulators, which have never previously been manufactured in the British Empire.

Ruston and Hornsby, Ltd. (Lincoln). The exhibits here include a back-acting trenching machine. This machine, which weighs about 14 tons, arrived, we understand, at Castle Bromwich sidings, dismounted unaided from the truck and proceeded under its own power to its position in the Fair buildings. The machine is a full circle half-cubic yard universal excavator, and is fitted with special equipment by which it can easily be converted for work as a shovel, dragline, excavator, back-acting trencher, skimmer scoop or a grabbing crane. Trenches can be dug to a depth of 10 feet. The machine is fitted with a petrol-paraffin engine and enables the excavating to be undertaken within a few minutes of starting. Where electric power is available the machine can be fitted for electric drive.

Davidson and Co, Ltd. (Belfast), are showing a complete range of "Sirocco" fans. Included in the range are fans for ventilation, dust removal, and for supplying high pressure blast to cupolas, furnaces, and forge fires. Those concerned with corrosive gases will be specially interested in the fan lined with ebonite, which protects the internal metal surfaces

The equipment with which demonstrations of plumbing are being given by Callender's Cable and Construction Co., Ltd.

from the action of such gases and consequently greatly increases the life of the fan. One of the practical and efficient methods of grit collection is exemplified by the Davidson patent flue dust collector, of which a working model is to be seen in operation. These collectors we understand, have been installed in over 100 power stations. A similar collector for dealing with industrial dust can also be seen at work. A fascinating exhibit on this firm's stand is the "Sirocco" aerostat, which is the source of much speculation on the part of the visitor as to how the rotating balls are maintained in position.

The Foster Instrument Co. (Letchworth). The exhibit here demonstrates how a special spring mounting for the moving system with moving coil measuring instruments, has eliminated one of the troubles due to damaged pivots

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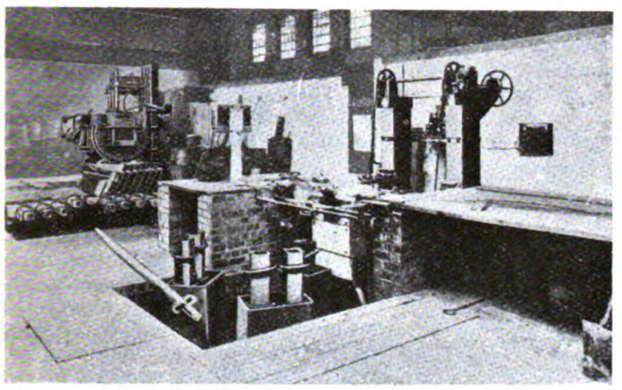
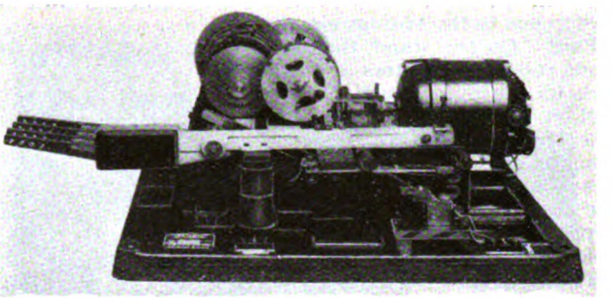
MORE OF THE EXHIBITS AT BIRMINGHAM.

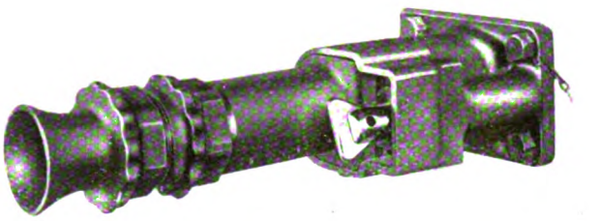


A 150 kW Ajax-Northrup electric furnace, together with a 10-cwt. Heroult machine, by the Electric Furnace Co., Ltd.



One of the exhibits of automatic equipment shown by Gent and Co., Ltd.

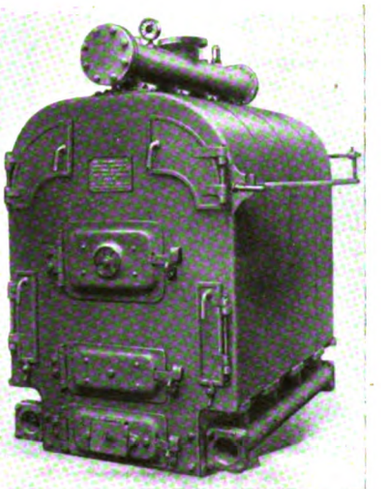
One of the electric syrens exhibited by Clear Hooters, Ltd.



A 100 A flame-proof, mining type, three pin and earthed plug and socket, made by A. Reyrolle and Co., Ltd., in accordance with B.S.S. 279/1927.

A 100 A metal-clad switch-type fuse box with bushes for the incoming and outgoing leads, by A. Reyrolle and Co., Ltd.

One of the "Tiltrack" units shown by Messrs. Bertram Thomas.



A sectional all-steel boiler to be seen on the stand of Davey, Paxman and Co., Ltd.

or jewels. While spring mounting in various forms is not novel, the particular way in which it has been developed in the construction known as the "Resilia" is specially interesting as it ensures that the pivot and jewel can never strike each other a blow under adverse conditions of service. In the illustration on page 226, this construction is indicated diagrammatically. A magnetic field is established between the pole pieces of the magnet 7 and the cylindrical iron core 6. The coil 1, carrying the current by means of which the measurement is made, swings in the space between 6 and 7, turning about an axis 4. The coil carries inturned pivots 2, having their bearings in the conical jewels 3. These jewels are mounted upon a staff 4, which itself is very light and which is held in position relatively to the core 6 by the light springs 5. Any jolt of the instrument, therefore, will move the whole system of coil, pivots, jewels and staff, and it is impossible for the pivots to strike a blow on the jewels. The current to be measured is led into the coil through the control spring 10, and the ligament 15; thereafter the circuit is carried by the frame 11 at the top and by the insulated arm 17 at the bottom. The zero is controlled by the arm 12. Attached rigidly to the coil is a light pointer 8. The coil 1 is mounted slightly eccentric to the axis 4 so that its weight balances the weight of the pointer 8, a final adjustment of balance being made by the position of the small sliding weight 9. This construction avoids the necessity of a counterweight tail and counterweight usually previously employed, and therefore enables the weight of the whole moving system be kept to a minimum, thus the controlling forces may be small and the pivot points very fine, and therefore the internal resistance of the instrument can be high without introducing objectionable mechanical delicacy or friction errors. The core 6 is held by the screw 14 to the rigid frame 13, which, in turn, is attached to the magnet and combines the whole moving system into a unit.

THE MICANITE AND INSULATOR CO., LTD. (Empire Works, Blackhorse Lane, London, E.17). Here is shown a comprehensive display of all classes of insulating materials, including mica, micanite, paxolin, bakelite, varnish-paper insulation, empire varnished cloths, tapes, silks, papers, leatheroid, etc, A feature of the exhibit is a complete range of indoor and outdoor condenser type terminals and bushings for transformer and switchgear, including a 132 kV terminal designed to meet the requirements of the Central Electricity Board.

GEORGE ELLISON (Perry Bar, Birmingham). There is

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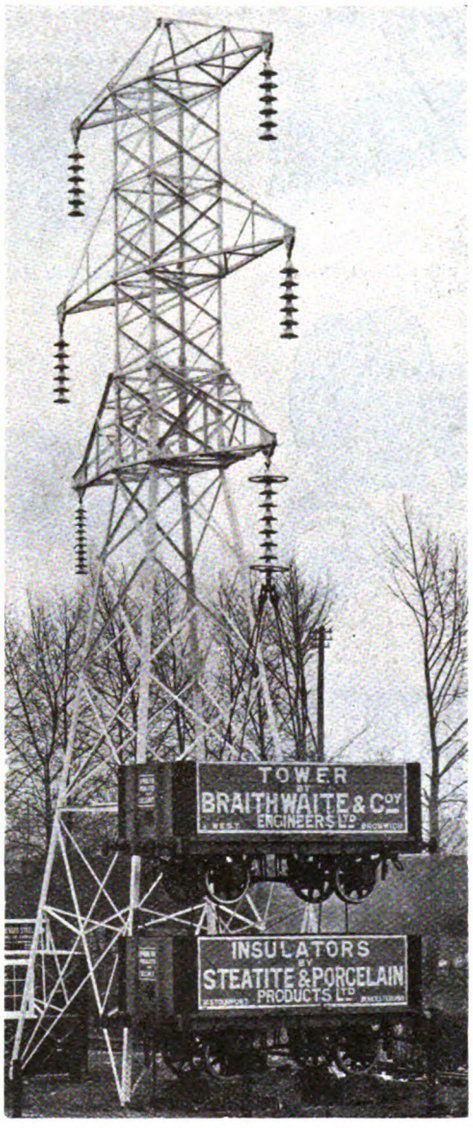
shown here a range of switchgear and accessories for the control of electrically-driven machinery for all industries, and switchgear for electricity supply sub-stations up to 11 000 V pressure. Ellison switchgear is also to be seen in the exhibition sub-station controlling the high-pressure supply from the Birmingham Corporation mains to the transformers and from the transformers to the various circuits of the Fair. On the stand, the exhibits include resistance starters and control panels for slip-ring induction motors; direct-on, star-delta and auto-transformer starters for squirrel-cage motors, automatic circuit breakers of various types; underground switchgear and cable couplings for mines; control equipment for cranes; and several examples of metal-clad distribution and main switchboards. A new design shown is an improved totally-enclosed circuit breaker for power circuits up to 660 V, having a higher than usual breaking capacity on short-circuits and accessory fittings which claim to simplify the work of installing and connecting up. A new type of switchboard consists of a group of small automatic circuit breakers mounted on a bus-bar enclosure to form a distribution point for branch circuits. This is an alternative to switch-fuse gear. The circuit breaker of the series for use at the coal face in mines is mounted on skids for portability. It is a welded steel cased unit, certified flame-proof, fitted with trailing cable plug connector and end coupling for the supply cable. The cable end coupling is a patented accessory which obviates the jointing of cables underground, as when the breaker is moved and another length of cable has to be laid, the new length of cable is readily connected up by bolting together the sealed end boxes, and connecting the cores by the links provided. Another exhibit of interest is a display of insulating material made in the company's factory for use in switchgear designs. This includes "Tufnol" in all kinds of shapes and a plastic compound, the material being a laminated synthetic resin material baked under pressure in moulds; it is claimed to be tough, and of high dielectric quality.



The spectacular exhibit of Steatite and Porcelain Products, Ltd., and Braithwaite and Co. (Engineers), Ltd.

NEGRETTI AND ZAMBRA (38, Holborn Viaduct, London, E.C.1). The exhibits here include indicating and recording pyrometers, thermo-couple type, for furnaces, stoves, annealing ovens, steam and flue gas temperatures, etc., suitable for temperatures up to 3 600° F.; mercury-in-steel dial and recording thermometers, distance type for temperatures of gas, liquids, etc., up to 1 000° F. Dial type draught and low reading pressure gauges, diaphragm type, for flues, ventilating ducts, forced draught, etc., sensitive to 1/100th of an inch water gauge; and electrical distance thermometers of the resistance pattern, multiple-point type, suitable for cold stores, refrigerating plants, etc.

THE STREETLY MANUFACTURING CO., LTD. (Ammunition Works, Aldrige Road, Streetly), is showing a variety of articles used in the electrical and other industries, moulded from bakelite and beetle powders. The exhibitors point out out that hitherto mouldings from synthetic resinous compounds have been largely limited to the darker shades, but the introduction of beetle powders has made possible their manufacture in all colours—plain or mottled.

CHESTERTON, JONES AND CO., LTD. (Alexandra Works, Walsall), display a comprehensive range of electric heating and cooking appliances, electric light fittings, and accessories. A range of "Davidson" reflector and bar-type fires is shown, the models varying from decorative designs to robust heaters suitable for the workshop. Another exhibit is a whistling kettle provided with a flat surface at the top so that a teapot or other utensil can be conveniently warmed while the kettle is being boiled. Other electrical apparatus is being shown, among which are plate warmers, table kettles, and a bath-water heater of the storage type with thermostatic control. The standard "Davidson" element is used in these tanks and this can be removed without the tank being emptied. These heaters are finished in white enamel. Tubular heaters for window and general warming are included in the exhibit as well as a variety of electric light fittings.

HADFIELDS, LTD. (East Hecla Works, Sheffield). The examples of heat-resisting steels exhibited demonstrate the wide variety of uses to which these special alloys have already been put industrially. They are remarkable for their strength at temperatures up to 900° C, and are adapted for work involving high temperatures, and those subjected to the oxidising effect of highly heated and sulphurous gases. For the retaining rings of the armatures of turbo-electric generators, a special material of high tenacity is called for. Further, it must be non-magnetic, otherwise there would be a diversion of the magnetic field through the rings, away from its proper path across the inter-polar space and through the windings. To this requirement must be added machinability. In the new "Resista H.Y." steel, Messrs. Hadfields claim to have provided a material which combines in itself each of these requirements. A specimen retaining ring, machined from this steel, is exhibited, while other specimens illustrate its tenacity and machinability, including turning, planing and shaping, drilling, slotting, and screw cutting. Under the tensile test, a yield point of 35 to 40 tons per square inch is obtained, the tenacity of the material being about 50 tons per square inch with an elongation of 30 to 35 %. At the same time, the material is non-magnetic, its specific magnetism not exceeding 0·1 % pure iron being reckoned as 100. While non-magnetic steels are no longer a novelty, in the past, such metal has been associated with extreme difficulty in machining.

W. CANNING AND CO., LTD. (133/137, Great Hampton Street Birmingham) are showing an extensive range of articles of special interest in regard to their equipment for electro-plating. There is also a range of low voltage electric-plating generators.

HAILWOOD AND ACKROYD, LTD. (Beacon Works, Morley, near Leeds). The chief exhibits on this stand are electric fittings of every description, including a number of novel designs in "Hailglass Ware" units for lighting large buildings, shops, etc. Bowls and ceiling fittings and galleries are also shown.

CABLE MAKERS' ASSOCIATION (Sardinia House, Sardinia Street, London, W.C.2). This exhibit, which is a joint exhibit prepared by the members of the Cable Makers' Association whose names are set out below, is intended to be generally representative of the various types of cables used in electric light and power installation. These include rubber insulated cables with various metallic and non-metallic protective covering, in single core, concentric and multicore types. Special system of wiring for houses, both in conduit and protected surface wiring systems, are shown. Types of telephone cables for underground work are also exhibited. Heavier cables for street mains, factories and power transmission in various types, insulated with paper and bitumen, armoured and unarmoured, are shown, while super tension cables for distribution at the highest pressures are also a feature of the exhibit. These types of cables are made by the members of the Cable Makers' Association, whose names

(*Continued on page* 230.)

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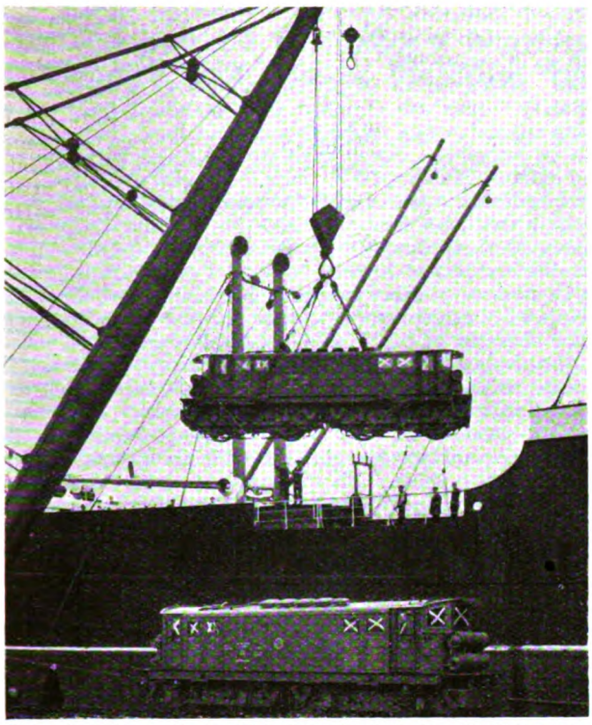
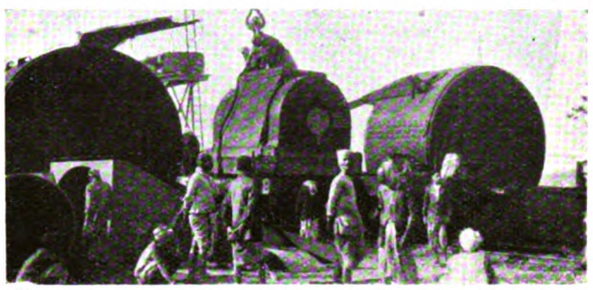
MORE ELECTRICAL EXPORT PICTURES.



Shipping two of six English Electric locomotives for service on the Christchurch-Lyttelton line of the New Zealand Government Railways.



Two views showing natives at Calcutta handling a large Parsons stator on its way to the Garden Reach power station.

The rotor and stator of a B.T.H. 20 000 kW turbo-alternator for the Japanese Government Railways.

A consignment of large transformers leaving the works of the Metropolitan-Vickers Electrical Co., Ltd., at Trafford Park, for shipment to Shanghai.

An electric passenger locomotive for the G.I.P. Railway being loaded at Manchester Docks for India.

This shipment of Callender Cables for use in China is seen on the wharf at Shanghai.

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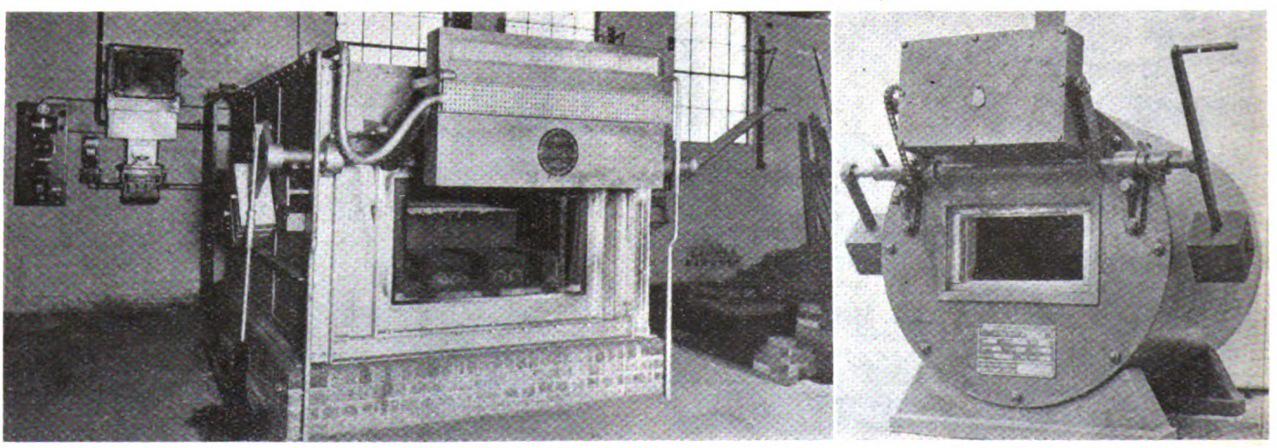
are :—The Anchor Cable Co., Ltd., British Insulated Cables, Ltd., Callender's Cable and Construction Co., Ltd., the Craigpark Electric Cable Co., Ltd., the Enfield Cable Works, Ltd., the Greengate and Irwell Rubber Co., Ltd., W. T. Glover and Co., Ltd., W. T. Henley's Telegraph Works Co., Ltd., the India Rubber, Gutta Percha and Telegraph Works Co., Ltd., Johnson and Phillips, Ltd., Liverpool Electric Cable Co., Ltd., the London Electric Wire Co. and Smith's, Ltd., the Macintosh Cable Co., Ltd., the Pirelli-General Cable Works, Ltd., Siemens Bros. and Co., Ltd., the St. Helens Cable and Rubber Co., Ltd., the Union Cable Co., Ltd., and Standard Telephones and Cables, Ltd.

A modern type of bracket shown by Metro-Vick Supplies, Ltd., using "Gilbert Riley" glassware. Other Metro-Vick fittings are illustrated on page 245.

Berkeley and Young, Ltd. (Hay Mills, Birmingham). Here is shown a very comprehensive range of exhaust and ventilating fans. Every industrial type is shown with the exception of large blowers. Amongst the more recent productions exhibited is the "Ellipso" oscillating fan, which the makers claim to be the simplest control movement yet evolved. The elliptical traversing action of this fan is obtained by means of a single link which is connected to and rotates with a slow motion shaft. The link is anchored by a universal ball joint to a fulcrum fixed to the base. The reducing gear of 144 to 1 is contained in a simple gear box integral with the motor end cover and fitted with a clutch eliminating all chance of damage by anything fouling the guard. The reducing gears are exceptionally robust of hardened steel, polished and ground, worm wheels having straight cut teeth thereby reducing friction to a minimum. Amongst the several models of slow-speed ceiling fans exhibited, one of particular note is the model known as the "08" for direct current, which has a totally enclosed motor. This fan has been specially produced to comply with the exacting conditions of tropical service and Government requirements. The fan is automatically lubricated, costing little to run, it is of high volumetric efficiency, and combines the features of better-class fans together with low watt consumption and silent running. Another interesting exhibit is the "Ace" alternating current ceiling fan, the motor of which is of the enclosed induction type, fitted with ball bearings and so constructed to be grease tight; it is fitted with three and four 54 in. sweep blades, the watt consumption is 110 at 210 r.p.m., giving an air displacement of over 10 000 cu. ft. All "Bandy" fans are supplied in a standard finish of three coats enamel, white or black and gold lined, but any colour can be supplied. Speed regulators for use with the ceiling and exhaust fans both d.c. and a.c. are also exhibited. These are fitted with five to seven different speeds, and are supplied with or without fans. In addition to the range of fans Messrs. Berkeley and Young also manufacture the "Bandy" a.c. lift and crane motors, a model of which is displayed on their stand; other interesting exhibits are models of the "Giljay" battery charger, this having been designed for home charging of 6 and 12 V accumulators on d.c.

Birmingham Electric Furnaces, Ltd., (55, George Street Parade, Birmingham). One of the features of this exhibit is a full scale half section of a large "Birlec" furnace. The heating elements in this type of furnace consist of heavy section strip nickel chromium and an exceptionally long life is claimed for them. Photographs of some large installations are shown, including furnaces for annealing and general heat treatment of steel and non-ferrous metals (nickel, nickel silver, and other nickel alloys, brass copper, aluminium and its alloys, etc.), carburising, hardening, colour firing, etc. Two standard portable furnaces, out of a range extending from 8 to 40 kW are also included in this exhibit. A small machine designed to operate on single or two-phase, has a hearth 30 in. long by 16 in. wide, and is shown oil-hardening steel parts. A larger model C.P. 4 A having a maximum rating of 30 kW at 440 V, three-phase, has a hearth 36 in. long by 24 in. wide, and is shown carburising. The company's portable type of furnace consists of a welded steel cylinder lined with refractory and insulating material. The hearth however is flat, and is covered with nickel chromium plate. The heating elements, which consist of nickel chromium strip, are mounted in the roof, sides, and hearth, which together with the circular construction, give an even distribution of heat. "Sil-o-cel" insulation is employed, ranging from $4\frac{1}{2}$ in. to 9 in. thickness. The door is of the parallel motion type and is lined with refractory and insulation, the latter being covered with nickel chromium sheet; opening the door cuts off the current. Automatic temperature control is fitted to all models as standard, maintaining any desired temperature up to 1 000° C. Two of the exhibits are illustrated on this page.

The Wardle Engineering Co., Ltd. (Old Trafford, Manchester). This firm specialises in the design and manufacture of lighting equipment. The "one piece" reflectors shown incorporate an "easy wiring" cap and vibration proof porcelain lamp-holder and are worthy of special attention. The designs conform to the B.E.S.A. Specification and meet the Home Office recommendations. Bruce "one piece" copper lanterns, incorporating the dust-tight Holophane dome refractor with internal prisms, is another exhibit. Projectors for floodlighting, glass units for office, classroom, etc., "Prismat" bulkhead fittings, are also shown.



TWO of the exhibits of Birmingham Electric Furnaces, Ltd., showing on the left a box-type "Birlec" furnace arranged with mechanical charging for use in carburising work, and on the right a C.P. furnace for single or two-phase supply.

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THE ALL-ELECTRIC "VICEROY OF INDIA."*

Some General and Preliminary Notes on the Biggest Electric Ship yet Constructed in this Country, and One of the Most Important Electrical Constructional Enterprises of the Year.

By A. C. HARDY, B.Sc., A.M.I.Mar.E. (Author of "Motor Shipping," "Merchant Ship Types," etc.)

On board the "Viceroy of India," February 19th.

WE are, in this sophisticated age, accustomed to having different ships or different machinery layouts hailed as marking eras in marine propulsion or epochs in engineering but even now it is not without interest to claim that an all-electric British ship is something out of the ordinary—particularly when that ship is capable of running at some 19 knots and has a total developed S.H.P. of about 17 000 H.P. Those who are intimately connected with the electrical industry, and particularly with the marine side of it, and those who are interested in marine propulsion, may possibly like to recall that it is only within the last year or so that marine electricity has been regarded, in this country, with anything approaching seriousness.

The First Official Run.

It seems fairly safe to suggest, therefore, that the "Viceroy of India," whose demonstration run has to-day been attended by a more representative and important collection of people who really matter in shipbuilding and marine engineering circles than has gathered together for some time, does definitely mark an era in British marine propulsion. It definitely marks the placing of marine electricity upon an established basis.

The P. and O. Company, who are in the main responsible for the construction of the "Viceroy of India," make no extravagant claims of fuel economy, but they do at least claim comfort for passengers. They have decided, moreover, that the best way to generate electricity to supply their two main propelling motors is by turbo-generators. Here, again, in conjunction with the builders, Messrs. Alex Stephen and Sons, of Linthouse, Glasgow, and the British Thomson-Houston Co. (represented by Mr. W. J. Belsey) they have achieved the considerable success of a neat, compact engine room, with a wonderfully complete, replete, and accessible main switchboard control at "top" platform level.

Excluding for the moment the boiler equipment, the beauty of the turbo-alternator, from the marine point of view, is its extreme compactness. The Diesel engine and the Diesel engine generating set are necessarily a spreading affair. The turbine generator crams maximum power within minimum space. Modern boiler practice, too, with high steam pressures and super-heat, permits of reducing the overall space taken per, say, 1 000 H.P. generated to within a very reasonable space. On the "Viceroy of India" the main propelling machinery consists of two separate turbo-alternators, each with its own condensing plant and auxiliaries supplying current to two slow speed synchronous motors, each coupled direct to a propeller shaft. The whole of the electrical equipment has been manufactured by the British Thomson-Houston Co. of Rugby.

The two turbo-alternator sets are rated 9 000 kW maximum at 2 690 r.p.m., 2 720 V, 3 phase. The maximum speed rating is 6 536 kW at 3 110 r.p.m., 3 150 V. These supply current to the two synchronous propulsion motors, each of 8 500 S.H.P. at 109 r.p.m., 3 150 V, 3 phase. These motors, which are smooth running and almost noiseless, give the ship a loaded speed of about 19 knots. It is stated unofficially that she can make over 17 knots with one turbo-alternator running, and that she can, if occasion demands, easily exceed 20 knots.

A special control cubicle is arranged on the upper platform on a level with the turbo-alternators. At the forward end are the isolators and the switch, each being triple-pole, and operated by handwheels. The isolators enable each alternator to be electrically connected to its respective propeller motor, or either of the alternators to be connected to both propeller motors. One likes, from a shipping point of view, to imagine the possibilities of bridge control for a ship of this type, but it would seem that the complication at this present stage of development would be too much. The control cubicle is very compact, and communication with the navigating bridge is by means of Siemens' electric engine room telegraphs.

Actually for each propeller there are three controlling levers. These are provided for operating contactors and speed setting of the turbine governors. There is a direction lever; a field and speed controlling lever; and a dead slow speed lever. These are all mechanically interlocked to ensure correct operation. Thus, the direction lever can only be moved if the manœuvring lever is at "stop." The field lever is in its first half of travel when it operates the field contactors in the correct sequence for starting the motor. For the remaining half travel, control is on the turbine governor, the speed setting of which it varies between one fifth and full speed. A micrometer adjustment is also provided in this lever, and this permits fine speed settings. Because the same lever is used for both purposes, all manœuvring must take place with the governor setting at one fifth speed. This lever is interlocked with the slow speed lever so that the latter cannot be used for reducing speed below one fifth, unless the field and speed controlling lever is in its slowest speed position. Correspondingly, the dead slow speed lever must be at its maximum speed position, before speed can be increased with the field and speed controlling lever.

The following is the sequence which must be observed to start the propelling motors: Place the "slow speed" levers in the open position. Place the direction levers "ahead" or "astern" as required. Move the "field" levers to notch No. 1 and lift the side latch, watching the speedometer until the two pointers are opposite each other. Further, move the, "field" lever to notch No. 3. The motor should immediately pull into synchronism. As soon as the motor synchronises lift the side latch and pass on to the "run" position, which is notch No. 4. The speed may then be adjusted as required. Actually the work is much simpler than the description appears and the ship handles very well indeed.

Auxiliary Power Requirements.

Auxiliary electricity for heating, lighting, ventilating and cooking, it is interesting to note, is taken from a batch of auxiliary generators, and for this purpose, also at upper platform level, there are four small turbo-generators, each developing 500 kW. In addition, for standby purposes, when the ship is more or less shut down during a longish spell in port, there are two Diesel-generator sets on tank top level. Each is a 165 kW unit driven by a 4-cylinder air-less injection Petter engine, operating at 275 r.p.m. In addition, in view of my recent comment on the "Celtic" disaster, it was interesting to note a 2-cylinder Petter airless injection Diesel coupled to an emergency generator in a special compartment on the boat deck—on which deck also comfortable quarters for the engineer officers are located.

The main turbo-alternators, of course, always rotate in the same direction and with both in operation, the speed and direction of either propeller may be varied irrespective of the other. When one turbo-alternator is used for driving both propulsion motors, both motors operate at the same speed. Note, however, that at this speed they may actually rotate in the same or in opposite directions of rotation.

Steam for the turbines is supplied at 350 lb. per square inch pressure and 700 deg. F., total temperature by six special Yarrow water tube boilers situated in two separate stoke-holds. Four boilers are placed in the aft stoke-hold, and are of sufficient capacity to enable the forward stoke-hold to be entirely closed down when the ship is steaming at 16½ knots. This, with the possibility of being able to use one turbo-alternator only, gives to the ship almost the flexibility of a Diesel-electric layout. All the auxiliary machinery for the boilers and turbo-alternators is electrically driven. The main switchboard, supplied by the B.T.H. Co., is at the aft end of the engine room and within view of the starting platform.

Such is a brief idea of the layout and arrangement of this, the first large example of a British electric liner. The "Viceroy of India" makes her maiden sailing from London on March 28th for Bombay and Karachi, and unquestionably her future performance will be watched with great interest by the shipping world. Seldom has such a galaxy of marine engineering talent been gathered for a short period on one single ship. This may, of course, be mere curiosity. On the other hand, it may be the forerunner of further developments in marine electricity.

* These notes have been specially compiled for us by Mr. Hardy as a resumé of his impressions after attending the trials of this important ship.—ED.

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WATER POWER IN THE PUNJAB.

Possibility of Economic Development of 1 770 000 kW on Seven Rivers—Important Bearing of Schemes on Agriculture and other Industries.

By COLONEL AUBREY O'BRIEN, C.I.E., C.B.E.

ALREADY considerable progress has been made with the first instalment of hydro-electric power which can be produced to such a vast extent from the rivers of the Punjab. A small water plant has been established in the snow-fed valley of the Uhl, a tributary of the Beas, and with the 960 kW thus generated, a start has been made in the boring of a 9 ft.

The mountains above the River Uhl.

tunnel through the solid granite of a hill. Ultimately through this tunnel 2½ miles of waterway will be constructed, and the minimum supply of the Uhl will be dropped down 1 800 ft., and thus permit the development of 36 000 kW in the first instance. The Kangra Valley Railway, already opened for goods traffic, is primarily intended for the carriage of the heavy material for the power house and other works to be erected at Shanan, 100 miles from the present railhead of the broad gauge line.

Col. B. C. Battye, D.S.O., of the Royal Engineers, has been connected throughout with the hydro-electric schemes of the Punjab. At first, he was appointed to consider the possibilities of water power in connection with the Bhakra Dam Irrigation project. The Sutlej, just before it emerges from the Himalayas on to the plains, makes a very sharp bend, and the bend formed a good site for an impounding dam 400 ft. high. The suggestion was to make a short cut for the whole river through a tunnel under a hill 3 500 ft. high, and thereby to create water power. After elaborate calculations embodied in seven volumes, it was found possible to develop 80 000 kW without an impounding of water, with a possibility of increasing this to 240 000 kW if the lake was formed for irrigation purposes. However, a hitch arose in connection with the canal problems, and Major Aylward, D.S.O., M.C., was then

The headworks of the hydro-electric scheme at Shanan.

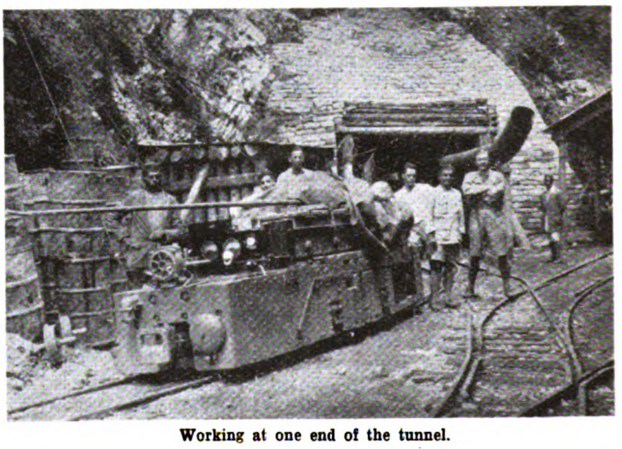
instructed to make a complete survey throughout that part of the Himalayas which touch the Punjab.

It was fortunate that the Bhakra scheme was not treated as a separate entity, for it was discovered that the resources of the Punjab were very large, and in particular, a site on the Uhl which is now being dealt with, was a better one than that on the Sutlej.

The power capable of economic development amounts to 1 770 000 kW on the seven rivers. The Indus and the Sutlej, which rise beyond the Great Himalayan range, have a much flatter slope than the others, and would give 210 000 and 80 000 kW respectively. Of the former the Swat tributary could supply a well placed 50 000 kW at the point where the irrigation canal emerges from the Malakand tunnel.

The Mid-Himalayan rivers, the Jhelum and the Chenab, will give 270 000 and 190 000 kW respectively, but the sites are mainly within the Indian States. Of the remainder, the Jumna which forms the boundary between the Punjab and the United Provinces is disappointing, with 50 000 kW, and the power of the Ravi with 190 000 kW lies mainly outside the Punjab proper.

The little Beas is, without doubt, the best river in the Punjab. With one exception all the sites are in British territory, and the gross yield is no less than 832 000 kW. The main river, fed by a large snowfield, tumbles down through alpine pastures and forests in gorges of remarkable depths and many waterfalls. The scenery of the Parbati and the Sainj tributaries is on a grander and even wilder scale than that of the Beas. The mountains rise steeply from the river beds, through narrow belts of cultivation and magnificent forests, to grassy alps and the regions of glaciers and eternal snow. The eastern line of the Mid-Himalayan range which forms the watershed rises in places to 21 000 ft. There are



Working at one end of the tunnel.

many other tributaries tearing down with a rapid slope, but for the present a start has been made on a programme which may one day reach prodigious proportions, at a site within the Mandi State on the snow-fed river, the Uhl.

By an agreement with the Rajah of Mandi it has been arranged to divert the Uhl from the height of 6 000 ft. underneath a high mountain by a 9 ft. tunnel, 2½ miles long, through solid granite, and to drop it in the first instance 1 800 ft. to the neighbourhood of Shanan, near the existing cartroad from Kangra towards Mandi. This stage is already under construction. A small water-power installation has already been set up, and with its aid tunnelling has started from either end. By means of the Kangra Valley Railway, which is now complete, heavy material will be carried to the site, of which some will be taken over the hill by an electrically worked cable way. Thus, it is expected that by April 1930 the first instalment of 36 000 kW will be available for public use. The cost of this will be 422 lakhs of rupees, or £3 165 000.

The next stage will be to construct a dam 260 ft. high, and thus to impound a lake in the valley of the Uhl. By this means it will be possible to increase the available power to 70 600 kW. After this the water will be taken through 3 miles of duct and dropped down a second fall of 1 200 ft., by which the total will reach 118 000 kW. The cost of the later stages will be less than the initial, and it is expected that £7 500 000 will cover the total, including the whole of the transmission system and distribution down to Delhi, and

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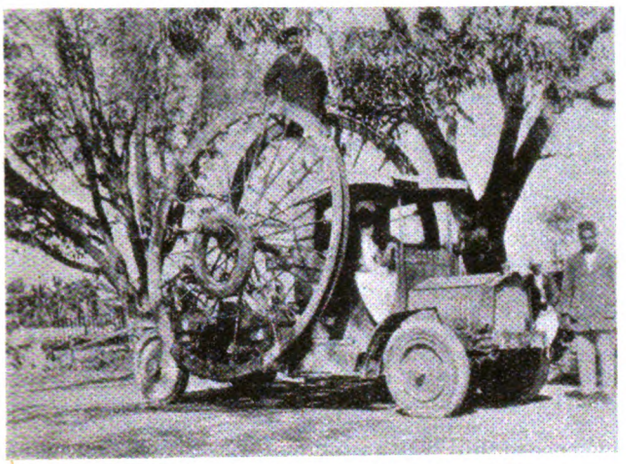
covering the whole of the Punjab between Wazirabad and Delhi. It is possible to use a third fall of 750 ft. and thus bring the total value of the Uhl to 145 000 kW, but the details of this have not yet been thoroughly worked out.

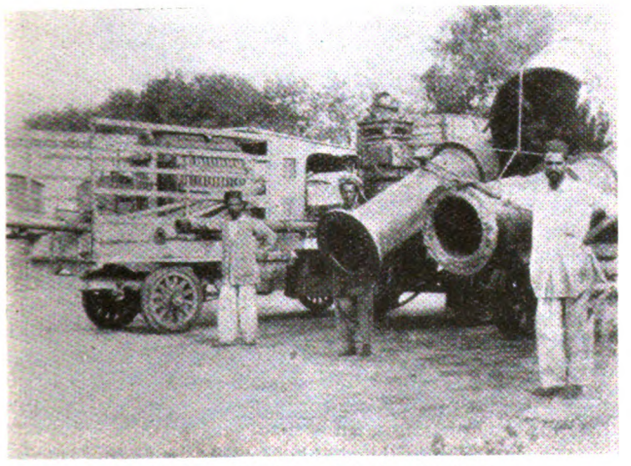
When this power is fully utilised, the Parbati and Sainj will be harnessed within the beautiful land of Kulu, to give 165 000 kW more, and finally the Beas itself will be taken in hand. The aim of the future is to have a system of electric



An awkward lorry load before completion of the railway.

power transmission line extending from India's capital at Delhi to Peshawar on the frontier. Negotiations have yet to be undertaken with the States within whose boundaries are several sites, but it is possible to create a continuous supply within British territory alone by the aid of a station on the canal fall near Rasul where the Lower Jhelum Canal takes off, by a site on the Haro river near Campbellpur, and by the use of the Swat canal near the Malakand. It has also to be noted that at present little use can be made of the latent power that exists at the numerous canal falls, because the channels do not run continuously. In the future it is hoped that all the best falls will be developed, and linked with the power from the Himalayas. In such a case when any one fall is not working, power will still be available from elsewhere, and the total additional supply from the canals will be substantial. It is hoped, of course, to obtain the whole 1 770 000 kW from the rivers in their upper reaches, but it is sufficient to say that something like a million kilowatts can be obtained for certain.

The Punjab problems, therefore, are not so much of adequate supply as of the creation of sufficient demand. For the purpose of calculation whether the scheme will pay, the engineers have only considered the needs of 20 towns of the Central Punjab for the first stage of the Uhl project, and those of 59 which, it is hoped, will use 118 000 kW in course of time. The majority of these towns are flourishing and have a knowledge of mechanics. They will of course make good use of the



Anothor awkward load handled by motor lorries.

power, which should be available at from ¾d. to ½d. per kWh. There will be a demand for existing and new factories, for light and fans, and for other urban needs. Speaking generally the towns can be relied upon to look after themselves.

The most important community in the Punjab, however, is that of the agriculturists, and since agriculture is by far the greatest industry for people dwelling on alluvial plains, the way in which electricity can be made subservient to agriculture requires most careful consideration. A Committee which discussed this subject in the Punjab, came to the conclusion that something like 80 000 kW might be used up in adding two and a half million acres to the irrigated area of the province at a cost which the cultivators could easily pay, especially if they devoted themselves to the more profitable crops.

The water for this purpose would be pumped electrically from tube wells, existing open wells with electrically-driven water lifts, and from open pumping stations drawing from canals, water-courses and seepage drains. In the latter connection electric pumping is likely to have most valuable action, for the vast increase of canals in the Punjab has had the result of creating various waterlogged areas. The lining of canals is expensive, and it is not always feasible to obtain the requisite outfalls for drainage; but once electric power is available, areas now lying waste and the sources of disease

The Uhl side of the tramway over the hill.

can be reclaimed, and additional water made available for irrigation elsewhere.

The yield from sugar cane in the Punjab averages 2 000 lb. of raw sugar per acre, as opposed to 8 000 in Java. It has been estimated that a considerable improvement might be obtained if, with the aid of the power available, and the gypsum that is abundant in the Salt Range ammonium sulphate can be manufactured at cheap rates. An increase of 20 per cent. more juice might also be extracted from the canes by means of more efficient crushers driven by electric power instead of by the aid of bullocks. However, the whole subject of the use of electricity on farms is so new to the Punjab that with the exception of the pumping, drainage, and fertiliser scheme referred to above, no definite plan has been thought out, and the future has been left to take care of itself. This is regrettable, because in other countries, from California to New Zealand, agriculturists have gained much from water power.

The problem is partly electrical, for it is a question of stepping down to small units on behalf of the villages without being involved into too great an expense. However, owing to the historical fact that villages are huddled together, because in the past they needed to do so for their own protection, the concentration of demand should be considerable.

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EXPORT OPENINGS.

Some Market Points for Exporters of British Electrical Equipment—Meters for Spain—Conditions in the Argentine.

AN examination of the import and export statistics of many of the overseas markets reveals a number of promising openings for British electrical goods.

Corea is a market about which little definite information exists, but the present activity in connection with the making of railways, roads, harbour works and hydro-electric schemes, immediately suggests a variety of openings. The hydro-electric schemes entail the purchase of consumers' apparatus in addition to the generating plant, and in the irrigation schemes there is a fair demand for small electrically-driven pumps. Normally, much of this work will go to Japan, but there still remains a fair proportion for other suppliers and of which Great Britain could secure a larger share. Corea's total imports of machinery in 1927 were valued at 9 420 000 yen, of which 1 155 000 yen came from foreign countries. Though the market is not a large one at the moment it is to be remembered that the figures are for machinery only and not for materials. Furthermore, the above figures of foreign imports show direct imports only.

The Philippine Islands is another small but expanding electrical market, the recorded imports of electrical machinery, apparatus and appliances having risen from £335 620 in 1925 to £501 410 in 1927. British goods form too small a proportion of this total, and German suppliers are steadily advancing.

Recent reports show that there is only one Spanish manufacturer of electricity meters. Approximately 45% of the meters sold are of Swiss manufacture, most of the remainder coming from Germany.

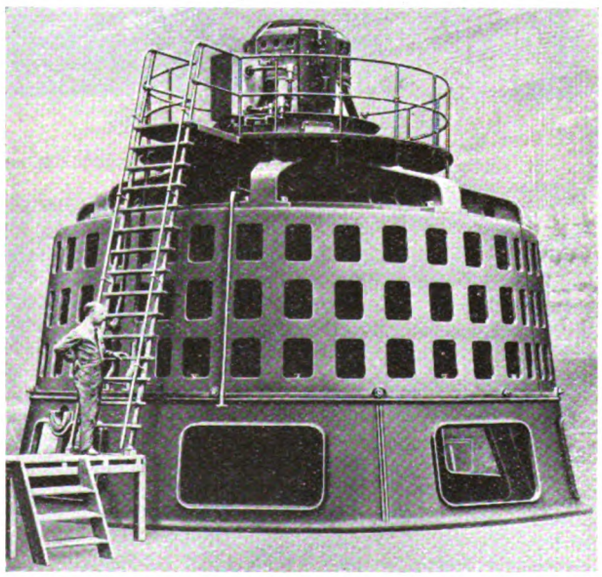
In his latest report to the Department of Overseas Trade on conditions in the Argentine Republic, Mr. H. O. Chalkley says British firms would be well advised to give special consideration to the reports of their Argentine connections on the changing situation and endeavour to frame a leading policy. American interests are particularly active, sometimes in association with German interests and at others in competition. The German electrical manufacturers have suffered from increased cost of production, and from the local prejudice that German plant and materials should be cheaper than others, so that their margin of profits has become small, and they are endeavouring to fix prices and sales conditions. Both they and the Americans, also the Italians, have plans for further local manufacture. Stronger competition from Italy, Holland, and even Denmark, is expected, and representatives of Swedish and Swiss finance and electrical industries have visited the Argentine to study conditions.

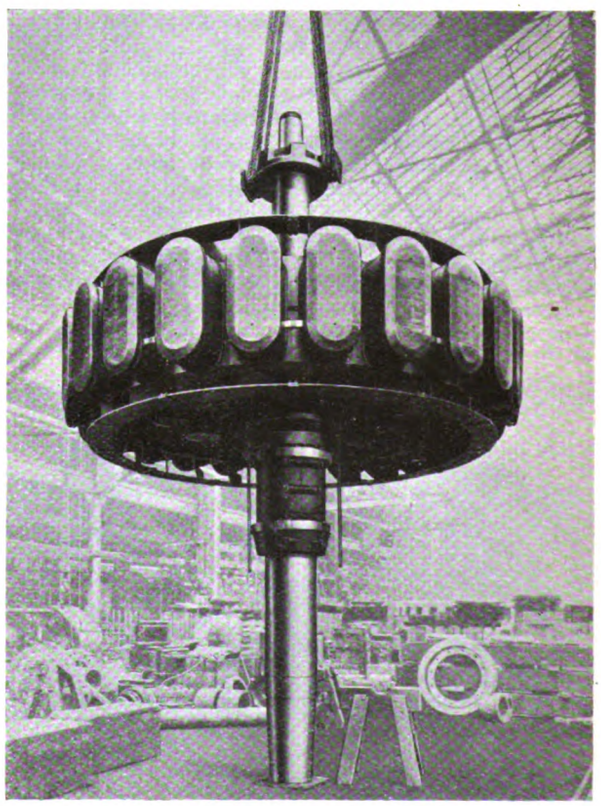
The sale of large generators, motors and transformers in any particular line is mostly in the hands of the nationality that controls the capital; for instance, the Germans and Italians, who own the largest power plants in and around Buenos Aires, naturally buy machines of German and Italian manufacture, and moreover impose their own standards for the installation of equipment to their lines. The railways are users of large generating machinery of British make. Any further electrification of the large British railways (and the Central Argentine company propose to convert from steam to electric traction their second suburban route) will make a big difference to British manufacturers of generators, transformers, h. and l.t. cables, switchboards, third rail, insulators, etc. The Germans and Americans so far usually outbid the British manufacturer on generating machinery in most of the smaller plants that are constructed throughout the country.

Latterly there has been an increase in the sale of British motors, but the competition in this line is very great.

There is a large and growing demand in the Argentine for insulated wires and cables of all kinds. The British manufacturers stand very high in the manufacture of cables for underground transmission, but the Germans seem to get the British specifications and undersell.

HYDRO-ELECTRIC PLANT FOR CHILE.





ONE interesting export field catered for by British electrical manufacturers lies in the supply of plant for hydro-electric schemes. On the left is seen one of three 13 330 kVA Metropolitan-Vickers vertical waterwheel alternators for the Maipo River power station of the Cia Hidro-Electrica Volcan, of Chile. Each machine is of 21 ft. 3 in. overall diameter, and weighs 128 tons. The rotor, seen to the right, is 21 ft. high and weighs, without the exciter, some 53 tons. The stator of each machine was built up in four sections, to facilitate transport, each section being shipped separately with its own part of the core assembled, and the winding in position, except for the coils bridging the joints.

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TELEPHONES IN CHINA AND JAPAN

Possibilities for Supply of British Equipment—Progress of the Automatic System—Local Conditions and Tendencies Analysed.

By WALTER BUCHLER.

THERE are about 100 towns in China with sizeable telephone installations, and many more with smaller systems. Of these the Chinese Government operates 30 installations, and the rest are managed by companies or private concerns. The largest, most efficient and up-to-date telephone system is that owned by the Shanghai Mutual Telephone Co., of Shanghai, which has the monopoly of all telephones in the foreign concession, whilst the suburbs and Chinese native city telephones, as well as trunk lines, are under the control of the Chinese Government Telegraphs Administration.

The Shanghai Mutual Telephone Co., which is a British concern, has now 21 254 lines and 27 217 instruments in use.

Automatic telephones are gradually being installed in China's principal trade centres. An automatic switchboard was recently installed at the central exchange in Shanghai; Harbin, Dairen, and Tsinan already have automatics, and Tientsin is also installing one for its foreign concessions; another has been planned for Mukden, an important city in Manchuria, at an estimated cost of £180 000.

Some of the telephone systems run by the Chinese Government are inefficiently run, and require new apparatus. Besides telephones, China has a fairly extensive and efficient telegraph service, most of the equipment having been imported. With the growing popularity of the telephone and telegraph in China, there is no doubt that the next few years should see a steady increase in the demand for construction materials and apparatus.

Imports of telegraph and telephone materials during recent years were as follow:—

From:	1923.	1924.	1925.	1926.
Great Britain	£50 300	£59 300	£33 000	£22 000
Japan	39 500	23 000	46 700	42 000
Germany	18 000	40 800	29 000	136 000
U.S.A.	11 200	14 200	13 250	11 210
Sweden	13 700	46 100	20 600	14 900
France	66	7 700	12 100	14 300
Denmark	820	1 060	4 000	1 350
Netherlands	1 100	800	370	934
Norway	—	200	670	940
Belgium	1 700	670	1 460	25 600
Canada	23 200	430	1 000	1 400
Hong-Kong (port of transhipment)	15 540	7 115	7 950	7 630
Total (including others)	£186 000	£206 000	£182 000	£316 000

The total imports for 1927 were valued at £304 000.

There is also a considerable demand for insulated wire and cables, of which China imported in 1927 quantities to the value of £186 300 and £102 800 respectively. Japan and Germany supply the cheaper and lower grades of materials, those coming from Japan being inferior; Great Britain, America, and other Western countries obtain most of the orders for the better quality equipment. Larger towns (as Shanghai, Tientsin, Dairen, Harbin, Hong-Kong, Canton, Hankow, etc.) generally prefer the best quality materials to those of lower grade, though cheaper goods. In the interior, where it is more a question of finance than of efficient service, more consideration is given to price than to quality.

Saleable Equipment.

As regards the type of instruments suitable for this market, wall telephones are mostly used in the Chinese cities, extensions and other conveniences being available for an extra charge. Briefly, every description of telephone material and equipment is saleable in China. Tenders are often given out in Shanghai and elsewhere by the larger telephone companies, and it is necessary either to be on the spot oneself or to be represented by a foreign firm already established in China.

The present disturbed state of China should not deter those interested in this market from entering it, as Chinese "wars" seldom cause any great disruption of trade, which follows its usual course. In fact, in several cities in the interior the telephone system is run by the local Military Governor, as it constitutes a good source of revenue. The various military factions are often good customers for telephone materials and other electrical equipment required either for increasing their private revenue or for their "military" movements.

The Japanese telephone service was first opened in 1890 between Tokyo and Yokohama, and ten years later was extended to all the principal cities (Osaka, Kobe, Nagoya, Kyoto, etc.). Innovations are extremely popular among the Japanese, who quickly take to anything new, especially if introduced from abroad. The telephone soon became in great demand, though the service rendered was not very good; applications for telephone installations exceeded the number of instruments available, and the waiting list grew longer and longer; it is said now to number over 200 000. The fixed charge for having a telephone installed varies from 10s. to £1 according to place, but such an ordinary application takes 10 to 15 years to fulfil. One can, however, get an "urgent" telephone installed, but the cost of this is extraordinarily high; in Tokyo the charge is £120, in Osaka £110, in Yokohama, Nagoya, Kyoto, and Kobe £95, and £33 to £70 in other towns. These figures represent "reduced" charges, and this reduction took place only a few months ago, the cost before the reduction varying from £100 to £200.

The "Telephone Problem."

At present, there are in Japan approximately 600 000 telephone subscribers, whilst her population numbers 65 millions. The limited number of telephones made available by the Department of Communications in the principal cities of Japan has given rise to the telephone broker, whose business is a very profitable one in Japan.

The possession of a telephone is in Japan a fairly valuable asset. For every call one has to pay 3 sen (just under ¾d.), and there is the yearly charge of £4. Even with the present limited number of telephones in use, the Japanese Government derives a good profit from this source, its net revenue from the telephone being approximately £2 500 000 a year. If the system were improved, the service made more efficient, and the cost of a telephone made more reasonable and within the reach of the majority of the Japanese population, this revenue could be increased to many times this figure.

The majority of the telephones installed in Japan's cities are of local manufacture, and the Government is not anxious to import foreign makes. The home-made equipment is by no means perfect, and, though it serves the purpose, it is inferior to that made in the West.

Japan is, in many respects, the most progressive country in the Far East, though this is not so in the case of her telephone system and equipment. China, with her telephone organisation built up with foreign aid, and with imported equipment, has the more efficient system. There is, nevertheless, no doubt that Japan will, sooner or later, have to bring her telephone system to the same standard as in the West; her gradual industrial development, the anxiety of the Japanese to appear as up-to-date as possible, and the exigencies of trade and cost of living will make a moderate-priced telephone necessary in every office in Japan, if not in every home. Telephone equipment will have to be imported, unless Japanese manufactures improve greatly.

At present, the Japanese Government hesitates to make too many telephones available for fear of causing a reduction in price, which would also cause a depreciation of the telephones held by subscribers who have bought them at the "normal" price of £100 to £200. The question of financing the wholesale introduction of telephones is another difficulty facing the Department of Communications, a strict policy of retrenchment having been adopted by the Japanese Government.

Manufacturers of telephone equipment here should invite representatives of Japan's Telephone Bureau (selected by the Government) to study the telephone system in this country; a return visit of inspection of Japan's telephone system on the part of representatives from this country, with a mutual exchange of opinions and advice (the latter would be rather one-sided) would probably lead to the adoption on Japan's part of a more enlightened policy at home, and at the same time bring orders to this country for telephone equipment on a large scale as well as for one or two telephone experts to see to the organisation.

In South Manchuria, Japan has a better telephone service, with more modern equipment, than in Japan proper. The automatic telephone exchange, which was recently completed by an English company in Dairen is the largest of its kind in the Far East. Japan is extending her long distance telephones along the South Manchurian Railway.

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A SOLUTION FOR TAPPING 132 kV LINES.

Investigation of Latest Practice Shows No Reason Why 5 000 kW Loads Should Not Be Tapped—Estimating Return on Capital Investment.

By WILLIAM T. TAYLOR, M.Inst., C.E., M.I.E.E.

IN the introductory note to a paper entitled "Electric Transmission of Power as Applied to Large Areas," which was presented by Mr. Archibald Page, at the Institution of Civil Engineers Engineering Conference, 1928, it was stated that ". . . . the cost of tapping the main lines (of the 132 kV grid) is still such that this will not be done for loads below 10 000 kW." In reply to this statement, Dr. S. Z. de Ferranti said: "Mr. Page reminds us that it is not worth while from a commercial point of view, and probably from a technical view, to tap the grid for less than 10 000 kW. . . . It is a very serious limitation."

An Investigation.

The writer has recently investigated the latest practice of 132 kV tapping, and herein gives briefly some idea of what is actually being done elsewhere for 132 kV sub-stations and lines exposed and operated under far worse climatic conditions than exist in this country; hence they should be relatively more robust and expensive and obviously require a greater load than 10 000 kW, assuming the above statement to be correct. It may be definitely stated that there is something wrong somewhere if a load of 10 000 kW is the *minimum* for a 132 kV tapping of a main line in a country like this, where practically all the materials, apparatus, and equipment are manufactured within a few miles or few hours' transport journey from the sites. Lines that traverse sun-scorched plains, continually battling excessive temperature ranges and high winds, where frozen fog often forms 2 ft. thick on towers and from 3 to 8 in. thick on the conductors, where continuity is just as important as any electric supply in this country, where the price of everything is either lower or no higher than the "grid" will offer, and where, from one electricity undertaking, over 25 000 farms are served, and, from another electricity undertaking some 300 cities and towns spread over 38 counties are served.

The tapping of a 132 000V line, or any line, depends on the amount of revenue that would be secured from the extension and installation as decided by the engineering, commercial, and operating items involved.

To arrive at that figure, or range of figures by close estimating, the engineer would compute the amount that would be required to be spent on the line (or lines) and station (or stations); he would also insert the operating expenses and figures, preferably giving a range of closest values for varying items; he would then deduct the return on the investment, this latter being the deciding factor as to what can be done when requiring to receive a reasonable return on the capital outlay.

First of all we desire to know the minimum kVA load, or the r.m.s. of average load in kW, to be tapped and paid for—the price per unit, etc., being understood. But this does not answer the whole problem. Four or more conditions are possible for any given length of extension and type of construction and design. That is to say: (*a*) when extending the line and completing the tapping entirely at cost of supply undertaking; (*b*) when doing so at part their cost, depending on the amount the consumer (or receiver) would pay; (*c*) when extending the line or part of the total installation only at supply undertaking's cost; and (*d*) when doing so at part their cost and part consumer's cost, depending on maximum amount consumer would pay. Also, the minimum kVA load for a given line voltage varies with the length of transmission extension.

Up to the present time, 100 kV to 200 kV lines are entirely used for the transmission of power between generating stations, and between generating stations and main terminal sub-stations at the larger and more important centres of distribution.

Ordinarily, such lines are not tapped to supply an industrial load unless, for (say) a 132 kV line, it is in the neighbourhood of 5 000 kW and is located in or close to rural territory. The question is rarely a matter of jeopardising the service "of the more important stations and towns" by having trouble in industrial sub-stations interfere with them—actually these should give no more trouble than the city sub-stations.

For a good and proper commercially-constructed 132 000 V line and system there is little or no reason why a 5 000 kW load should not be tapped. The writer has good reasons for saying practically every privately-operated 132 kV supply undertaking would willingly accept an extension of their 132 kV line for a load of 5 000 kW, *or less*; the 5 000 kW figure is but *one-half* of that load which has been referred to as the lowest possible for connection to the 132 kV national "grid" of this country. Independent of extension length, the minimum load depend on *a*, *b*, *c*, *d* given at end of article.

In some parts of the world engineers think this out in terms of population, saying they can afford to tap their main 132 kV lines for a city of not less than fifteen to twenty thousand people, but less than this when there is an extraordinary power load in connection therewith. The writer knows of one company operating 140 kV lines tapping for a population of 10 000 people. For this country and present conditions, it is doubtful whether *ten* times this figure will represent the maximum population for any 132 kV tapping.

As yet, such main transmission lines designed and operated at from 110 kV to 220 kV are not for individual consumers. Experience so far tells us that it is best to serve rural communities or consumers from some adjacent city or town supply, rather than to attempt to tap lines of this kind. The writer knows of at least one 120 000 V line tapping for 2 500 kW, also a 140 000 V line extension and sub-station built for, and supplying a *maximum* load of 5 000 kW; and the case of a 110 000 V line extended at part cost of power company and consumer for a load of 1 000 kW. Incidentally, going back 25 years, it may be noted that the writer has extended 66 000 V lines, and built and equipped sub-stations for loads less than 600 kW; and, past twenty years ago, the writer built and operated 60 000 V river *floating* sub-stations, each for a load less than 600 kW.

The materials, apparatus, and equipment for these 60 000 V floating sub-stations travelled nearly 8 000 miles by sea, nearly 2 000 miles by railway, then several days' transport journey by road beyond the nearest railway point.

Total costs for the construction of a 132 kV line extension are high and, it is necessary to secure a good amount of load in order to realise a reasonable return on the capital investment made.

Two Alternatives.

There are two alternatives, but they have somewhat interrelated solutions. As we consider best, we may base the proposition on the figures of kW load secured, or we may base it on the return received on the particular investment. We cannot go far wrong when we compute the amount of load that would have to be secured to earn a reasonable return on the amount of money invested. A reliable and simple method of estimating the return on the investment that may result from any extension and tap is given in the following forms:—*

METHOD FOR ASCERTAINING RETURN ON INVESTMENT FROM EXTENSION.

Municipality..... Town..... County.....

Physical Data: (1) Length of line..... Voltage.....
(2) Sub-station capacity..... Secondary Voltage.....
(3) Wayleave required.....
(4) Sub site required.....
(5) Give details of alternative construction .....
(6) Give details of commitments and obligations .....

(A) COMMERCIAL SURVEY BASED ON ESTIMATED ANNUAL BUSINESS.

	Within 1 year.			Within 5 years.		
	Consumers. (number of)	Sales. kWh.	Revenue	Consumers. (number of)	Sales. kWh.	Revenue.
Service Classification:						
Industrial power						
Commercial power						
Commercial lighting						
Street lighting						
Residential lighting						
Range and appliances						
TOTAL						

Generation with ..... % loss.
Sub-station demand ..... kW.

* Applicable to transmission or general distribution, such as distributing centres, of any voltage.

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(B) CAPITAL EXPENDITURE REQUIRED.

	Within 1 year.	Within 5 years.
	£ s. d.	£ s. d.
Purchase of.....		
" " ..... @ £/kVA		
Construction (material and labour):		
.....miles.....kV line .. .. @ £/mile		
.....miles.....kV line .. .. @ £/mile		
.....miles.....kV line .. .. @ £/mile		
.....kVA.....kV sub-station .. @ £/kVA		
.....kVA.....kV sub-station .. @ £/kVA		
.....kVA.....kV sub-station .. @ £/kVA		
.....miles.....V distribution .. @ £/mile		
.....miles.....V distribution .. @ £/mile		
Total, including % construction overhead.....		

(C) OPERATING EXPENSES.

	Annual Expenses.	
	Within 1 year.	Within 5 years.
	£ s. d.	£ s. d.
Production @ .....pence kWh generated ..		
Primary Distribution:		
.....miles.....kV line .. @ £/mile ..		
.....miles.....kV line .. @ £/mile ..		
.....miles.....kV line .. @ £/mile ..		
.....kVA.....kV sub-station @ £/kVA ..		
.....kVA.....kV sub-station @ £/kVA ..		
Secondary Distribution:		
.....Consumers @ .....per Consumer ..		
New business and capital expenditure at.....		
" per consumer		
General expenses @.....		
Tax and reserve @ .....% of capital expenditure		
Total operating expenses		
Operating ratio.....		
Net earnings.....		
Return on Capital Expenditure		

The above computation should be made as complete and as accurate as possible for every tapping. The amount of revenue from the line extension under (A) is best given by the commercial department of the supply undertaking. The money required for line and station as estimated under (B) is then given, and the operating department provides the operating expenses under (C). The return on the investment is then figured so that we have *the* required factor; hence, there is no assumption of guess work. The nearest possibility for assumption is in the character of the load, which involves the relation existing between average and maximum rate at which power is necessary to meet the demand—costs rising as the load factor decreases.

Although the 132 kV "grid" for this country is essentially for the "dump" and "transfer" of power to and from cities and towns it is no less essential that definite rules be framed for prospective new business, that computation of probable earnings, and the amount of investment which can be afforded. This also should apply to cases where the necessary investment is greater than can be afforded by the supply undertaking (the Central Electricity Board, for this country), so that, in place of ignoring or putting aside new business, the proposed consumer or consumers obtain a tapping provided they make up the deficiency.

In computing figures based on the return received from investment, and on kW of load secured, the writer believes the following figure to be conservative for earning a reasonable return on the amount of money invested for an "average" 132 kV tapping, *when*:—

(*a*) Extending the line only at part consumer's cost .. .. 2 000 kW

(*b*) Extending the line, building transformer house and placing the switchgear and transformers, at part consumer's cost .. .. .. 3 500 kW

(*c*) Extending the line only at supply undertaking's cost .. .. 3 500 kW

(*d*) Extending the line, building transformer house and placing the switchgear and transformer, all at supply undertaking's costs .. .. 6 500 kW

It is felt that there is no necessity to discuss the relative economy of Government constructed, owned, and operated *versus* company constructed, owned and operated utilities; the differences in every respect are apparent to all.

BIRD GUARDS.

Some Advantages of Fibre Tubes—Extensive Use on 11 000 and 30 000 V Lines.

(By A CORRESPONDENT.)

PROBABLY the simplest method of avoiding trouble, due to birds perching on the metal cross arms of medium pressure overhead lines where pin type insulators are in use, is to cover the arm with an insulating sleeve which is non-hygroscopic and not liable to deterioration by exposure to the weather. Porcelain and many moulded insulations comply with these requirements; but there are other factors which narrow the field of choice.

The material chosen should be (1) low in cost, (2) not fragile, (3) capable of being machined, not only to ensure a snug fit round the arm and pins, but also so as to provide a self-fitting grip on the cross-arm without tieing or anchoring.

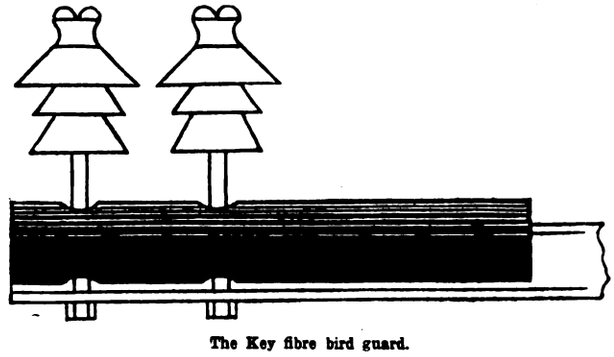
Porcelain, though reasonably inexpensive, is rather easily broken; it cannot be machined, and requires special methods of fixing and anchoring; this, of course, applies to most moulded insulations.

About eight years ago it occurred to a large power company in the North of England, who had for a long time been accustomed to use Key fibre conduit, supplied by the Key Engineering Co., Ltd., for underground cables, that these fibre tubes might very well be adapted for use on their lines where pin type insulators were used. A handsaw, brace and bit and a jack-knife can fashion quite a serviceable bird guard from one of these fibre tubes, and some were made as an experiment and put into commission.

From this beginning there has grown up an extensive demand for Key fibre bird guards, and to-day they are used on lines ranging principally from 11 000 to 33 000 V.

The illustration shows a very usual and simple form, used where single wooden poles with steel angle cross-arms are employed. The bird guard, with its accurately tooled slot, being of circular section, tends to close on and grip the cross-arm firmly. It is slipped on from the outer end and requires no tieing or anchoring.

In the supply of guards for even a comparatively short line, it is often necessary to have a dozen or so different shapes, and the manufacturers have literally hundreds of dimensioned prints to which they are working. This has quite an appreciable economic bearing, as it is obviously cheaper to cut out and shape a fibre tube than to make special mouldings. It also puts this little accessory in its proper place, as the bird guards can easily be made to suit the lay-out instead of designing the lay-out to suit the bird guards.



The Key fibre bird guard.

Many of the earlier transmission lines were erected without provision for bird guarding, and in order to rectify this, without interfering with the installation, short tubes, to cover the cross-arm up to the insulator only, have often been supplied. In this case the tubes cannot be slid on from one end, of course, but as there is a good deal of spring in the circular guard, it can be sprung over the angle iron from the front, the slot opening out sufficiently for the purpose.

One of the companies who contract for overhead transmission lines, when doing this, apply a blow lamp flame at the back of the tube opposite the slot. This temporarily softens the material slightly, but sufficiently to open out the slot, so as to pass the guard over the angle of the cross-arm without any effort. The material hardens again in a very short time, and the slot closes to make a grip.

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GAS ALARM APPARATUS.

Device for Preventing Street Explosions—Automatic Operation of the "Ringrose" Gas Sentinel.

APART from the serious danger to life, street explosions of the kind which paralysed one of London's main thoroughfares just before Christmas result in enormous financial loss, not only in the cost of reinstating the roadways and pavements and other damaged property, but also through loss of trade due to the prolonged closure of the affected district.

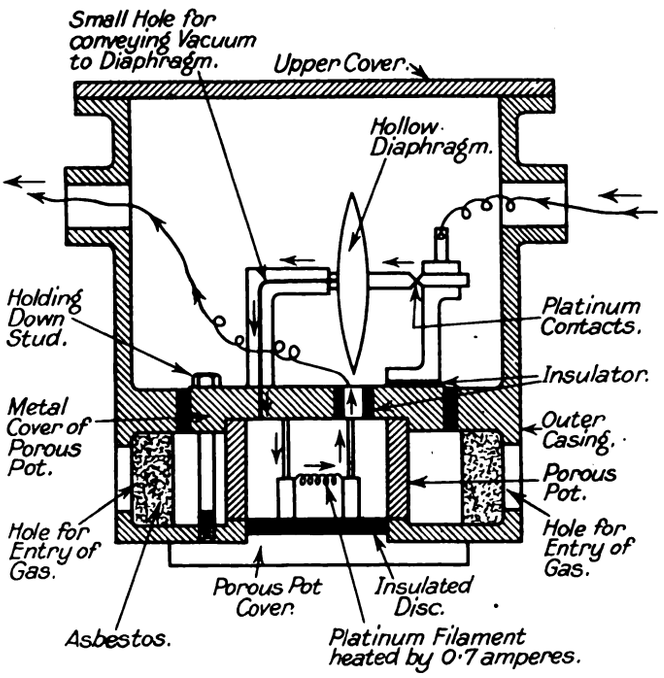
There is at present a distinct feeling of uneasiness at the prospect of further upheavals of this nature, and not without cause, for not only London, but many other cities, are literally honeycombed with networks of tunnels interconnected through manholes and shafts, all of which are potential pockets for the accumulation of explosive gases. Many of the gas mains are laid in areas subjected to the ever-increasing vibration of heavy traffic over roads which were never designed, and, having regard to the nature of the subsoil cannot be expected, to withstand it.

Natural cavities due to sinkage and silting must be added to the already enormous number of "pockets," and thus the danger of explosion from fractured gas mains grows daily. Punctures due to erosion are, of course, a further source of danger.

In spite of the gravity of the situation and the possibility of a repetition of the trouble at any moment, some of the authorities concerned have confessed themselves powerless to avert a future calamity.

Examination of the problem shows that there is only one sure way of preventing such explosions; and that is to detect the presence of gas before it assumes a dangerous concentration, and to arrange apparatus which, at the moment of detection, will simultaneously give visual warning at a control point and operate machinery for dispersing the gas. Fortunately a device of this kind is already an accomplished fact, and a demonstration of the apparatus to a representative of THE ELECTRICIAN furnished convincing proof of its efficiency.

The "Ringrose" gas sentinel, as it is called, is a modification of the "Ringrose" gas and fire-damp alarm and safety lamp made by W. R. Patents, Ltd., of Leeds, and it will be



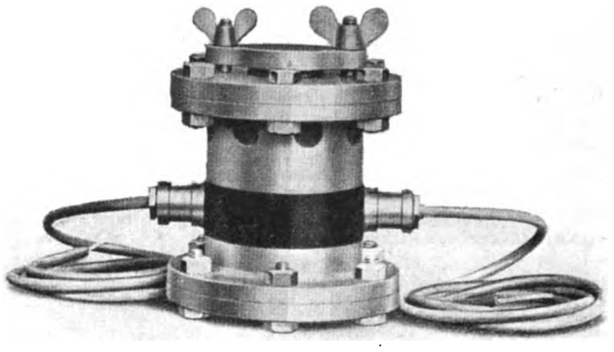
A diagrammatic sketch of the interior of the "Ringrose" gas sentinel.

recollected that this lamp, following approval by the Ministry of Mines, is providing extensive employment in collieries.

The device is very compact, as will be gathered from the illustration shown in the next column, and can be fitted inside any manhole, tunnel or inspection chamber.

Its functions may be briefly described as follows. It signals to any desired point or points when gas is present to a percentage of 1¼. It then automatically sets in motion an electric fan for dispersing the gas. When the gas has been reduced to below 1¼%, it signals "all clear," and resets itself ready for a further attack, without attention, so long as gas is present. Should any fault occur on its signalling circuit the appliance signals and assumes the "danger" position, a process which is automatically repeated. It is fool-proof and robust in construction, requires no attention beyond, say, five minutes every eighteen months or two years, and the cost of operation is approximately 5s. per annum.

The action and construction of the alarm may be followed in the diagram on this page. Enclosed in the apparatus is a



The "Ringrose" gas detecting equipment is fool-proof in its action and robust in construction.

porous pot, within which is a special filament heated electrically by an electricity supply such as is employed in telephone exchanges. Any gas present in the atmosphere percolates via gauze-covered holes through the porous pot, and is slowly burned by the heated wire. This creates a partial vacuum in the pot, and the vacuum so produced passes to the interior of a diaphragm and separates two platinum contacts, thus breaking the electric circuit. This breakage gives visual warning at the telephone exchange or other desired point, and at the same time sets in motion an electric fan for dispersing the gas.

E.P.E.A. (SCOTLAND DIVISION).

Annual Dinner Views on the Association and Conditions of Labour.

AT the annual dinner of the Electrical Power Engineers' Association (Scotland Division) at the Caledonian Hotel, Edinburgh, on February 9th, Mr. R. A. D. Macalister presided, and others present included Principal J. Cameron Smail (Heriot-Watt College); Major Herbert Bell (Glasgow Electricity Department); Mr. F. A. Fitzpayne (Edinburgh Tramways Department); and Mr. T. D. Martin, president of the Electrical Power Engineers' Association.

Principal SMAIL, proposing the toast of "The Electricity Supply Industry," said in these days, which were not altogether free from gloom and depression, it was very pleasant to be able to talk about something which was in a flourishing condition, and which it seemed in all probability would continue to flourish. It seemed to him that the electrical industry had behind it the great advantages of recent development and tremendous achievement. People seemed to be prepared to invest millions quite calmly in the new developments.

Major BELL, responding, said he had heard they were going to get electricity at ½d. per unit. Just at the moment he did not know how that was going to be done, but it was very interesting to know that the general price of electricity throughout the country was gradually coming down to a figure which it was believed would make it of use and available to all.

Mr. F. A. FITZPAYNE, proposing the toast of "The Association," said the reason for the formation of the Association was as strong to-day as it was then. It was to have an Association to protect their professional interests, and the E.P.E.A. had most efficiently performed that function.

Mr. P. D. MARTIN said if they compared the chaotic condition of salaries and conditions of labour in the early days with the present day it would be seen that the Association had fully justified its existence.

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ORGANISING FOR INCREASED SALES.

Six Vital Points in Selling—Importance of Legislating for the Future—Overcoming the "Inferiority Complex"—Lamp Sales as Basis of Bigger Retail Turnovers—Preventing the Yearly Spring Cleaning.

ORGANISING for Increased Sales, with special reference to the "Spring Cleaning Season, 1929," was the subject of a paper read by Mr. H. W. Roberts at the E.D.A. Sales Conference held at the Royal Society of Arts, London, on February 15th, Mr. F. W. Purse in the chair.

Mr. ROBERTS dealt first with the general question of increasing sales under the following headings:—

(1) Salesmanship consists of:—(a) creating a selling atmosphere; (b) mastering your selling points; (c) method of approaching the customer.

(2) Organising for increased business is synonymous with looking ahead. Looking ahead does not mean next week or next month, but five, 10 or 15 years, and all our plans should be prepared so that expansion takes place in a normal manner.

(3) We must think on much broader lines, and prepare for really big business. Our turnover in merchandise to-day is very small in comparison with other industries, and we must learn to think in thousands where we have previously thought in hundreds.

(4) We must make up our minds how this business is going to be handled. The basis of all big business is the means of distribution to the general public. The obvious solution is through retail shops such as exist in other industries. When, therefore, deciding any policy we should ask ourselves: Will that help to bring about a large and stable retail section of our industry?"

(5) Two of the essential features of "organising for increased business" are: standardising and simplifying.

(6) Price-cutting as a means of "organising for increased business" should be avoided at all costs.

A good example of looking ahead was provided by the operations of the Central Electricity Board, which was definitely legislating for the future, and not just meeting the demand as it came along. There should be no hesitation about adopting this policy, as we had no excuse for lack of confidence. The consumption of electricity had doubled during the past seven years, and there was no reason why it should not be doubled again in the next three to four years, particularly in the south-eastern area of England.

Hand to mouth buying was very prevalent in our industry, which could only mean that there was a lack of confidence, whereas our industry, above all others, had the brightest of futures. This attitude was small thanks to those pioneers of thirty and forty years ago, who laid the foundations of future prosperity for the many young men and women now employed in the industry. It was the lack of thinking on broader lines that accounted for the inferiority complex which, according to one of our technical journals, existed in our industry.

Adequacy of Shops Questioned.

Mr. Roberts suggested that the E.D.A. local circles should devote one of their meetings to a survey of the retail shop representation in their area, and see whether, in their opinion, this was adequate to the public needs. A well known motor car manufacturer advertised that he had nearly 2 000 dealers associated with his service organisation, and every user of his cars knew where to go for immediate replacements or repairs. Speaking generally, did the public know where to go—without hesitation—to buy electrical apparatus or get advice on electrical matters? He was inclined to think not, as the electrical industry was very badly represented in the main shopping thoroughfares of the country.

It was frequently levelled against manufacturers that prices for apparatus made to B.E.S.A. specifications were too high, but this was purely a question of demand, and he was sure that if there were a general tendency always to adopt B.E.S.A. standards, the prices, as they had actually done in one or two cases, would much more nearly approach what had become regarded as standard prices for the accessories in question. At present all sections of the industry were hampered through varieties of stocks and patterns which should really be quite unnecessary.

The desirability of rendering electricity accounts monthly was stressed by Mr. Roberts. He thought it was a great mistake to couple a service like electricity with that of local rates, rent, and other such disagreeable charges that had to be met during the course of the year. By charging for electricity monthly one brought it within what was generally known as the "housekeeping money" atmosphere, rather than that of the quarterly bill.

Price-cutting was the royal road to bankruptcy. It showed lack of confidence in selling policy, quality of product and quality of work. There was much too great a tendency to depreciate values inside our own industry and amongst ourselves, instead of allowing the usual economic method of public demand to operate. Good value for money, coupled with good service, was the basis of public goodwill. Mr. Roberts feared we did not realise what good value we gave in certain of our commodities; it was instructive to consider what the public got for 2s. 3d. in a 60 W lamp and to compare the difference with the value obtained from a couple o cocktails, or 2s. 3d. worth of coal. Again, compare the price of electric fires with those of coal grates and gas fires, and it would be found that we were giving far better value. If we started selling goods with the idea that we were asking a high price, while not realising the value we were giving in comparison with other industries, we should never create in our own minds the confidence necessary to increase our business.

Fixing Desired Turnover.

In considering the question of increasing business it was essential to have a goal to aim at, and one should decide on the turnover that it was necessary to reach, then analyse it with a view to seeing how it could be achieved. The turnover and expected profit must, of course, bear a definite relation to the establishment charges to be incurred, and when speaking of a retail shop the first consideration should be to select a standard line in constant demand, such as lamps, and make up one's mind that the business in that particular line must, say, pay the rent of the shop. The advantage of lamp turnover was that it was quick, and quick turnover was the secret of profitable retail trading. Lamp selling, if studied carefully by the assistants, was an extremely good basis of building up salesmanship in all other lines of electrical apparatus.

The next step was to prepare a definite campaign, making up one's mind as to the turnover to be reached in various classes of apparatus, and then deciding as to how to get that business, namely, by canvassing, advertising in the Press or effective window displays. Having settled on a programme for say, three or six months ahead, it was essential to stick to it.

Another important point for consideration was the value of stock in relation to the expected turnover. It was, for instance, no good expecting to do a turnover of £250 per week with a stock valued at £100, as it was quite impossible to give good service, and the variety offered to the general public was too small. On the other hand, stocks should be very carefully selected and continually reviewed, to see that none of it was relegated to back shelves and forgotten. Standardising and simplifying should, of course, be the keynote of carrying stocks, as not only did it lead to buying in better quantities and at better prices, but it enabled a more careful watch to be kept, and made the task of the salesman much simpler.

As one of the greatest selling points in favour of electricity was its cleanliness, all shops, showrooms, etc., associated with the selling of electricity should be kept scrupulously clean and tidy.

Referring to the E.D.A. publicity plans in connection with Spring Cleaning, Mr. Roberts thought the campaign dealt too prominently with the suction cleaner, without referring to the numerous other possibilities of increasing business at that particular time of the year. Spring cleaning in the electrical age should be non-existent, but it would probably take another two or three generations to kill this horrible annual upheaval. There was, however, no better period during the whole year than the spring cleaning season for propaganda work by the electrical industry. We should not forget the old saying "Prevention is better than cure," and if we could educate the public up to the all-electric idea, then we should be preventing spring cleaning, instead of curing the evils of the other nine months of the year. The fact that during the early winter we were busily meeting demand should direct attention to another part of the year for creative work, and

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there was no better time than when the householder was fed up with clearing dust and grime accumulated in the winter.

In conclusion, Mr. Roberts pointed out that this year extra vigour would be called for to counteract the upsetting tendencies of the coming General Election. The electrical industry, above all others, had the best chance of helping the nation back to its old prosperity, as we could ensure better homes, better working conditions and improved methods of production.

DISCUSSION.

Mr. BERNARD emphasised the necessity for confidence as the basis for any organisation for increased sales. Confidence must be the key-note of the whole selling policy. The salesman could not too often repeat that electricity and its appliances were the finest commodities in the world, and the more this was realised the faster we should get on. Confidence also came into the question of standardisation of apparatus, and the more we could get down to standardisation the greater must be the success achieved in the use of electricity. In the same way a great deal more should be made of relative cost of electricity and its apparatus in comparison with other forms of lighting and heating. On the question of rendering accounts monthly, it appeared that the gas companies found it satisfactory.

Mr. F. SELLEY said the foundation for any increased selling campaign was to get the price per unit on the proper basis, to start with. He did not agree with rendering accounts monthly, owing to the largely-increased costs for meter reading and clerical work. At present it took three weeks in each quarter to read the meters in his district, and assuming there was a staff of 100 at present to do this work on a quarterly basis, it would need a staff of 300 on a monthly basis. Standardisation was not such a simple thing as some people seemed to think, especially in connection with kettles, cookers, toasters, etc., as it was too often found that one householder would not have an article just because the lady next door had one. They wanted something different.

The trouble with electrical washing machines, especially in central London, was that there were no conveniences for drying. Simplicity was certainly necessary in regard to tariffs. Although he agreed that electrically-operated hot water systems would solve many household difficulties, it would be impossible to sell such apparatus with a charge of 2d. per unit.

Miss JONES remarked that as regards electrical washing machines, the poor people who really ought to have them could not afford them, whilst the richer people who could afford them would not bother with them and preferred to send their washing to the laundry.

Mr. E. A. JOYCE said that want of capital was preventing the increase of sales taking place in the electrical industry. What was wanted was a very much larger number of retail electrical shops in our large towns. At the present time there were remarkably few, although some enterprising electricity supply companies and municipalities had opened up excellent showrooms. As regards contractors, it seemed impossible to get them to use propaganda literature and printed matter, although it was supplied free by the manufacturers. Contractors very often, he said, were too busy filling in tender forms for public contracts and seemed to be too much concerned in getting on to a L.C.C. or similar list to give much attention to increasing the sales of apparatus.

Exploiting Wiring Possibilities.

Mr. P. M. SHEARS suggested that the most likely way of increasing the sales of apparatus in a spring-cleaning campaign was to tackle the large amount of new wiring work waiting to be done. He also suggested that a great deal of progress would be made if lamps could be obtained at 1s. each.

Mr. MOORE asked the author for an explanation of the expression "inferiority complex" which had been referred to in the paper.

Mr. B. C. HOLDING suggested that Mr. Roberts should be given a medal for his courage in reading a paper on salesmanship at a Sales Conference! It was, he continued, a real reflection on the trade in this country that so little domestic electrical apparatus was in use. It had recently been stated that in America only 37% of the homes using electricity for lighting were using suction cleaners, but the position was probably far worse in this country. If he might be permitted to criticise the E.D.A. Publicity, it would be for its tacit assumption that spring-cleaning is a necessary annual event, whereas the suitable and adequate use of electrical appliances should render, as the author said, this annual upheaval unnecessary. Electrical spring cleaning propaganda should have as its key-note some interpretation of the slogan "Make this Spring Clean your Last." It was obvious that the use of electrical appliances for domestic purposes was not yet sufficiently appreciated, and he was convinced that there was a big electrical field absolutely demanding to be cultivated. Mr. Roberts had shown the importance of the great selling principle of to-day: "make it easy for them to buy." Demonstration was the greatest of the things to make buying easy. As to washing machines and the difficulty of drying, there was on the market one machine which claimed to incorporate a centrifugal drier, which would seem to get over that difficulty.

In the selling of lamps nobody seemed to care much about the wattage of the lamp which a customer placed in an empty socket. Yet the wattage of each lamp sold was an important governing factor in the lighting load of some central station.

At the retail selling end we had a fair number of electrical shopkeepers who waited firmly entrenched behind heavy counters for the customer to come and demand electrical appliances. The real need was to turn these mere tenders of goods into sellers of the greatest and most valuable service known to civilisation.

Miss TICKELL (Leyton) mentioned that a firm of suction cleaner manufacturers had, in the name of the Leyton electricity undertaking, canvassed that district with its own canvassers, and had sold 250 suction cleaners in five months.

Lack of Sales Specialists.

Mr. PATMORE suggested that the industry was suffering from a lack of specialist staff on the sales side; otherwise it would not be necessary, as in the case of Leyton, for the manufacturers to send their own staffs to push the sale of apparatus from which the undertaking would secure a large revenue. Speaking of electric fires and tariffs, he mentioned the fact that a certain electricity supply company had just sent round a circular asking consumers to use their electric heaters as sparingly as possible between 10.30 a.m. and 4.30 p.m., as otherwise there might be a danger of shortage of supply. The trouble, said Mr. Patmore, was that this company was supplied in bulk, and under the present arrangements by which bulk supply was given, it was afraid to increase its maximum demand as the charge payable by the company was based on the average maximum demand over a certain period. He suggested that the Electricity Commissioners should be asked to revise this system in the interests of general development.

The CHAIRMAN, who incidentally mentioned that the campaign for the sale of suction cleaners in Leyton—where he lives—had resulted in considerable waste of effort, as the canvassers repeatedly called at his house in spite of being told that a suction cleaner was already in use, said that any campaign for increasing sales must be based upon the conditions and requirements of the particular district. He reminded Mr. Selley in connection with washers and drying, that steam laundries always dried indoors in drying cupboards, and there might be a possibility of increasing the load by providing electrically-heated drying cupboards. He anticipated a great development in connection with wiring on the rental system, and another direction in which he himself proposed to take action was to establish a maintenance department, which had proved so successful in the case of the gas companies.

Mr. H. W. ROBERTS, replying to the discussion, said he had no desire to criticise contractors or supply authorities. The whole object of the paper was to emphasise that the key-note of selling either electricity or appliances depended upon keeping in continuous contact with the public. Although he had expected Mr. Holding to explain the meaning of "inferiority complex," his own idea was that it indicated a looking down upon ourselves so far as value was concerned, in relation to other industries, and he felt it was time we held ourselves up a bit more.

As to the suggestion that lamps should be sold at 1s., he doubted whether this would be realised for a long time. The prices of lamps in this country compared favourably with those on the Continent, and although American lamps were cheaper, that was due to the fact that 95% of the consumers there were on one voltage.

Finally, Mr. Roberts mentioned that there was a large number of installations in this country fitted with current limiters. He regarded these devices as sales limiters, because it was impossible to sell even an iron to such consumers, and the sooner current limiters were abolished the better it would be for everybody.

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ELECTRICAL WHOLESALERS' DINNER.

Sir Philip Nash Predicts Bright Future for British Electrical Trade—President Urges Closer Co-operation Between Wholesalers and Contractors.

ABOUT 300 members and guests of the Electrical Wholesalers' Federation were present at the annual dinner of that body, held on February 14th, at the Savoy Hotel, London, Mr. T. Stretton presiding.

Sir HAMAR GREENWOOD, proposing "Co-operation in Industry," referred to the merging of electrical companies, a proceeding which, he believed, was inevitable in all industries. He would like to see the British electrical industry develop throughout the Empire and throughout the world. Co-operation in industry was the hope of the human race. It meant continuity of employment, a reasonable standard of wages and a reasonable profit to the producer.

Sir PHILIP NASH, in reply, said that every generation in industry had its own particular problems. During this generation many methods had been tried with a view to promoting co-operation in industry, and the Turner-Melchett proposals were of great value in creating the right atmosphere for the prosecution of further steps in that direction; but the real place for the initiation of such co-operation was the floor of the workshop. The future of the electrical industry depended more than ever before on co-operation, and he was therefore glad to see that quality abundantly evident in the industry.

One of the directions in which big developments were to be looked for was in the application of electricity to the propulsion and general manipulation of ships. As a seafaring nation we had always taken the lead in marine matters, and he hoped that British electrical firms would help British shipbuilding to take the lead with electrically propelled ships.

Electrical manufacturers were co-operating with the wholesalers, as they were an essential link in the distribution of electrical products. So long as a wholesaler carried out his proper function of pushing sales and reducing the cost of a product to the consumer, he, as a manufacturer, was perfectly content to pay for those services.

British industry possessed many assets which were not always fully realised. Our location, from the point of view of getting raw materials, was unique, our labour was the most intelligent, we possessed a financial system which in point of of view of size, integrity and reputation, was unequalled in the world, and deep down in every Britisher was the accumulated knowledge and tradition of how to do business with other countries. And then we were the centre of the greatest Empire the world had ever seen. With these assets the only things necessary to restore our trade supremacy were confidence in ourselves, co-operation, organisation and hard work.

Mr. J. Y. FLETCHER proposed "The Electrical Wholesalers' Federation." He believed in co-operation in industry, as the days for individual negotiation were gone. He believed that the electrical manufacturing industry approved of the wholesaling policy, but wholesalers who did not sell goods bearing the brand of a manufacturer did not meet with his approval. He also thought that wholesalers in general should purchase material before they sold it.

Mr. THEODORE STRETTON, acknowledging the toast, said that Sir Hamar Greenwood, Sir Philip Nash and Mr. Fletcher had stressed the necessity for co-operation in the electrical industry. Never was it more important that there should be the widest and closest co-operation. During his term of office he had used every endeavour to get into closer touch with every other kindred association, and on the whole considerable progress had been made.

Perhaps their endeavours to get together with the contractors had not been quite as successful as could have been wished, and he appealed to them to get together. Both sections had exactly the same objects in view, and both desired that there should be a definite line of demarcation between the wholesaler and the retailer. Only by complete agreement as to that line of demarcation could there be proper control in the sale and installation of manufacturers' products. As there was no reason why there should not be the closest co-operation between the wholesaler and retailer he hoped they would put aside small grievances and get together.

Whilst on the subject of getting together, he again asked why it should not be possible to have, in the electrical industry, an association embracing all sections of that industry. The motor car industry had had for many years a society immensely strong in every way, and representing every section of the industry. It controlled that industry, and its word was law. The only thing outside its province was price maintenance, and that was controlled by an allied association.

He considered that one great electrical association with sections for every branch of the industry would be true co-operation and for the good of all. He was certain that this need not be a dream, as there were gentlemen at present controlling important trade associations who would probably be quite willing to bring such an organisation into being.

The E.W.F. had always endeavoured to play the game. They were out to give service to the manufacturer in the distribution of his goods to the retailer. The labourer being worthy of his hire, expected a living wage. The Federation would not accept for membership anyone who was not a genuine wholesaler, and the rules are stringent. It seemed to him, therefore, that they should be able to claim and obtain the assistance and co-operation of the manufacturer. They were, in spite of the loss of a few of their oldest and most respected members, the recognised organisation and mouthpiece of the wholesale electrical trades. He took the opportunity of saying publicly that from day to day the E.W.F. lived in the hope of the return to the fold of those they had, so to speak, temporarily lost.

The toast of the "Guests" was proposed by Mr. A. Albrecht, and replied to by Mr. A. Nichols Moore and Mr. L. B. Atkinson. Mr. G. P. Dennis proposed "Our President."

Some of the members of the Electrical Wholesalers' Federation and their guests at the annual dinner at the Savoy Hotel on February 14th. A report of the speeches is given above.

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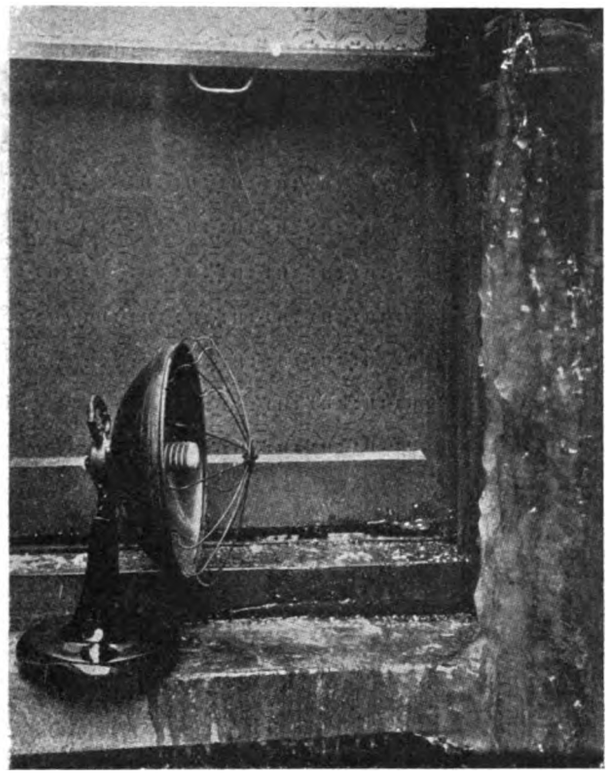
CORRESPONDENCE.

The Editor welcomes the free expression in these columns of genuine opinion on matters of public interest, although he disclaims responsibility alike for the opinions themselves and the manner of their expression.

Thawing Out: Electricity to the Rescue.

[To the Editor.]

Sir,—It occurred to me that some of your readers may be interested to see the accompanying photograph showing how a frozen-up outside water pipe at my house in Hampstead was thawed by means of an electric bowl fire.



A seasonable use for the electric bowl fire.

I believe that Hampstead has recorded almost the lowest temperature in the country (—2° F.). But, fortunately, we have almost the cheapest electricity (½d. per kWh) !—I am, etc.,

D. J. Bolton.

Hampstead.
February 16th.

Safety Factor of Concrete Poles.

[To the Editor.]

Sir,—I have read with interest Mr. W. T. Taylor's letter in your issue of February 8th, and can assure him that the officers responsible for framing the New Zealand Regulations are fully alive to the complicated nature of the problem of the design of reinforced concrete poles, and that the factor of safety of two was only arrived at after full investigation.

Owing to the high cost of material and labour the manufacture of these poles has not been carried out to any great extent, but two of the Power Boards have adopted this type of pole for practically the whole of their distribution work.

Steel is usually imported from England, cement is manufactured locally and costs over twice the English price, whilst labour is about 75% higher than the ruling rates for a similar class of work in England. In view of the fact that Ironbark can be obtained from Australia at reasonable prices it will be realised that it is only under special circumstances—such as low cost of crushed stone, efficient conditions of manufacture and cheap transport—where the reinforced concrete pole can compete commercially with Ironbark. The conditions in England are, of course, quite different.

A few years ago an investigation was carried out by Mr. H. R. Climie, M.I.E.E., of New Plymouth, New Zealand, who pointed out that the formulæ given in text books for the determination of the stresses in concrete poles, while approximately accurate for working loads, give quite fallacious results if applied to crippling loads. The results of this investigation are embodied in a paper which Mr. Climie read before the Electric Supply Authority Engineers' Association of New Zealand, in June, 1928. This paper deals in detail with the points raised in Mr. Taylor's letter, and I shall have pleasure in forwarding him a copy.—I am, etc.,

W. P. Gauvain.

London.
February 13th.

Sealing Medium for Insulators.

[To the Editor.]

Sir,—In his article on "Glass Insulators" in your issue of January 25th Mr. North condemns the use of Portland cement for fixing the pins into outdoor insulators and recommends plaster of Paris mixed with powdered glue as the most satisfactory sealing medium.

I have carried out some tests and find this sealing medium to be extremely weak mechanically, the pull required to dislodge a spindle from an 11 000 V insulator being only 460 lb. compared with 4 950 lb. when using Portland cement.

A further source of weakness is the extreme porosity of plaster of Paris, even when mixed with glue, and its tendency to disintegrate when moistened. An insulator with pin fixed as suggested was inverted and a little water poured into the inner pocket; within two minutes the top surface had powdered, and after one hour the disintegration had penetrated to a depth of ½ in.

Although insulators are not normally mounted in such a way as to collect water, a certain amount of moisture must inevitably come into contact with the plaster of Paris, which would eventually crumble away.

I shall be pleased if Mr. North will say what his experience has been with regard to the above two features of this sealing medium.—I am., etc,

P. M. W.

Waltham Cross, Herts.
February 18th.

"Glass Insulators."

[To the Editor.]

Sir,—Referring to the correspondence in connection with my article on "Glass Insulators," I am afraid that at least the earlier critics have looked at the question purely from an academic or test-house point of view, with entire disregard or lack of experience of Outdoor Transmission Equipment under service conditions.

No one appreciates more than the writer the very valuable contributions to the advancement of the art which the porcelain manufacturers have made during rceent years, but I am also compelled to take notice of the developments carried out by the glass works, and when my notice is brought to only a few of the characteristics indicated in my article, I am bound to plagiarise from a popular weekly, and feel that to change my opinion is but to say I am more wise to-day than yesterday.

If glazing is of so little, or no value, is it not remarkable that makers still include this expensive process in their manufacture—even for indoor service ?

When glazing is done simultaneously with firing of the main body, the danger of porosity becomes all the more likely, and I have known of cases where a faulty insulator has only been discovered by the accidental fracture by a workman during assembly, which has disclosed a porous porcelain under a perfectly glazed surface.

In regard to the temperature cycle test, the very fact that such insulators which undergo the test are not allowed to be put into service is surely the most convincing proof one may have of the high value of a test which can be applied to every insulator, because, conversely, one can only say that the insulators which are in service have never been tested, and even Mr. Goodlet, with his self-admitted obtuse views, would agree that, as is customary with all other electrical plant when possible, a test on the actual component part, or equipment, is better.

Personally, I think the application of the polarised light test opened up a new era for the possibilities of glass as a suitable, and, above all, reliable, insulating material, and the fact that over 4 000 000 extra high tension insulators have been supplied, by two firms alone, for service under the most extreme climatic conditions, combined with the fact that they are practically unheard of in this country, is sufficient to convince me of the justification for further interest in the subject at home.—I am, etc.,

Norman E. North.

London, W.C.2.

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NEWS IN BRIEF.

Oldham and Assisted Wiring—Annual Dinner of the E.D.A.—Meetings of Electrical Women—Brookhirst Benevolent Fund—Telephones in Jamaica.

A GENERAL manager is required for Aberdeen Corporation tramways department.

Halifax T.C. recently held a meeting in committee to discuss the proposed purchase of a turbo-generator at a cost of £25 000.

Under the assisted wiring scheme inaugurated at Oldham nine months ago, applications for installations have now reached 1000.

The city architect of Sheffield and the fire brigade are to arrange for a fire alarm system to be installed at Lodge Moor Hospital, at an estimated cost of £263.

Hull Telephones Committee has decided to instal an additional 15 cord circuit and associated apparatus in the automatic exchange at Queen's Road, at a cost of £987.

The Brighton, Hove, and District Advisory Town Planning Committee discussed last week the proposal to erect 80 ft. steel towers across the Downs, under the national electricity scheme.

The Post Office is to have a new building erected in Queen Victoria Street, London, of sufficient capacity to house the trunk telephone exchange, the City and Central exchanges, and the toll exchange.

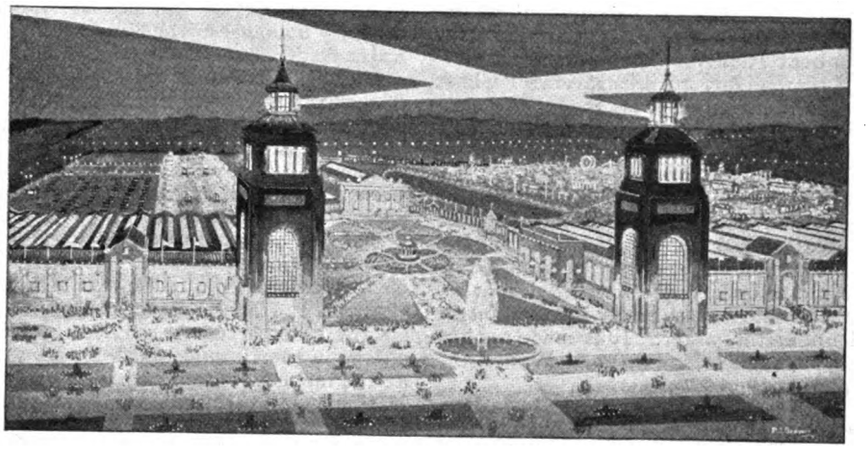
At a meeting of the Institution of Civil Engineers, on Tuesday, a paper by Mr. A. H. Barker on "The Electrical Heating and Ventilation of Bourne and Hollingsworth's Premises" was read. The Institution's students visited the Post Office (London) Railway on February 16th.

A village automatic telephone exchange was recently opened at Haynes, Bedfordshire. The exchange is the first of its kind in the country. Without an operator nearer than Bedford, seven miles away, the 12 subscribers at Haynes can make trunk calls day and night and a kiosk provides the same facilities for the public.

The annual dinner of the British Electrical Development Association, at which Sir John Gatti, president of the Association, will preside, will take place at the Piccadilly Hotel, London, on March 14th, at 7 p.m. for 7.30 p.m. Ladies are invited, and there will be dancing after 10·15 p.m. Tickets from the Association, 15, Savoy Street, London, W.C.2, at 21s. each, include wines during dinner.

The Italian National Research Council created by Signor Mussolini was formally inaugurated at the Campidoglio, Rome, on February 16th. Senatore Marconi, acknowledging his appointment as chairman of the Council, said that twelve committees—one each for agriculture, astronomy, biology, chemistry, physics, geophysics, geography, geology, engineering, mathematics, medicine and radio-telegraphy—had already begun work.

The annual report of telephone progress in the Birmingham district states that there are now 81 telephone exchanges in the area, including three hypothetical exchanges designed to facilitate the introduction of new automatic exchanges. The conversion of the Walsall, Bloxwich and Aldridge exchanges is expected to be completed in the next few months, and Dudley, Brierley Hill, Cradley Heath and Stourbridge will be converted during the present year. There are 68 333 telephone stations, an increase of 8·57%, and 56 061 677 local calls were originated in the district during the past year, an increase of 3 764 480.



AN artist's impression of the North-East Coast Exhibition which opens in May at Newcastle-upon-Tyne. The exhibition is being well supported by firms with electrical interests, and details of the special scheme of illumination which has been prepared for the buildings and grounds are given on page 250.

There are 46 students in electrical engineering at Blackpool Technical School.

Blackpool T.C. has applied for a loan of £8 000 for the hiring out of electric cookers, wash boilers, etc.

The British Cable and Telephone Co. has applied to the Jamaica Government for a concession to operate an island telephone service in parts of the island outside the area covered by the license of the Jamaica Telephone Co.

A mid-Gloucestershire branch of the Electrical Association for Women was inaugurated at Gloucester on February 13th. Mrs. H. S. Ellis presided, and the Mayor and Mayoress of Gloucester and Mr. F. H. Corsan, the city electrical engineer, were present.

An inaugural meeting of the Bristol branch of the Electrical Association for Women will be held on March 5th, at 3 p.m., at Rotary House, Colston Street, Bristol. Lady Augusta Inskip will preside, and the chief speakers will be Miss C. Haslett (Director E.A.W.), Miss M. Partridge and Mr. J. H. Inskip.

At the ninth annual meeting of the Brookhirst Benevolent Fund, Mr. W. W. Lea stated that during the past year 34 members had received sick benefit, and two had died. The total membership was 461, an increase of 37. The treasurer (Mr. C. H. Worth) stated that the assets of the fund were now £1 010 11s. 7d.

During the annual dinner of the Association of Veteran Wireless Operators of America in New York last week a tribute was telegraphed by the President to Senatore Marconi in Rome, referring to him as the greatest figure in the world of wireless, and expressing the warmest sentiments of brotherhood to him and to all comrades in "that great society that knows no boundaries."

Berkshire County Valuation Committee has obtained an opinion of Counsel that machinery and plant installed for the purpose of generating electric power or changing it to a kind suitable for the requirements of the occupier is rateable, while any machinery or plant installed for utilising the power after it has been generated or changed is part of the equipment of the premises, and is not rateable.

An "outlet" campign meeting was held on February 12th under the auspices of the Birmingham and Midland branch of the Electrical Association for Women. Mrs. L. A. Wilson, vice-president of the Association, said it was regrettable that the price of current varied so much, and it was for women to urge for such terms that they would be able to have all the economical and efficient articles at their elbows. A discussion followed.

A meeting of the Physical Society will take place to-day (February 22nd) at the Imperial College of Science, South Kensington, London, S.W.7. Papers will be read on "The Construction and Calibration of a Sensitive Form of Pirani Gauge for the Measurement of High Vacua," by L. F. Stanley; "The Free Periods of a Composite Elastic Column or Composite Stretched Wire," by Dr. Chas. H. Lees; and "A Capillary Tube Method for the Simultaneous Determination of Surface Tension and of Density," by Dr. Allan Ferguson and J. A. Hakes. A demonstration of a standard voltmeter and wattmeter for measurements of a.c. at power frequencies will be given by Dr. E. H. Rayner.

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BUSINESS ITEMS.

MR. T. B. M. WHYTE, Glasgow Road, Blantyre, has added an electrical engineering branch to his business.

Mr. J. HAROLD JACKSON, electrical engineer, has recently opened premises at the corner of New Road, Winsford, Cheshire.

GRIFFIN, HARDING AND BRYANT, LTD., electrical engineers, of Swindon, have transferred their showroom from 66, Devizes Road to larger premises at 1, Park Lane.

The lifeboat searchlight of the London Electric Firm.

THE LONDON ELECTRIC FIRM, of Brighton Road, South Croydon, has supplied a searchlight for the Royal National Lifeboat Association, which forms part of the equipment of the recently launched super-motor lifeboat delivered to Cromer. The searchlight, an illustration of which is here given, is made in non-corrodible metal which, at the same time is very light. Perhaps one of the most important features is that the searchlight is entirely watertight. There is an inlet gland for the cable and another for the spindle of the lamp focus gear, it being possible for the user of the lamp to operate the former without removing the hand from the handle, consequently the searchlight could even be worked under the water. It is made for low voltage compressed filament bulbs taking up to 60 W, and the gasfilled variety is usually employed.

CORSON, GRINDLEY AND CO., LTD., electrical dealers, 1, Grange Road, West Kirby, Cheshire, have opened a new and up-to-date workshop, which will be managed by Mr. Thomas Brighouse, who was formerly with Messrs. Jordan and Godsell, ironmongers and electricians, West Kirby.

An electrical exhibition was opened at Ashford, Kent, on February 7th, under the auspices of the Ashford Electric Circle, in conjunction with the local branch of the Electrical Association for Women, members of which gave cooking demonstrations. The exhibition was officially opened by Mr. E. E. Hoadley.

A concession has been awarded to a concern in Pisa for the construction and working of an electric tram-line. Firms desirous of offering plant or materials likely to be required of British manufacture can obtain further particulars upon application to the Department of Overseas Trade. Reference No. A.X. 7 481.

DIXONIA, LTD., 4, Portsmouth Street, Kingsway, London, W.C.2, announces the purchase of the plant and goodwill (with the exception of the special and experimental engineering and tool making departments) of the FLUID PRESSURE PUMPS, LTD., Clifton Street Works, Clifton Street, Latimer Road, London, W.11.

Among the transformer orders received last month by JOHNSON AND PHILLIPS, LTD., Charlton, London, S.E.9, may be mentioned two 5 000 kVA, three-phase units for Woolwich Corporation; four 2 500 kVA three-phase units for the East Anglican Electric Supply Co., Ltd.; four 2 500 kVA, three-phase units for Ipswich Corporation; and two 1 800 kVA, single-phase units for the New South Wales Government Railways.

We are informed by the Department of Overseas Trade that two competitions in connection with power-driven agricultural machinery will be held in Switzerland in September, 1929 and 1930. The first competition will deal with the designs of machinery suitable for the exploitation of small holdings. The 1930 competition will involve the practical demonstration of machines. British firms interested may obtain further particulars on application to the Department, quoting Ref. No. A.X. 7 394.

Following on successful tests, the Conservative Central Office has placed a substantial order with the MARCONIPHONES CO., LTD., Tottenham Court Road, London, N., for public address equipments, on behalf of a number of the candidates at the forthcoming General Election. The apparatus consists of a special microphone, gramophone pick-up, valve amplifier and 200 V rotary transformer, supplied from from a 12 V car battery. The loud speaker is of a special type, having a rubber diaphragm which reproduces speech capable of reaching over half a mile. Although individual members have already used Marconiphones at several by-elections, the adoption of these outfits marks the commencement of a new official policy.

PERSONAL.

ALD. Major Hall-Thompson has been re-elected chairman of Belfast Electricity Committee.

Cape Town Electricity Committee has promoted Mr. J. S. Clinton to the position of charge engineer, with a minimum salary of £451.

Mr. J. W. Fawcett, electrical engineer to Holmfirth U.D.C., has accepted the position of resident engineer with the South-East Yorkshire Power Co.

Mr. Andrew Robertson, chairman of the Westinghouse Electric and Manufacturing Co., has been elected a director of the Radio Corporation of America.

Estate of the gross value of £12 262 with net personalty £12 031 was left by the late Mr. James Hay Jones, who was formerly manager of the Singapore cable depot of the Eastern Extension Telegraph Co.

Mr. R. A. Fearnley, manager of Keighley Corporation tramways, has been appointed to a similar position with Southend Corporation at a commencing salary of £750. He is a son of Mr. A. R. Fearnley, general manager of the Sheffield Corporation tramways.

Mr. Leslie H. Ham, who has since 1926 been the head charge engineer at the Bargoed power station, has accepted the appointment of combustion engineer at the new Government power station at Kalyan, Bombay, in connection with the electrification of the Indian State Railways.

Mr. E. P. Hart, assistant charge engineer in the Portsmouth electricity department, has been appointed junior engineer-in-charge in the Hammersmith (London) electricity department, at the inclusive salary provided by Grade 8a, Class F, of the National Joint Board's scale, at present £336 3s. 11d. per annum.

Sir Hugo Hirst, chairman and managing director of the General Electric Co., Ltd., accompanied by Lady Hirst and Sir Ernest Clark, formerly Assistant Under-Secretary for Ireland, and Lady Clark are passengers on the s.s. "Tamoroa," which is expected to arrive at Southampton from Australia early to-day (Friday). Sir Hugo Hirst and Sir Ernest Clark left England at the end of August as members of the Government Commission appointed to confer with the Commonwealth Government and the leaders of industry and commerce on the development of Australian resources and other matters which might tend to the promotion of trade between the two countries.

Obituary.

MR. C. W. SCHAEFER, electrician-in-chief of the Eastern Associated Telegraph Companies, at his home on Sunday morning.

MR. A. H. ALLEN. The funeral of the late Mr. A. H. Allen, technical editor and director of the "Electrical Review," whose death was announced in our last issue, took place on Monday at the Forest Hill New Cemetery, London. The family mourners were Miss Constance Allen (daughter), the Rev. A. Allen and Mr. Frank Broadbent. Mrs. Allen and other members of the family were prevented by illness from being present. Amongst others present were Mr. E. A. Gatehouse, Mr. A. H. Bridge, Mr. E. S. Middleton, Mr. H. Porter Cox, Mr Arthur Cox, Mr. P. J. Haskell, Mr. W. H. Wicken, Mr. W. A. Jones (E.P.E.A.), Mr. R. W. Hughman ("Electrical Times"), Mr. E. J. Wilcock, Mr. A. L. Johnson, Mr. B. G. Stewart, Mr. A. S. E. Ackerman, Mr. A. Brammer, Major T. Rich, Mr. J. H. C. Brooking and Mr. B. C. Holding (editor of THE ELECTRICIAN). A recent photograph of the late Mr. Allen appears on page 249.

MR. THOMAS HOLMES BLAKESLEY, on February 13th, aged 81 years. He made extensive research with respect to measuring alternating currents. Mr. Blakesley's publications on the subject began in THE ELECTRICIAN, and the first edition of his treatise, entitled "Papers on Alternating Currents of Electricity for the Use of Students and Engineers," appeared in 1885. At the time that he began this work Wilhelm Weber had produced an electro-dynamometer which Siemens had improved for measurements of direct current, and it was with an instrument of this kind and a primitive alternating-current dynamo that Blakesley demonstrated the principles of which he had given geometrical proofs. He separated the two coils of the instrument and sent alternating currents through each, to illustrate the measurement of power. Further, he showed that, by a combination of three such instruments, phase could be determined. He was for some years hon. secretary of the Physical Society.

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BUSINESS OPENINGS.

Latest Particulars of Electrical Engineering and Wiring Installation Contracts for which Tenders are being Invited at Home and Abroad.

WE give below the latest particulars of contracts for which tenders are invited. The closing date is given, when available.

ALTRINCHAM DIVISION CONSERVATIVE ASSOCIATION.—Electric light installation in connection with alteration of premises at 23, George Street, Altrincham. Specification from Mr. G. Sisam, 12, Dunham Road, Altrincham.

POWELL DUFFRYN STEAM COAL CO., LTD.—Six months supply of electric cable and accessories. Forms of tender from Stores Manager, Ystrad Mynach, near Cardiff.

BEDFORD CORPORATION, February 22nd.—Supply of e.h.t. h.t. and l.t. underground cables (section 1) and incandescent electric lamps (section 2) during year ending March 31st, 1930. Only British manufacturers in the U.K. are invited to tender. Specifications, etc., from the Borough Electrical Engineer, Prebend Street, Bedford.

BELFAST EDUCATION COMMITTEE, February 22nd. Electric light installation, at Malone Public Elementary School, Balmoral Avenue, Belfast. Specifications, etc., from the Education Architect, Victoria Street, Belfast; deposit £1 1s.

BELFAST EDUCATION COMMITTEE, February 22nd.—Installation of electric lighting and heating system, in Riddell Memorial Public Elementary School, Malvern Street, Belfast. Specifications, etc., from the Education Architect, Victoria Street, Belfast; deposit £1 1s.

CENTRAL ELECTRICITY BOARD, February 22nd.—Supply of 132 kV outdoor switchgear, for transforming stations in area of Central England Electricity Scheme Specification from Sir R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2.

HAMMERSMITH (LONDON) BOROUGH COUNCIL, February 22nd.—Wiring work under wiring scheme. Specification from the Borough Electrical Engineer.

BAKEWELL GUARDIANS, February 23rd.—Three-valve wireless apparatus, with three loud speakers (for connection to a.c. mains), for Haddon District Hospital. Tenders to the Clerk, Hospital Committee, Union Offices, Bakewell.

DUMFRIES CORPORATION, February 25th.—Electrical work in nine blocks of houses. Particulars from the burgh surveyor, Mr. John Barker.

PLYMOUTH CORPORATION, February 25th.—Supply of lamp columns. Specification from the City Electrical Engineer, Prince Rock, Plymouth.

STIRLING CORPORATION, February 25th.—Electrical work in connection with Drip Road No. 3. housing scheme. Specifications, etc., from Mr. A. H. Goudie, borough engineer deposit £1.

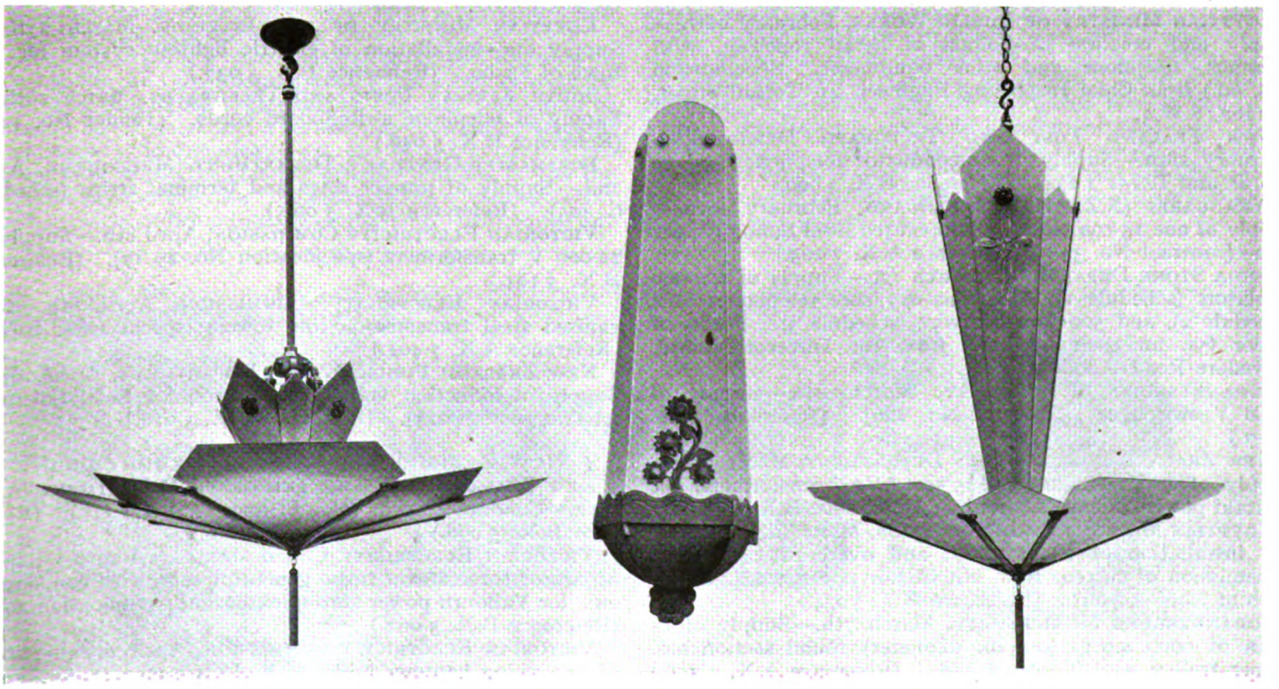
BELFAST CORPORATION, February 26th.—Twelve months supply of stores to the tramways department, including electrical accessories, insulation, carbon brushes, rail bonds, trolley head spares, trolley booms, guard and span wire, electrical equipment spares, etc. Forms of tender from the General Manager, Napier Street, Sandy Row, Belfast.

CONNAH'S QUAY URBAN DISTRICT COUNCIL, February 26th.—Installation work, in connection with free wiring scheme. Particulars from Mr. A. J. Leigh, consulting engineer, 167, The Albany, Old Hall Street, Liverpool; deposit £1 1s.

RHYL URBAN DISTRICT COUNCIL, February 26th.—Supply and laying of about 1 750 yards of 0·06 sq. in.; three-core, 11 000 V cable (C.M.A.), about 1 100 yards of 0·25 sq. in. four-core armoured cable (C.M.A.); and about 1 750 yards of telephone, etc., cable (C.M.A.); also supply and erection of e.h.t. switchgear, two 250 kVA static transformers and l.t. switchgear. Specifications from Mr. E. B. Wright, Electricity Works, Rhyl; deposit £1.

SUNDERLAND GUARDIANS, February 27th.—Automatic telephone system for the Poor Law institution, Hylton Road, Sunderland. Specifications can be seen on application to W. and T. R. Milburn, 19, Fawcett Street, Sunderland.

WATFORD CORPORATION, March 1st.—Wiring of lighting and heating points in dwelling houses, in connection with house wiring schemes. Particulars from the borough electrical engineer, Mr. A. W. Barham, Cardiff Road, Watford.



MORE EXHIBITS AT BIRMINGHAM.

THREE of the modern type of electric lighting fittings to be seen on the stand of Metro-Vick Supplies, Ltd. On the left is a pendant incorporating English sand blasted panels, illuminated by 12 lamps. The metal work is in dull gilt. The centre picture shows a bracket fitted with white opalescent glass for two double-ended tubular lamps, the metal work being green bronze. The right hand fitting is also of English-sand blasted glass for 12 lamps.

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CAMBRIDGE CORPORATION, March 2nd.—Twelve months' supply of electric lamps (schedule 16), etc. Forms of tender, etc., from the Borough Engineer.

BROMLEY EDUCATION COMMITTEE, March 4th.—Electric lighting installation in Raglan Road Council School. Particulars from Mr. W. G. Trend, borough electrical engineer, West Street, Bromley.

DOVER HARBOUR BOARD., March 4th.—One year's supply of electrical sundries and cables. Particulars from the registrar, Mr. Rutley Mowll, Castle Street, Dover; deposit, 2s. 6d. for each schedule.

RACECOURSE BETTING CONTROL BOARD, March 5th.—Supply and erection of equipment for mechanical control of racecourse betting transactions in Great Britain. Specifications, etc., from Mr. J. R. Chambers, Secretary, 33, St. James's Street, London, S.W.1; deposit £2 2s.

CENTRAL ELECTRICITY BOARD, March 6th.—Supply and erection of 66 000 V switchgear, for South-East England Electricity Scheme (London area), and supply and erection of 132 000 V transformers. Specification from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2.

NORTH BRITISH ALUMINIUM CO., LTD., March 12th.—Supply and installation of all material required for electric power and lighting distribution system, at the company's works, near Fort William, Inverness-shire. Specification, etc., from the Company's Offices, Adelaide House, King William Street, London, E.C.4.

PADDINGTON (LONDON) GUARDIANS, March 20th.—Six months' supply of electricians' sundries, etc. Forms of tender from the Clerk, 313-319, Harrow Road, W.9. Stamped, addressed envelope to be sent.

EDINBURGH CORPORATION, March 25th.—Supply of materials to the electricity department for 12 months, including cables, conduits, fuses and fuse boards, electrical material, electricity meters, meter boards, etc. Specification from the Engineer and Manager, Dewar Place, Edinburgh.

Overseas.

UNLESS otherwise stated, particulars of overseas contracts are to be had from the Department of Overseas Trade (Room 52), 35, Old Queen Street, Westminster, London, S.W.1. *Note.—An asterisk denotes that local representation is, in practice, essential.*

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, February 26th.—Supply of induction coils and registers, for telephone work (schedule C. 394). (Reference B.X. 5 031.)

EGYPTIAN MINISTRY OF PUBLIC WORKS, February 28th.—Supply and erection at Sollum of aerial ropeway, with dynamos, telephone and other equipment. Specification (10s. 6d.) from Chief Inspecting Engineer, 41, Tothill Street, London, S.W.1.

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, February 28th.—Supply of six-conductor telephone cordage (No. P. and T. 151/1 234). (Reference B.X. 4 990.)

WHANGAREI (N.Z.) HARBOUR BOARD, February 28th.—Supply of one 15-ton electrically-operated level luffing gantry crane (contract No. 35). (Reference A.X. 7 263.)

INDIA STORE DEPARTMENT, March 1st.—Supply of 200 000 insulators (schedule 1), 49 drums dry core telephone cable (schedule 2), and 500 tons g.i. wire (schedule 3). Forms of tender (5s. for each schedule) from the Director-General, Belvedere Road, London, S.E.1.

JOHANNESBURG MUNICIPALITY, March 4th.—Supply of 6 600 V switchgear (Contract No. 126). (Reference B.X. 5 087.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, March 5th.—Supply of seven single-phase 5 500 kVA transformers, for Waitaki power scheme, section 4. (Reference B.X. 4 873.)

EGYPTIAN MINISTRY OF THE INTERIOR, March 6th.—Supply and installation of underground and overhead cables, for transmission of current from Mit Chamr power works to the town of Kom el Nour. (Reference B.X. 5 074.)

JOHANNESBURG MUNICIPALITY, March 7th.—Supply of 15 miles of 0000 s.w.g. (0·4 in. diameter) round section h.d. copper trolley wire (Contract 128). (Reference A.X. 7 506.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, March 7th.—Supply of hydraulic accumulator, horizontal ram pump, electric motor, motor or belt driven air compressor, starter and control gear.

YUGO-SLAV MINISTRY OF COMMUNICATIONS, March 10th.—Supply of various materials, including electric welding apparatus, machine tools, Diesel engine with electric generator and switchboard, two electric motors (25 and 20 H.P.), various electric generators and other electrical materials, for the River Shipping Board; telegraph and telephone materials, for the Construction Department; electric lighting sets for passenger coaches, for the Machinery Department, etc. (Reference C.X. 2 982.*)

POSTMASTER-GENERAL'S DEPARTMENT, Melbourne, March 12th.—Supply of telephone relays (schedule C. 408). (Reference B.X. 5078.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, March 12th.—Supply of switchboard cords (P. and T. 151/1 247). (Reference B.X. 5 017.)

CAPE TOWN MUNICIPALITY, March 15th.—Supply of metal-clad switchgear (specification 449/28). (Reference B.X. 5 004.)

CHILEAN MINISTRY OF MARINE, March 15th (extension of date).—Two electric travelling cranes, for Port of Valdivia. (Reference A.X. 7 353.)

VICTORIA ELECTRICITY COMMISSION, March 18th.—Supply of 1 300 strings of suspension insulators, 600 strings of tensioning insulators, 1 300 conductor suspension clamps, 350 conductor tensioning clamps, 50 semi-anchor clamps for "V" strings of insulators, 200 semi-anchor clamps for single strings of insulators, 475 earth wire suspension clamps and 125 earth wire tensioning clamps. (Reference B.X. 4 997.)

LOURENCO MARQUES PORT AND RAILWAYS BOARD, March 19th.—Supply of three-phase, Diesel-driven 50 kVA generating set, and electrically-driven water pumping set. (Reference B.X. 5 050.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, March 19th.—Supply of 110 000 V transformer, for Mangahao electric power scheme (section 204). (Reference B.X. 4 952.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, March 19th.—Supply of 11 000 V switchgear, for Mangahao power development (section 203). (Reference B.X. 4 953.)

DUNEDIN, N.Z., CORPORATION, March 20th.—Supply of hand brake equipment, electrical equipment for magnetic brakes and bogie trucks, for tramcars.

CAPE TOWN MUNICIPALITY, March 21st.—Supply of 300 A fuses (specification 453/1928). (Reference B.X. 5 080.)

JOHANNESBURG MUNICIPALITY, March 21st.—Supply of 65 500 porcelain insulators (contract No. 135). (Reference B.X. 5 114.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT March 26th.—Switchboard cords. (Reference B.X. 5 067.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, March 26th.—Supply of telephones and dials (schedule C. 401). (Reference B.X. 5 023.)

EGYPTIAN MINISTRY OF THE INTERIOR, March 27th.—Supply and installation of electric lighting system for the town of Fashn. (Reference B.X. 5 037.)

SOUTH AFRICAN POSTS AND TELEGRAPHS, March 28th.—Supply of telephone switchboard cords. (Tender No. 148). (Reference B.X. 5 048.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, April 2nd.—Supply of jumper rings and terminal strips (schedule C. 405). (Reference B.X. 5 066.)

VICTORIAN ELECTRICITY COMMISSION, April 8th.—Supply of 22 000 V transformers (specification No. 29/17). (Reference B.X. 5 101.)

VICTORIAN ELECTRICITY COMMISSION, April 8th.—Galvanised steel transmission line towers (specification 29/13). (Reference A.X. 7 401.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, April 9th.—Supply of induction voltage regulators, for Lake Coleridge scheme (section 215). (Reference B.X. 5 018.)

New Zealand Government Requirements.

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, April 15th.—Conductor cords (No. P. and T., 151/1 319). (Reference B.X. 5 098.)

VICTORIAN ELECTRICITY COMMISSION, April 29th.—Supply of two or three steam turbo generator sets, with condensers, etc., for Yallourn power station extension (specification 29/7). (Reference B.X. 5 062.)

VICTORIAN ELECTRICITY COMMISSION, April 29th.—Supply of two swing hammer mills, with electric motors, for brown coal (specification 29/9). (Reference A.X. 7 434.)

TANGANYIKA GOVERNMENT, June 1st.—Concession for utilisation of Pangani River Falls for the development of electric power. Copies of the draft concession may be obtained from the Crown Agents for the Colonies, 4, Millbank, London, S.W.1.

STATE ELECTRICITY WORKS, MONTEVIDEO, July 8th.—Construction and equipment of 50 000 kW power station.

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FEED WATER TESTING.

Description of Interesting Apparatus for Use by Power Stations.

WE give below a description of an interesting appliance which has been developed to meet the stringent requirements of modern marine and power station work. The increasing use of water-tube boilers and the tendency towards high steam pressures have made the question of the purity of the feed water a most vital one. The high rates of evaporation now general have accentuated the dangers resulting from the deposit of salt and other solids, and these dangers are naturally increased with higher pressures. In such circumstances, it is essential to have a means provided for keeping the condition of the feed water under continuous observation, if the lives of the operating engineers, and the successful and economical working of the plant, are to be adequately safeguarded. The means taken must possess certain essentials, such as continuous operation, reliability, simplicity and ability to withstand ordinary engine room use.

The Simplex patent electric salinometer by W. Crockatt and Sons, Ltd., 62-64, Darnley Street, Glasgow (based on the electrical conductivity of the solution being tested) answers these requirements, and has been in successful operation for some years in both marine and land installations, having been fitted in the British, Italian, Argentine, Chilean and Dutch Navies and in power stations all over the world. It is known that the resistance offered to the passage of an electric current through fluid of definite concentration, varies with the temperature of the fluid, and if an accurate reading of the concentration is to be obtained, a means of overcoming this variation is necessary. This is automatically done by the instrument itself, so that the reading as given on the scale is correct over any specified range of temperature, thus obviating any manipulation by the engineer or any reference to compensation charts. The instrument consists essentially of an electrode cell, a temperature compensation device, and an indication instrument.

The first photograph shown below illustrates the type of instrument supplied for use in naval work, and is known as the self-contained salinometer. The electrode cell, temperature compensator and indicator are all incorporated in a single unit. The water to be tested is led to the inlet in the left side of the compensator pocket, passes through this pocket and through the electrode cell and is returned either to the suction side of the pump or to a drain tank. The only other connection required is a lead from the lighting mains.

The indicator gives a clear reading on the dial in grains of salt per gallon, and the temperature compensation is arranged to suit the individual requirements. Should the impur ty content at any time exceed a certain pre-determined amount, the indicator is automatically cut out of circuit, and a red warning lamp lights behind the circular window in the top left hand corner of the case. When required, a warning bell or horn is fitted in addition to the warning lamp, both coming into operation simultaneously. When the water becomes pure again, the warning devices automatically cut out, and the indicator resumes reading. The instrument requires no handling or attention of any kind.

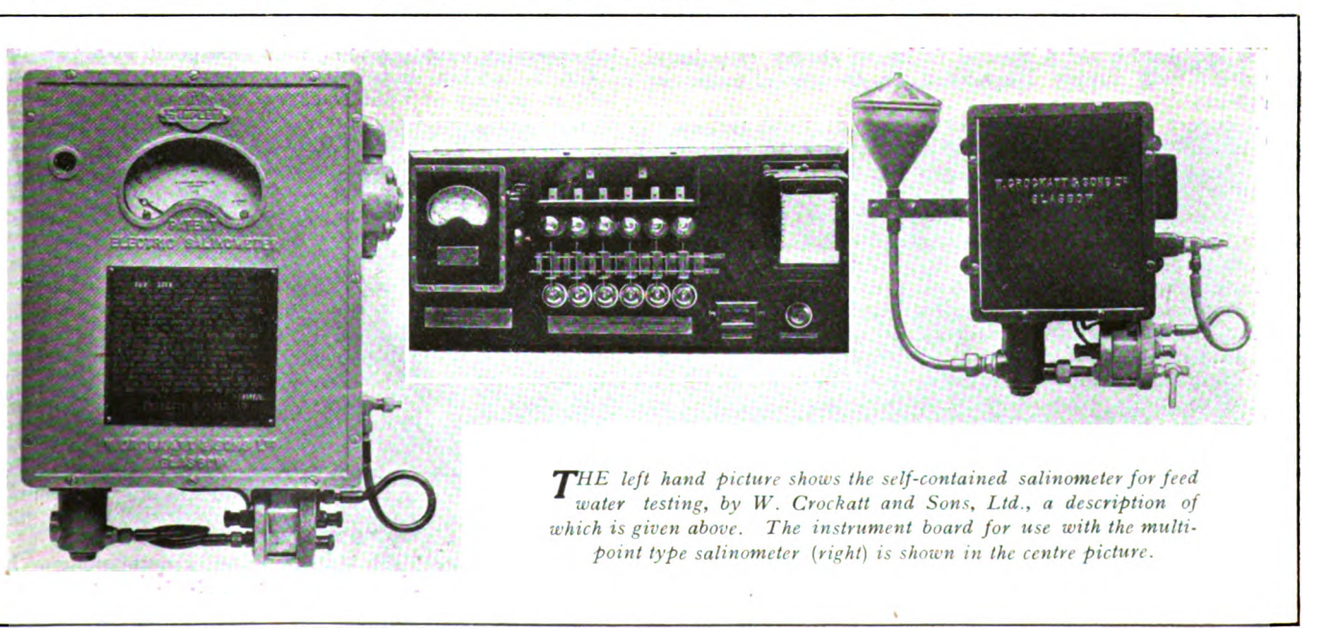
Another type of electric salinometer produced by the same firm is known as the multi-point type. This type is illustrated in the second and third photographs and is used where a considerable number of points are to be kept under observation. The essential elements are the same, but there is only one indicator and the electrode cell and temperature compensation device are placed in a separate case, known as the compensator box. These compensator boxes are placed in the vicinity of the points to be tested (condensers, feed pumps, etc.) and the water is led through the electrode cell as before, electric cable connections are made to the instrument board, on which are mounted the indicator, warning lamps and interlocked switches to correspond to each compensator box, relays, warning bell, master switch, etc. The only other connection to be made is a lead from the lighting mains to the instrument board. All the wiring terminals are arranged in a panel behind the board.

The normal electrical circuit is through the electrode cells and the warning lamps, and in the event of a sudden influx of impurity, the lamps light up brightly and the warning bell or horn comes into operation simultaneously. When the water clears again, the bell ceases ringing. When the engineer wishes to take periodic readings of the actual impurity content at any point, he sets the switch locking lever and switches in that point to the indicator. The locking gear is so arranged that only one point at a time can be switched in to the indicator, the others remaining in circuit through their warning lamps. The switch corresponding to the point which has been read must be replaced in its original position before the locking lever can be moved to allow another switch to be operated.

In the instrument board illustrated, a recording apparatus is supplied, in addition to the indicator, so that if the indicator gives a reading for any point, that point can be then switched in to the recorder and a record kept, over several hours, of the amount of impurity leaking into the feed water.

SOUTH AFRICAN STUDENTS VISIT WORKS.

A party of students from the University of Capetown visited the Stafford works of the English Electric Co., Ltd., on February 12th. The students, who were under the care of Prof. A. E. Snape and Mr. G. Stewart, travelled from Euston in a special saloon, accompanied by a member of the company's export department. The tour of the works was carried out in accordance with a pre-arranged programme, and an expert was present in each department to explain the various processes and special features of design; further informal addresses on technical subjects were given later in the Guest House. Before their return to London the party was entertained to dinner, and in speeches made by two of their number expression was given to the fact that the English Electric Co. had no reason to fear comparison with the electrical works they had seen in Germany.



THE left hand picture shows the self-contained salinometer for feed water testing, by W. Crockatt and Sons, Ltd., a description of which is given above. The instrument board for use with the multi-point type salinometer (right) is shown in the centre picture.

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ELECTRICITY SUPPLY.

Loans for Extensions at Tilbury—The Clyde Valley Co.'s Charges—Walsall Electric Street Lighting—Kent Electric Power Co.'s Expansion—Carlisle's New Generator—Reductions of Rateable Value Charges—Pontefract Inquiry.

GLASGOW Electricity Committee has authorised mains extensions at a cost of £14 000.

The Yorkshire Electric Power Co. is to lay cables for the supply of electricity to the urban district of Gainsborough.

Aldershot T.C. has applied to the Commissioners for sanction to alter the system from d.c. to a.c. in the whole of the Council's area.

THE stand of the General Electric Co., Ltd., in the Electrical Section of the British Industries Fair, at Birmingham. The industrial exhibits are dealt with on page 219.

Warrington Electricity Committee has requested the Electrical Engineer to report on the supply of electricity to the parishes of Warburton, Agden and High Legh.

Doncaster T.C. has reduced the annual charge to Bentley-with-Arksey U.D.C. for street lighting by electricity with 122–120 W lamps from £6 10s. per lamp to £5 10s.

Lincoln Electricity Committee is to lay a new feeder cable from St. Swithin's power station to St. Giles. The cost, including alterations and other expenses, will be £3 613.

Bolsover Colliery Co. has made application to Nottingham County Council for permission to lay short lengths of electricity cables under the main road in the village of Edwinstowe.

Electricity has been provided for the village of Harrold by the Rushden and District Electricity Supply Co., by means of overhead cables, and the supply was inaugurated recently.

Buglawton U.D.C. has decided to join Congleton T.C. in an application for a Special Order to supply electricity. Congleton will supply Buglawton at the price ruling at Congleton.

Southport T.C. is applying for a loan of £1 000 for mains and equipment for the supply of electricity to the parish of Scarisbrick.

Tilbury U.D.C. has applied for loans of £600 for kiosk switchgear, £2 024 for mains in the North ward, £976 for h.t. cable in the South ward, and £2 500 for installations for a further 200 houses.

Marlborough T.C. has applied to the Electricity Commissioners for consent to extensions of the College generating station, and the installation of an additional 100 kW generating set, at an estimated cost of £6 000.

Representatives of the Consumers' Council, which has been formed to further the interests of electricity consumers in the area served by the Clyde Valley Electrical Power Co., are to meet the company and discuss alleged anomalies in the charges made for supplies to various sized houses and in different housing schemes.

Rotherham Electricity Committee has decided that from the end of the March meter readings the standing charges to consumers under the rateable value system be based on 13% of the new assessments, with a minimum assessment of £15 as at present, and that the matter be further considered at the expiration of three months.

Walsall Corporation has decided to improve the lighting of the central portion of the borough by approximately 60 750W electric lamps, at a cost for all-night lamps of £13 17s. 6d., per lamp per annum, and for half-night lamps £10 13s. 9d. per lamp per annum (plus £1 per lamp per annum where standards are provided by the Electric Supply Department).

Representatives of Sittingbourne U.D.C. and Milton Regis U.D.C. and R.D.C. met representatives of the Kent Electric Power Co. recently, relative to a supply of electricity for the district. The secretary of the company stated that the supply would be available next autumn. It was agreed that the councils should be supplied with a plan showing how the rural district would be served.

Moray County Council has decided to oppose the extension of the Grampian Co's electricity scheme to the county. The Council has resolved to endeavour to secure the support of Elgin Town Council in petitioning the Secretary of State for Scotland against the scheme, and to press for a guarantee that should they become distributors themselves there should be no competition on the part of the company.

The North-West England and North Wales Electricity Scheme provides for the installation of a 15 000 kW turbo-alternator in the first instance at Carlisle Corporation's Willow Holme station. The Electricity Commissioners consequently declined to authorise the installation of a 7 500 kW set. The Central Electricity Board has offered to pay the annual charges on the difference in the cost of a 7 500 and a 15 000 kW set (estimated at £43 000), and the Corporation has decided to accept the Board's proposals. The cost of the extensions is estimated at £129 000.

Barking U.D.C. has considered a letter from the Ratepayers' Association with respect to the provision of additional lighting facilities in the principal streets of the district, and has directed the Electrical Engineer to report on the question. —The Electricity Committee has considered the question of the revision of the scale of charges for the supply of electricity on domestic rate, arising from the increase of rateable value of property throughout the district, and recommends that the charge on domestic rate be amended from 15 per cent. on rateable value plus 1d. per kWh to 10 % on rateable value, plus 1d. per kWh.

An inquiry on behalf of the Electricity Commissioners was held recently into the application of the Chesham Electric Light and Power Co., for permission to extend its overhead mains from Northchurch to Little Gaddesden. There were objections by local residents to overhead lines crossing their grounds. Mr. Swann, for the company, put forward alternative suggestions. Mr. A. H. Randall, deputy clerk of the Berkhampsted R.D.C., said his Council raised no objection provided the company placed cables underground at Little Gaddesden. The inspector (Mr. Erskine) said he would meet the objectors, to see if some compromise could be agreed upon.

Col. T. C. Ekin, on behalf of the Electricity Commissioners, held an inquiry at Pontefract last week into the application by the local Chamber of Commerce and the T.C. for a reduction of the Yorkshire (West Riding) Electric Tramways Co.'s maximum charges for electricity. For the company, it was stated that they had not yet benefited from the reduced cost of coal. Negotiations were in hand for a new agreement with the Power Company and any exhaustive examination of the figures might prejudicially affect the Tramways Co. Consequently, the petitioners had agreed to the reduction of the maximum charge from 9d. to 7d. The inspector said the Order would be amended accordingly.

Birkenhead Corporation has received from the Ministry of Transport consent to the placing by the Corporation of overhead lines in the parish of Thornton Hough for the transmission of electrical energy at pressures of 11 000 V and 240 V for the purposes of the Wirral and Neston Electricity Special Order, 1925.—The Electricity Committee seeks sanction to borrow £5 000 for the equipment of sub-stations on consumers' premises and £1 360 in connection with extension of h.t. mains and installation of an additional switchgear cubicle at the Singleton Avenue sub-station.—The Commissioners have sanctioned a loan of £16 468, for the provision of the 33 000 V main transmission line between the Birkenhead and Wallasey generating stations.

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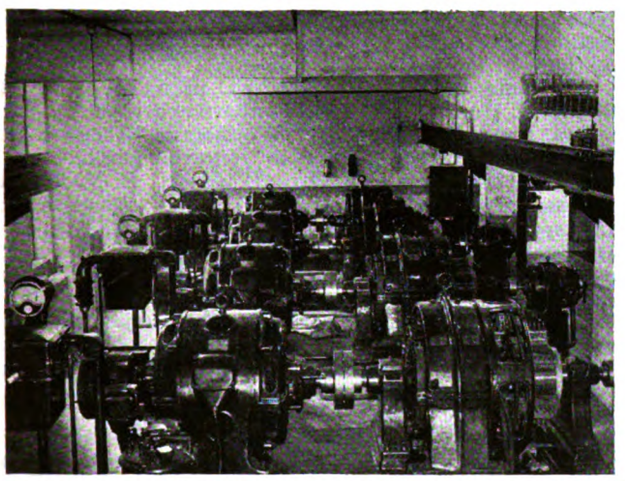
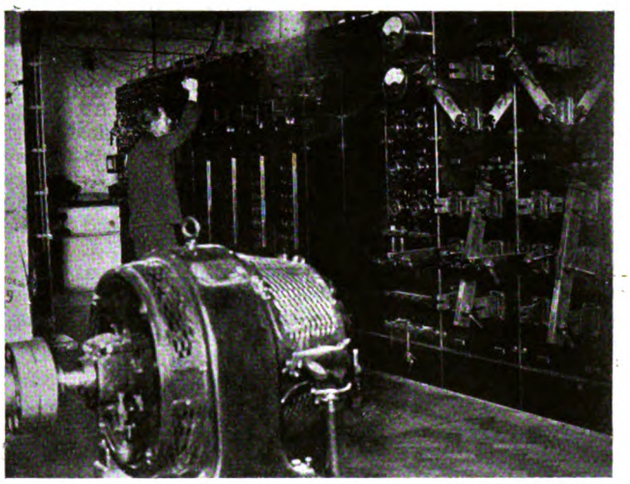
ELECTRICAL NEWS OF THE WEEK IN PICTURES.

Mr. A. H. Allen, whose funeral took place on Monday, at the Forest Hill New Cemetery, London. The names of electrical friends who were present are given on page 244.

The Shropshire, Worcestershire and Staffordshire Electric Power Co. has embarked on a comprehensive series of electrical exhibitions, designed primarily to promote the general use of electricity in rural areas. The first of these was held last week at Bridgnorth, and a section of the exhibit is shown above.





To those whose knowledge of automatic telephone exchanges is limited to their use, the two pictures above of the Wood Street, London, exchange, now nearing completion, are likely to yield something of a surprise. Though it is not generally realised, the equipment installed in such an exchange is considerable, and, as evidence of this, the left-hand picture shows the plant installed for battery charging, with the switchboard for controlling such plant on the right.

Fifty years ago, Werner von Siemens showed at the Berlin Trade Exposition what is believed to be the first electric "train." The "carriages" were pulled by a comparatively small vehicle over a railroad, and, as may be seen from this illustration, at least eighteen persons could be carried.

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A NEW READING LAMP.

A NEW adjustable type reading lamp has been introduced by Falk, Stadelmann and Co., Ltd., 83/93, Farringdon Road, London, E.C.1. The lamp has a carefully proportioned green-cased opal parabolic reflector which focusses the filament of

The new reading lamp which has been introduced by Falk, Stadelmann and Co., Ltd.

a gasfilled lamp, thereby tending to add to the primary candle power developed. The prevailing style of reading lamp, with a channel reflector, is claimed by the makers of this new lamp to be ineffective when used with a gasfilled lamp, in that the thin arc of light given by the incandescent filament is in the wrong position to obtain full service. The new lamp is made with three adjustments, securing maximum flexibility, so that at whatever angle the rays may be projected, they are screened from direct contact with the eye. This flexibility is given by adjustment at the juncture of the base and the arm, at the saddle sustaining the shade carrier, and at the swivel immediately above the saddle.

The lamp is supplied complete with green-cased opal shade, 3 yards of flexible cord, pushbar lamp-holder and bayonet lamp-holder connector; it is obtainable in polished brass, or oxidised copper.

LORD BIRKENHEAD.

Relation of Cost of Energy to Industrial Prosperity.

LORD Birkenhead has announced his acceptance of the chairmanship of the Greater London and Counties Trust, the subsidiaries of which include a number of British electricity supply companies. In his statement accepting the position, Lord Birkenhead said: For some time I have been giving my attention to the possibilities of the development and use of electricity in England, and in consequence I have become aware of the beneficial effect which a cheap and abundant supply will have upon increased productivity, employment and wage-earning capacity.

The organisation with which I have decided to associate myself is British, although associated with the Clarke interests in the United States. Its board of directors is, and will remain, British, and it is not tied to any manufacturing organisation. It is not interested in any respect in the purchase of American or other foreign materials or machinery, and its purchases will result in the employment of British material and labour, and its entire staff is, and will remain, British.

So far as finance is concerned, this has been found up to the present almost entirely through the Clarke interests in America, but the broad policy of the trust is to obtain money in the cheapest market, and it is within its province to obtain funds in Great Britain if it is possible to do so at a cheaper rate than elsewhere. The question as to the desirability of the use of American capital in England has been traversed by Parliamentary Committees, which have approved of the principle, and those competent to judge have invariably expressed the opinion that the use of such funds in the manner indicated is in the best national interests.

N.E. COAST EXHIBITION.

Details of Illumination Scheme for Buildings and Grounds for the May Show.

A FULL scheme of illumination for the buildings and also the grounds of the North-East Coast Exhibition has been prepared by the consulting engineers, Messrs. Mountain, Wood and MacLean, Newcastle-upon-Tyne. The outside lighting includes the use of the decorative pillars for the Main Avenue and Grand Court. In addition, there will be a scheme of floodlighting the whole of the walls of the Palace of Engineering, the Palace of Industries and the Towers. There will also be an illuminated fountain in the Main Avenue, arranged for a very ingenious colour changing scheme.

Through the kindness of Sir Charles A. Parsons two searchlights are being loaned to the exhibition authorities, and these will be installed on the top of the Towers, their powerful lights showing over a considerable distance. For the general illumination of the buildings and outside lighting, something like 10 000 lamps will be required apart from the large number in the amusement park. The lamps in the grounds and pillars will be of variegated colour, and the floodlighting is arranged to give a variation in colour on the columns of the buildings. A large coloured illustration showing some of the lighting effects will shortly be exhibited in one of the windows of the Newcastle-upon-Tyne Electric Supply Co. An artist's impression of what the exhibition will look like is given on page 243.

JOHN BENN HOSTEL.

Names of Winners of Electrical Prizes.

WE give below names of the winners of those prizes which were offered by electrical firms in connection with the John Benn Hostel Ballot. It will be remembered that competitors were asked to place a dozen favourite sports and pastimes in the most popular order.

The names of winners of electrical prizes are:—Mr. Otho Bromfield, Huntly, N.B.—three-valve wireless set, by JOSEPH LUCAS, LTD.; Mrs. Partons, "Westbourne," Chantry Road, Moseley, Birmingham—"Servac" electric cleaner, by the WHOLESALE FITTINGS CO., LTD.; Mrs. K. E. Wright, 255, Marshalls Cross Road, St. Helens, Lancs.—"Amplion" cone loud speaker, by GRAHAM AMPLION, LTD.; Mr. Wm. Leach, 41, Stenhills Crescent, Runcorn—"Threesome" receiving set, by the EDISON SWAN ELECTRIC CO., LTD.; Mr. W. J. Smith, 45, Worple Avenue, Isleworth, Middlesex—standard lamp, by FALK, STADELMANN AND CO., LTD.; Mrs. Respindo Lovewell, 50, Chantry Road, Moseley, Birmingham, and Mr. W. Davies, 68, Parkhill Road, Hampstead, N.W.3—each a "Gecophone" loud speaker, by the GENERAL ELECTRIC CO., LTD.; Mr. Audrey Wastie, Long Handborough, Oxford, and Mr. W. Fendith, Gas Works, Hemel Hempstead—each an "Xcel" toaster and kettle, by the AUTOMATIC TELEPHONE MANUFACTURING CO., LTD.; Mr. J. A. Gibson, 4, Hawthorns Terrace, Newcastle-on-Tyne—"A. E. G." heating pad and bottle, by the A. E. G. ELECTRIC CO., LTD.; Mr. R. J. Sivers, 27, Lower Teddington Road, Hampton Wick—"Ever-Ready" searchlight, etc., by the EVER-READY CO. (GREAT BRITAIN), LTD.; Mr. Wm. Lawrence, 172, Mill Lane, Sutton, St. Helens—electric bowl fitting, by the NICO LIGHT CO., LTD.; Mrs. D. Burton, Xela, Church Lane, Oxted, Surrey, Mr. R. E. Phillips, Janark Cottage, Thames Ditton, Surrey—each an "Xcel" electric iron, by SIEMENS ELECTRIC LAMPS AND SUPPLIES, LTD.

A complete list of prize winners was published in the "Daily Telegraph" on Wednesday.

COIL WINDING.

With the knowledge of the fact that the firm of H. CLARKE AND CO. (MANCHESTER) LTD., of Old Trafford, Manchester, has already for years been winding and making the well-known "Atlas" plug-in coils for the radio industry, it is not difficult to see why this concern has recently added to its accomplishments, windings for the electrical and other trades. The works are replete with modern machinery for winding coils on the cotton interwoven principle; also no-volt and overload release coils. Shunt coils, series resistances, chokes, medical coils, ignition coils, coils for bells and magnetos and wireless transformers are also wound. At present they are well situated for giving quick delivery of any windings in which the home and export trades may be interested.

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COMPANY NEWS.

Clarke, Chapman and Co.'s Increased Dividend—London Supply Companies' Reports—Greater London and Counties Trust—Proposed Transfer of Aluminium Corporation's Hydro-Electric Works—New Companies.

THE reaction in General Electric shares has continued, and the price has dropped a further five shillings to 62s. 6d. W. T. Henley's and Johnson and Phillips' ordinary are each half-a-crown down, at £6 and 38s. 9d. respectively. Ever Readies have regained the 1s. 3d. lost last week, and Thomson-Houstons have improved 6d. to 23s. 6d.; but English Electric preference at 9s. 4½d. show a fall of 7½d. British Electric Traction issues and Metropolitan Tramways 5% debentures have moved up. Buying of County of London Electric ordinary has caused a rise of 4s. 6d. in these shares; and Charing Cross and London shares also show some improvement.

Last Annl. Divd.	Description.	This Week.	Last Week.	1926 to 1928. Highest.	Lowest.
%	**Electricity Supply.**				
(d)	Brompton & Kensington Ord. ..	27/-	27/-	35/6	23/9
4	Central Elec. Sup. 4% Deb. ..	93	93	95½	88½
(a)	Charing Cross Elec. Ord. (£1) ..	26/6	26/-	51/-	24/3
4½	" " " 4½% C.P. (£1)	17/6	17/6	18/3	16/6
(a)	Chelsea Elec. Sup. Ord.	27/-	27/-	45/3	24/-
10	City of Lond. Elec. L'ting Ord. ..	31/10½	31/10½	52/10½	26/-
6	" " " " 6% C.P. ..	23/-	23/-	24/3	21/6
7½	County Lon. Elec. Sup. Ord. ..	56/-	51/6	68/6	25/9
6	" " " 6% C.P. ..	23/-	23/-	24/-	21/3
(c)	Kensington & K'bridge Ord. (£1) ..	27/-	27/-	27/6	23/9
(b)	Lon. Elec. Sup. Ord. (£1)	27/6	26/6	37/6	23/-
9	Metro. Elec. Sup. Ord.	46/3	46/3	53/-	24/9
4½	" " " 4½% C.P. ..	17/6	17/6	18/3	16/3
7½	N'castle & Dis. Elec. Ltg. Ord. ..	28/1½	28/1½	31/9	17/6
6	N'castle-upon-Tyne Elec. Sup. Ord.	26/3	26/10½	30/3	19/3
6	N. Metro. Elec. 6% C.P.	23/-	23/-	23/9	20/10
6	Notting Hill 6% C.P. (£10) ..	10½	10½	11½	9½
(e)	St. James' & P.M. Ord. (£1) ..	27/6	27/6	28/6	23/6
1/4½	Shrops. Worcs. & Staffs. Power B. Or.	37/6	37/6	37/6	21/4
(f)	W'minster Elec. Sup. Ord. (£1) ..	27/-	27/-	52/9	24/-
4½	" " " 4½% C.P. (£1)	17/6	17/6	17/10½	16/7½
8	Yorks. Elec. Power Ord.	36/6	36/6	38/9	24/6
6	" " " 6% C.P. ..	24/6	24/6	26/9	20/7
	Railways and Tramways.				
8	Brit. Elec. Trac. Pfd. Ord. Stk. ..	128	126	152½	117
6	" " 6% Pf. Stk...	128½	127½	133	103½
4	Cent. Lon. Ry. Ord. Stk. (asstd.) ..	73	73	72	54
4	" " " 4% Deb.	81	81	83	77½
4	City & S. Lon. 4% Perp. Deb. ..	79½	79½	81	76½
4	Lon. Elec. Rly. Cons. Ord. Stk. ..	75½	75½	75½	42½
4	" " " " 4% Pf. Stk.	75	75	77	68
4	" " " 4% Deb. ..	80	80	83	76½
5	Lon. & Sub. Trac. A. Deb. ..	97½	97½	97½	74
4	Lon. Un. Trams, 1st Deb.	61	61	63	39
4½	Met. Elec. Trams, 4½% Deb. ..	70	70	73½	62
5	" " 5% Deb...	69½	67½	70½	65½
3	Met. Rly. Cons. Ord. Stk.	65	65	81	54½
3½	" " " 3½% Pf. Stk. ..	65	65	67	60½
3½	" " " 3½% Deb. ..	71	71	73½	67½
4	Met. Dis. Rly. Ord. Stk.	80½	80½	77½	52½
4½	" " " 4½% 1st Pref. ..	82½	82½	84	74½
6	" " " 6% Perp. Deb. ..	116½	116½	118½	110
4	S. Met. Elec. Trams, 4% Deb. ..	70	70	70	64½
5	Underground Electric Rlys. Ord.	25/6	25/6	28/2	11/-
—	Yorks. (W.R.) Trams, Ord. ..	5/-	5/-	16/-	3/-
4½	" " " 1st Deb. ..	59	59	78	60
	Electrical Manufacturing.				
7	Brit. Elec. Transformer 7% C.P. ..	15/-	15/-	19/10	4/6
15	Brit. Insulated Cables Ord. ..	96/3	96/3	86/3	56/-
6	" " " 6% C.P. ..	22/6	22/6	23/10	21/-
7	British Thomson-Houston Pref. ..	23/9	23/3	24/9	19/7
7	" " " 7% Deb.	104½	104½	109½	102½
10	Brush Electrical Ord.	28/9	28/9	30/9	24/-
15	Callender's Cable Ord.	86/3	86/3	91/3	66/-
6½	" " 6½% C.P. ..	25/-	25/-	25/9	22/-
7½	" " 7½% B. Pref. ..	27/6	27/6	28/3	25/-
8	Crompton-Parkinson 8% Cum. Pf.	25/7½	25/7½	27/-	14/-
6	" " 6% Cum. 2nd Pf.	19/-	19/-	19/6	9/7
7½	Edison Swan Elec. Ord. (1st Pref., ..	25/7½	25/7½	13/-	7/4½
5	" " " 1st Deb Stk...	86½	86½	92	81½
7½	Elec. Construction Ord.	23/9	23/9	32/6	23/6
7	" " 7% C.P. ..	22/6	22/6	22/9	21/-
—	English Elec. Ord.	8/9	8/9	15/9	5/-
6	" " 6% C.P. ..	9/4½	10/-	18/9	7/-
7	Ericsson Telephones 7% Pref. ..	18/9	18/9	22/7½	17/6
35	Ever Ready (Gt. Britain) Ord. ..	25/6	24/3	92/3	18/1
6	Ferranti 6% Pref.	19/-	19/-	19/4½	16/9
7	" 7% 2nd Pref.	19/-	19/-	19/3	13/9
10	General Elec. Ord.	62/6	67/6	46/6	26/6
‡25	W. T. Henley's Ord.	120/-	122/6	120/-	69/3
12½	Johnson & Phillips Ord.	38/9	41/3	67/11	34/-
7½	Lon. Elec. Wire & Smith's Pref. ..	23/9	23/9	25/-	22/3
7½	Siemens Bros. & Co. Ord.	30/-	30/-	36/6	24/9
10	Telegraph Const. Ord. (£12) ..	25½	25	30½	20
	Telegraph.				
3½	Anglo-Am. Tele. Ord. Stk... ..	61½	61½	63½	56½
10	Eastern Ord. Stk.	264½	267½	273	135
3½	" 3½% Pref. Stk.	68½	68½	70½	59
4	" 4% Deb.	79½	79½	81½	74
10	Eastern Extension Ord. (£10) ..	26½	27	27½	14
22	Gt. Northern Telegraph (£10) ..	33	33	43½	26
10	Indo-European (£25)	54½	54½	48½	30
20	Marconi's Wireless T. Ord. ..	78/9	78/9	84/4	12/-
12½	" Int. Mar.	75/-	72/6	90/-	16/6
20	Western Tel. Ord. (£1)	26½	27	27½	12½

(a) 1s. 7½d. per share. (b) £8 8s. 6·66d. per cent. (c) 1s. 6·949d. per share.
(d) 1s. 8·706d. per share. (e) 1s. 9·3d. (f) 1s. 0.912d. (g) 1s. 7·223d.
‡ Including 1s. bonus.

MATHER AND PLATT, LTD.—Div. on ord. shs. of 10% p.a. and bonus of 5%, both tax free, are recommended, makg. 15%. Fwd. £108 006.

CHISWICK ELECTRICITY SUPPLY CORPORATION, LTD.—Fin. div. 8½%, making 16% for year 1928 (same as previous year). To depreciation res. £16 000. Fwd. £2 653.

PYE RADIO, LTD.—This co. invited subscriptions on Tuesday for an issue of 150 000 8% cum. participatg. pfd. ord. of £1 ea. and 150 000 dfd. ord. shs. of 1s. ea.

CHARING CROSS ELECTRICITY SUPPLY CO., LTD.—Fin. div. on ord. shs. of West End undertakings of 10 1/16d. p. sh., less tax, is announced, making standard div. for past year.

CLARKE, CHAPMAN AND CO., LTD.—Net pft. for 1928, £82 519, agst. £53 681. Fin. div. on ord. shs. 7%, makg. 10% for year, agst. 7%. To res. £10 000, agst. nil. Fwd. £16 548, agst. £7 022.

BERLIN ELECTRICITY SUPPLY CO.—An issuing syndicate in New York last week offered for subscription a £3 000 000 loan in 6½% sinkg. fund debentures for this co. The price of issue was 93½.

LONDON ELECTRIC SUPPLY CORPORATION, LTD.—Fin. div. for 1928 of 3% (or 3s. p. sh.) on 6% £5 pref. shs., makg., with intm. div. paid on Sept. 1, 6% for year, less tax. Fin. div. for 1928 of 5% (or 1s. p. sh.) on £1 ord. shs., makg., with intm. div. paid Sept. 1, 9% for year, less tax.

MERSEY RAILWAY CO.—Receipts for 1928, £227 780, expenditure £144 428. Addg. miscellaneous receipts, £9 899, and deducting miscellaneous charges £10 135, leaves net rev. £83 116, to wh. is added £2 961 blce. from last acct. Int. on deb. stks. £55 057, to gen. res., £2 000, div. on 3% perpetual pref. stk., £19 472, leavg. blce. £9 548. Div. of ½% recommended on con. ord. stk., fwd. £2 487.

FERDINAND SCHUCKHARDT TELEPHONE AND TELEGRAPH WORKS, BERLIN.—It is announced in the Berlin papers that the Ludwig Blattner group, of London, has acquired control of the Ferdinand Schuckhardt Works, with the object of bringing the shs. into a new Anglo-German co., the object of which is to exploit Dr. Stille's patents for "the fixatn. and reproductn. of acoustic happenings on steel material."

NORTH METROPOLITAN ELECTRIC POWER SUPPLY CO.—Net rev. for 1928, £374 621, plus £19 042 brt. in. After deductg. mtge, deb. stk. and other int., £37 506, and placing to res. fund for 5% mtges. £2 000, to redemptn. fund for 5½% deb. stk, £8 750, and to gen. res. £120 705, blce. was £224 702. Divs. proposed on 6% cum. pref. shs. for year and 10% on ord. shs. for year (of which 4% has already been paid), will absorb £196 500. Fwd £28 202.

J. G. WHITE AND CO., LTD.—It is announced that the control of J. G. White and Co., Ltd., has been transferred to J. G. White and Co., Inc., of New York, the latter co. having acquired more than 95% of the sh. cap. J. G. White and Co., Ltd., was registered in 1900, and has carried out many large constructional engineering contracts at home and abroad, including the laying of a large part of the London County Council's electric conduit system of tramways.

WESTMINSTER ELECTRIC SUPPLY CORPORATION, LTD.—Rpt. for 1928 states that blce. brt. fwd. from last acct. was £35 551, makg., with blce. from net. rev. acct., £193 205. Int. divs. to June 30, 1928, absorbed £54 354, leavg. £138 851, out of wh. div. on 4½% pref. shs. to Dec. 31, 1928, required £12 375. Directors recommend payment to ord. shhldrs. of 13·12d. p. sh., makg., with intm. div. of 8d. p. sh., standard div. of 1/19·12d. p. sh. To special res. fund (ord. shhldrs., proportn. of consumers' benefit for 1926, 1927 and 1928), £28 609. Fwd. £29 022.

GREATER LONDON AND COUNTIES TRUST.—The Utilities Power and Light Corporation (U.S.A.) announces that it has acquired, through the Greater London and Counties Trust, the entire capital stocks of the (1) Bedfordshire, Cambridgeshire and Huntingdonshire Electricity Co.; (2) Cookham and District Electric Corporation; (3) East Anglian Electric Supply Co.; (4) Edmundson's Electricity Corporation; (5) Oxford Electric Co.; (6) Wessex Electricity Co., and (7) Western Electricity Supply Co., besides substantial interests in other British power companies. It is also announced that Lord Birkenhead has notified his acceptance of the chairmanship of the Greater London and Counties Trust.

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AEONIC RADIO, LTD.—Statutory rept. states that total number of shs. allotted is 1 800 000. Of these 1 150 000 have been subscribed for at par, and blce. 650 000 allotted as fully paid. Total cash received in respect of shs. issued wholly in cash £114 733. Receipts and paymts to Jan. 31, 1929: receipts from shs., £114 733; amts. received in respect of shs. not allotted, £36 491; total, £151 224. Paymts., to vendors in respect of purchase of business and assets of J. L. Gottlieb and Co. and Aeonic Wireless Co., £15 000; to vendors in respect of stk.-in-trade, £25 000; prelim. exs., £15 000; issuing house fee, £3 000; brokerage, £279; underwritg. commissn., £5 750; on account of bldgs. and extens., £5 037; applicatns. repaid in respect of shs. not allotted, £36 491; transfer to tradg. acct., £14 680; blce. at bank, £30 986; total, £151 224. Prelim. exes. total £24 029.

YORKSHIRE (WEST RIDING) ELECTRIC TRAMWAYS CO., LTD.—Operatn. for 1928 resulted in net income, again includg. whole of pft. earned by West Riding Automobile Co. (less £473 carried fwd.) £28 133. Dividend of 6% p.a., less tax, on 6% pref. shs. absorbs £11 102, reinstatemt. of roadway after abandonmt. of tramways (Castleford sectn.) £4 876, and provisn. for expired cap. outlay (depreciatn.) £11 144, leavg. to be carried fwd. £1 010. Bad trade in area served by co. has operated adversely during year, and receipts from tramway passengers show decrease of £9 000, compared with 1927. Fare reductns which were made in Oct., 1927, have also largely contributed to this result, but directors were, and are still, of opinion that such fare reductns. were inevitable. Profit from co's. investmt. in West Riding Automobile Co. is much less owing to tax on petrol imposed on May 1st, 1928.

NORTH WALES POWER CO., LTD.—The co. has provisionally agreed to purchase the Aluminium Corporation's hydro-electric plant at Dolgarrog, at a total price of £500 000, made up of £350 000 in cash and the surrender of £150 000 of "C" debs. in the Aluminium Corporation held by the North Wales Power Co. A mtg. of the power co. will be held to-day (Feb. 22) to consider a resolutn. to reduce cap. from £1 000 000 to £808 059 by reducg. nom. value of each of the issued ord. shs. from £1 to 10s. It is also proposed that the 8% "B" debs. be purchased or redeemed, that all arrears of the 8% fixed cum. pref. div. on the pref. shs. shall be cancelled, that the pref. shs. be subdivided into two shs. of 10s. each, that resultg. shs. be converted into ord. shs. of the same denominatn, and that the authorised cap. shall then be increased to £1 000 000 in 2 000 000 shs. of 10s. each. A mtg. of the hldrs. of the 1st debs. of the Aluminium Corporation, Ltd., will be held on March 11 to consider a resolutn. sanctiong. the sale of the Corporation's hydro-electric undertakg. to the North Wales Power Co., Ltd., on the above-mentioned terms. The circular accompanyg. the notice conveng. the Corporation's mtg. states, *inter alia*, that the extensive developmt. of the power co.'s hydro-electric works at Maentwrog has placed that co. in such a positn. that in the near future it may not need to take further supplies of electrical energy from the Aluminium Corporation. This would deprive the Corporation of the profitable outlet for the sale of the main portn. of its electrical energy.

Company Meetings.

WEMYSS AND DISTRICT TRAMWAYS CO., LTD.—At a recent meeting in Edinburgh, the shareholders unanimously approved the Provisional Order promoted for the ensuing session of Parliament to restrict the alleged unfair omnibus competition along the tramway route.

SIMMS MOTOR UNITS, LTD.—At an extraordinary general meeting last Friday, the shareholders approved unanimously resolutions to increase the capital to £350 000 by the creation of 100 000 £1 preference shares. The entire issue is offered to the ordinary shareholders by way of rights.

BRITISH RADIO GRAMOPHONE CO., LTD.—Sir Ernest E. S. Bell, presiding at the statutory meeting on Monday, said the results obtained up to the present were very satisfactory. They had been fortunate in taking over the Peto Scott Co., Ltd., and the New Times Sales Co. as going concerns. The Peto Scott Co.'s sales during the two months following the issue had been 70% above those for the corresponding period a year ago. Mr. W. Scott Worthington, managing director, said the company already had a wide range of radio receivers, radio gramophones and electrical reproducing gramophones, varying from £10 to 165 guineas, and they had in production a new model radiogramophone operating off electric mains, that would sell at a popular price. They had been approached by a concern which proposed to float a company to open shops around London and handle the whole of the British Radio Gramophone Co.'s products.

UNIVERSAL GRAMOPHONE AND RADIO CO., LTD.—The statutory meeting of this company was held recently, Sir Louis A. Newton presiding. The company was established for the exploitation of the Racon Exponential Gramophone horn, the Murkham electrical pick up and the manufacture of gramophone and radio instruments generally. Regarding the Racon horn, Sir Louis explained that this horn, of which between four and five millions have been sold in the United States, was the only alternative to a horn constructed of wood. Exponential loud speakers for home use are being manufactured in quantity, and orders have already been booked. With regard to the Murkham pick-up, this is exclusive to the company, and negotiations are in progress with a continental company for the supply, over a period of years, of a large number of these pick-ups at a price which will give a satisfactory return to this company.

Ever Ready Trust's Good Prospects.

EVER READY TRUST AND FINANCE CO., LTD.—The statutory meeting was held on February 14th, Mr. Magnus Goodfellow presiding. The chairman said, while averse to any form of prophecy, he would like to give the shareholders such information as he properly could at that early stage in the company's history. In addressing the shareholders of the Ever Ready Co. on January 31st he was able to tell them that the Ever Ready Trust and Finance Co. had assisted the Ever Ready Co. financially in the acquisition of an interest in Lissen, Ltd., and he then expressed his opinion, which he had pleasure in confirming, that this acquisition should have far-reaching and beneficial effects both for the Ever Ready Co. and Lissen, Ltd. As the company was interested in the transaction, they might also anticipate benefits. Their company had acquired a substantial holding in the Ever Ready Co., and from this holding benefits had already been received. In several other directions they had acquired interests which should assist them in earning profits. Although the company was formed only three months ago, it had, in the board's opinion, already laid the foundations of a prosperous year.

TILLING AND BRITISH AUTOMOBILE TRACTION, LTD.—Mr. S. E. Garcke, presiding at the meeting on February 14th, said, in regard to the profit disclosed in the figures placed before the shareholders, it had to be borne in mind that the new capital was not yet fully productive, and in respect of many of the additional investments taken over in the spring a full year's dividend had not yet been received. In connection with the scheme whereby they acquired, from Thomas Tilling, Ltd., and from the British Electric Traction Co., Ltd., and others, further substantial holdings in omnibus undertakings, it was arranged to invite those companies to nominate additional directors to represent them on the board. Messrs. J. F. Heaton and R. M. Tilling, directors of Thomas Tilling, Ltd., and Mr. R. J. Howley, a director of the British Electric Traction Co., Ltd., had been appointed directors.

ALDERSHOT GAS, WATER AND DISTRICT LIGHTING CO., LTD.—At the annual meeting on January 30th, the chairman, Mr. R. W. Edwards, stated that the electricity department showed an increase in sales in "B" area during 1928 of 18·1%, as compared with 19·6% in 1927. The financial results of the Hindhead undertaking, absorbed by this company on December 20th, 1928, were not yet complete, but a full statement of the assets and liabilities would appear in the 1929 accounts. Three additional Special Orders had been deposited, and a public inquiry was held by the Electricity Commissioners on January 15th, 16th and 17th, the results of which was not yet available. The price of electricity for lighting purposes had been reduced since Michaelmas, 1927, by four-fifths of a penny per kWh, which included 3d. per kWh, operative from the last quarter day's meter readings and for all other purposes from midsummer, 1927, one and three-eighths pence per kWh, which included one-eighth of a penny per kWh operative also from the readings of the meters for Christmas last. It was hoped to make further reductions from midsummer, and again such reductions would be applicable to added areas.

ÆONIC RADIO, LTD.—Ald. Sir William Kay, presiding at the statutory meeting on February 14th, said the net profit up to February 7th was over £35 000. That profit dated from November 1st last, but it was not until the middle of December that they had the benefit of the new capital. Their increased factory space would be available in a few days, and they expected to have it in full working order by March 1st. The directors saw that even this increased space would not be

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sufficient to cope with the flow of orders, and further contracts were entered into with Messrs. J. Jarvis and Sons, Ltd., to again double the space available, making four times its original size, and this would, he hoped, be completed by May 1st. When this work was completed they would be able to employ from 1 500 to 2 000 hands at the Cromer Street service depot and the works at Horley. The company's product was of entirely British manufacture, and up to now had no components or accessories other than British. The directors were considering the advisability of manufacturing their own valves. They had already been approached by some of the leading old-established radio firms who were anxious to merge their interests with those of the company.

FIFE TRAMWAY, LIGHT AND POWER CO., LTD.—Mr. William Low presiding at the recent annual general meeting, said on the power and light ng side of the business, which had contributed approximately 65% of the total trading profit, the improved results were attributable to the steps which had been taken to develop the outlying districts of the area of supply, and to popularise the use of electricity by domestic consumers. Additional sections of the tramway tracks in the Dunfermline and Falkirk districts had been reconstructed and doubled, and, except for a short closing length between Halbeath and Crossgates, which would be proceeded with in due course, the main Dunfermline-Cowdenbeath route and the whole of the Falkirk tramway route had now, at considerable expenditure, been completely relaid in the most modern form of construction. The gross receipts of all the properties for 1928 totalled £421 648, an improvement of £80 000, and a record in the company's history. The net trading profit of £127 004 represented an improvement of £22 619 over the previous year. The directors' report and accounts were adopted, the dividend on the preference shares was confirmed, and the dividend on the ordinary shares at the rate of 4% per annum, less tax, was approved.

New Companies.

DOREE, LTD.—Cap., £800. Manufacturers of and dealers in lighting shades, lighting specialists, etc. Reg. office: 91, Minories, London, E.1.

ORMOND BRASSFOUNDRY, LTD.—Cap., £800. Brassfounders, manufacturers of and dealers in electric light fittings, etc. A director: W. Horton, 50, Claremont Road, Handsworth, Birmingham.

IBBOTSON BROTHERS (ROTHERHAM), LTD.—Cap., £500. To acquire business of electrical and general dealer now carried on by F. Ibbotson at East Dene Garage, Doncaster Road, Rotherham, as "Ibbotson Brothers."

M.E.D.A.S., LTD.—Cap., £3 150. To acquire business of electrical, radio, lighting and heating engineers carried on by A. C. L. Oovell and D. J. Quenzer, at 185, Hammersmith Road, W., as the Modern Electrical Development and Supply Co.

WINTONES, LTD.—Cap., £100. Manufacturers, buyers and retailers of sound-producing instruments, wireless receiving sets and apparatus, and electrical goods, electrical and wireless engineers, etc. Reg. office: 67, Westcliff Park Drive, Westcliff-on-Sea.

CHELMSFORD RADIO, LTD.—Cap., £1 350. To acquire business of dealers in wireless apparatus and electrical goods carried on by H. J. Hawkes and D. C. Clark at 76, Duke Street, Chelmsford, as Chelmsford Radio Co. Reg. office: 76, Duke Street, Chelmsford, Essex.

MOVING COLOUR SIGNS, LTD.—Cap., £500. To acquire an invention for improvements in or relating to advertising apparatus, to carry on business of manufacturers and sellers of advertising signs, moving and otherwise, etc. Reg. office: 12, Spring Street, Paddington, London, W.2.

CRYPTOCODE MACHINE SYNDICATE, LTD.—Cap., £10 000. Manufacturers of and dealers in automatic, electrical, mechanical or other apparatus, machines, implements or other means used in connection with codes, codification, other secret forms of communucation or similar processes, etc. Solicitor: S. Sebbs, 7/8, Great Winchester Street, London, E.C.

LEAD MARKET REPORT.

The market opened last week with a firm tone, and, according to James Forster and Co., up to £23 6s. 3d. was paid for February and £23 5s. for forward. On Wednesday a setback occurred of 8s. 9d. per ton, but the following day the market firmed up again, February advancing 2s. 6d. and May 5s. per ton from the bottom prices of the week. The backwardation ruling at the end of last week has been replaced by a contango of 2s. 6d. per ton. Firm conditions prevail in the U.S.A., where the leading interests advanced their price on February 11th by 6·85 cents per lb.

Closing prices on February 15th were £22 18s. 9d. for February, £23 for March, and £23 1s. 3d. for April and May, 3s. 9d. lower or unchanged on the week.

YORKSHIRE POWER CO.

Orders for New Areas—The Mid-East England Scheme.

THE 37th ordinary general meeting of the Yorkshire Electric Power Co. was held in Leeds, on Tuesday, February 19th, with Mr. Arthur G. Lupton in the chair.

The chairman said: The number of units sold in 1928 have increased by about 8% to a total which constitutes a record. The demand for bulk supplies continues to grow. Orders are being asked for with powers to supply in parts of the counties of Derby, Lincoln, Nottingham, and in the East Riding of Yorkshire, which will increase the use of the company's mains and the services the company can render to the areas concerned. These districts adjoin the company's existing area of supply, and if the powers are granted the present mains of the company can at once be readily extended to supply the new areas.

These areas are mainly of an agricultural character, and it is our view that rapid developments can best be obtained by entrusting them to a supplying authority which is already established, rather than by forming a new organisation.

There must always be unavoidable delay if a new company has to be formed, and our own experience shows how long a period is required for the obtaining of sufficient capital for such a purpose.

Throughout the year extensions of mains, both high and low pressure, have been going forward, to meet growing demands and to improve the facilities of supply.

We have heard that there is a tendency for industry to migrate to the South of England, but I think that if those who are proposing to establish new works will consider the many advantages of the West Riding they will be less disposed to establish factories in places where coal and electricity are dearer and where the facilities of rail, road, and river for transport are so much less than they are in our highly developed area.

The Central Electricity Board have just issued their "Mid-East England Electricity Scheme," which provides that the three stations of the company shall be "selected stations," and that of the five "base stations" two will be our stations at Ferrybridge and Thornhill. It is too early yet to say more than this, but there is no doubt that the work of the company in past years in extending supply over the wide area entrusted to them by Parliament has materially assisted to simplify the problem of supply in the area with which the Board has to deal.

The company's future development will be made in the knowledge of the Board's requirements under the scheme, and with every desire to assist the Board in developing the supply of electricity in the area in the most rapid and efficient manner.

METAL AND CHEMICAL PRICES.

TUESDAY, February 19th.

		Price.	Inc.	Dec.
Copper—				
Best Selected ..	per ton	£81 5 0	—	15s. 0d.
Electro Wirebars	,,	£84 10 0	—	—
H.C. Wires, basis	per lb.	11¾d.	—	—
Sheet	,,	11¾d.	—	—
Phosphor Bronze—				
Wire (Telephone) basis	per lb.	1s. 2¾d.	—	—
Brass 60/40—				—
Rod, basis ..	per lb.	8¾d.	—	—
Sheet ,, ..	,,	10¾d.	¼d.	—
Wire ,, ..	,,	10¾d.	—	¼d.
Pig Iron—				
Cleveland Warrants	per ton	£3 9 6	1s. 0d.	—
Galvanised Steel Wire, basis 8.S.W.G. ..	,,	£14 15 0	—	—
Lead Pig—				
English	per ton	£24 10 0	—	5s. 0d.
Foreign or Colonial	,,	£23 2 6	—	2s. 6d.
Tin—				
Ingot	per ton	£220 17 6	—	£3 15 0
Wire, basis ..	per lb.	2s. 10¼d.	—	¼d.
Aluminium Ingots	per ton	£95 0 0	—	—
Spelter	,,	£26 2 6	—	—
Mercury	per bottle	£22 5 0	—	—

Sulphur—Flowers, Ton £12 0 0 Roll ,, £10 10 0
Copper Sulphate ,, £25 to £25 10 0
Boric Acid (Crystals), ,, £30 0 0
Rubber—Para fine, 1s. 1d.; plantation, 1st latex, 1s. 0¼d.

Sulphuric Acid—(Pyrites, 168°) Ton £6 15 0
Sodium Chlorate per lb. 2¾d.
Sodium Bichromate ,, 3¼d.

∴ The metal prices are supplied by British Insulated Cables Ltd.

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COMMERCIAL INFORMATION.

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debt. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

BEAN, Mr. A. W., Eastgate, Sleaford, electrical engineer. £11 12s. 2d. January 14th.

DAVIS AND KING, Queen's Hotel Yard, Talbot Road, Blackpool, electricians. £22 16s. 2d. January 9th.

DRUMMOND, HIRST AND CO., Princess Street, Huddersfield, electrical power engineers. £10 9s. 4d. December 7th.

FREEMAN, Howard, 4, Hawarden Avenue, Liverpool, wireless dealer. £30 19s. December 20th.

LAWTON, Joseph, 83, Woolmer Road, Nottingham, electrical contractor. £21 18s. 9d. January 11th.

Bill of Sale.

FEATHERSTONE, Frank, 20, Chatsworth Gardens, and 274, High Street, Acton, trading as RADIO SPARKS, wireless engineer. Dated February 6th, filed February 11th. £50.

Private Meetings, etc.

[*Inclusion under this heading does not necessarily imply failure, Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

ATTAIX, LTD., wholesale electrical and wireless dealers, late 106, High Street, Southampton. In pursuance of the provisions of the Companies (Consolidation) Act, a meeting of the creditors was held on February 19th, when the liquidator, Mr. K. M. Scott, of Merrett, Son and Street, C.A., 32, Finsbury Square, E.C., submitted a statement of affairs showing net assets estimated to realise £7 400, and were subject to £7 347 to meet the claims of the debenture holders (the bank), totalling £7 415. There are no assets available for the unsecured creditors, whose claims aggregate £2 335. The company was registered in 1925 with a capital of £1 000, subsequently increased to £2 000, later to £7 000, and finally to £8 000. During the year to April, 1928, the sales were £9 600, with a gross profit of £1 390, but after allowing for all the expenses there was a net loss of something like £3 000. He estimated that during the eight months to December 31st last the sales were £7 000, but there was a loss of £3 000, attributed to the depreciation of the stock of wireless goods. The company had traded almost exclusively as wholesalers, and it had carried a large stock, much of which had become old-fashioned.

NEW ERA SUN-RAY CLINICS, LTD., Leicester.—The statutory meeting of the creditors in this voluntary liquidation was held on February 14th at the offices of Harry L. Price and Co., I.A., 47, Mosley Street, Manchester. Mr. Arthur T. Eaves reported that the liabilities were £260, but were likely to be increased as claims were being received in respect of treatment not given or only partly completed. In addition, there were fully secured creditors for £176 in respect of plant and machinery supplied on the hire purchase system. For the purposes of the statement, the plant and machinery was valued at the amount of the balance outstanding. The landlord had distrained for rent amounting to £30, and he was shown as fully secured for that amount. There were no assets, and the deficiency as regarded the creditors was £260. The company was only registered on November 15th last. The nominal capital was £600, and shares to the value of £300 were issued for cash. The present position was attributed largely to an article in a certain newspaper.

The creditors decided to confirm the voluntary liquidation of the company, with Mr. Eaves as liquidator.

London Gazette, etc.

Companies Winding-up Voluntarily.

MALDON ELECTRIC WORKS, LTD.—By special resolution January 22nd, confirmed February 8th, A. F. Lovell appointed as liquidator.

MARPOLE AND FRISBY. LTD. By reason of its liabilities, February 8th. F. S. Wilks, F.C.A., 31, Lombard Street, E.C., London, appointed as liquidator. Meeting of creditors in the offices of Gray, Stainforth and Co., chartered accountants, 31, Lombard Street, London, E.C.3, on Monday, February 25th, at 11 a.m.

Bankruptcy Information.

STEIN, Samuel, and STEIN, Benjamin, trading as S. STEIN AND SON, electricians, 36, Warwick Street, Glasgow, Estates sequestrated February 9th, by the Court of Session.

Notice of Dividend.

HARTIGAN, James Aloysius, and HARTIGAN, George Joseph Dominick, trading as LONDON FAN AND MOTOR CO., 81, Charlotte Street, Tottenham Court Road, London, W.1, electrical engineers. First and final dividend, 3s. 9½d. per £, payable February 20th, Poppleton, Appleby and Hawkins, 4, Charterhouse Square, London, E.C.1.

Notice of Intended Dividend.

PACIFICO, Alexander Pacy, PACIFICO, Jack Pacy, and FEITELSON, Raphael, trading as THE COMTON WIRELESS MANUFACTURING CO., 26-28, Bartholomew Square, Old Street, E.C.1. Last day for receiving proofs, February 26th. Trustee, W. A. J. Osborne, Balfour House, Finsbury Pavement, London, E.C.2.

Order Made on Application for Discharge.

HODGE, William Percy, 92, Cannon Street, London, E.C., wireless salesman. Discharge suspended for two years, until November 30th, 1930.

Bankruptcy Proceedings.

KAY (T. L.) AND CO., LTD., 6, Blake Street, York. The winding up order herein was made in November last on a creditor's petition, and according to the statement of affairs as at the 14th January, 1929, there are ranking liabilities of £4 867, against assets, subject to cost of liquidation, amounting to £892, leaving a deficiency of £3 975. The issued capital amounts to £1 902, so that there is a total deficiency, as regards contributories, of £5 877. The company was incorporated on April 24th, 1926, with a nominal share capital of £3 000 divided into 1 000 preference shares of £1 each; 1 950 ordinary shares of £1 each; and 1 000 employees' shares of 1s. each. It appears that 1 902 ordinary shares of £1 each have been issued for cash. The company acquired the assets of T. L. Kay and Co., at the price of £2 122, and took over the liabilities as at January 1st, 1926, amounting to £402. There was no sale and purchase agreement in writing. The purchase price was paid by issuing fully paid up shares to the members of the firm of T. L. Kay and Co., but it would appear that shares to the value of £1 802 only were issued, yet in the minute book the allotment of shares and the assets of T. L. Kay and Co. are expressed as being carried out by payments of cash in each case. According to the balance sheets prepared as at December 31st, 1926, and December 31st, 1927, it would appear that a profit of £450 was earned for the year ending December 31st, 1926, and for the year ending December 31st, 1927, a loss of £722 was sustained. In September of last year a private meeting of creditors was held at the office of Mr. Hugh G. Gardiner, when a statement of affairs was submitted which showed liabilities of £4 031, against assets of £989, a deficiency of £3 042. At this meeting Mr. Hugh Gardiner, accountant, of 1a, Low Ousegate, York, was appointed liquidator of the company. It would appear that the business of the company has been carried on at a very considerable loss since the date of the balance sheet prepared on December 31st, 1927, and the company has been in difficulties for some time. The gross profit earned from the formation of the company to date of voluntary liquidation amounted to £1 301.

IRWIN, Muriel, trading as the K. AND I. COMPANY, 35, Robertson Street, Glasgow, wholesale wireless apparatus dealers. At her public examination, at Glasgow Sheriff Court, this bankrupt stated that she was the sole partner in the business, but took nothing to do with it, and had only lent her name to her brother to carry on. She understood that he could not use his own name until he was discharged from the last time he was in the Bankruptcy Court. Her brother had previously carried on business under the name of Keith and Irwin, but had been unsuccessful, and had become insolvent. He had asked her permission to use her name, and she had given it. She had also assigned to him her interest in her uncle's estate, so that it could be used for the purpose of keeping the business going. She did not actually give him any money, and drew nothing whatever out of the business. The income from her interest in her uncle's estate amounted on an average to £14 per annum.

Charles Irwin, who was examined as a third party, confirmed the statements made by his sister. He stated that he signed a trust-deed in respect of his former business, under which he paid 3s. in the £ to his creditors. When he commenced the business of the K. and I. Company, which was registered in his sister's name, he borrowed £75 from friends; and the stock of Keith and Irwin was bought by Mr. John Trotter and loaned to him. He attributed his insolvency to the fact that he started with too little capital, which proved insufficient to carry stock to meet his turnover. Examined on behalf of a creditor, he stated that he understood he had no interest in his late father's estate, although he had never seen a copy of the will. A year ago he was in financial difficulties, but he carried on. He further admitted that he had received from a firm called the Rapid Company certain goods on sale or return. The goods had been sold, but not paid for. Irwin also admitted that summonses calling for return of the goods had been received on behalf of his sister, but he had taken no notice of their contents.

What it really comes to is, you fraudently represented to the general public that they were dealing with you, while it was not your business, but your sister's?

I would not say it was done fraudulently, but I admit that it looked like it. I did not do it in a fraudulent manner knowingly.

It was stated that the last balance-sheet of the K. and I. Co. showed a deficiency of £580.

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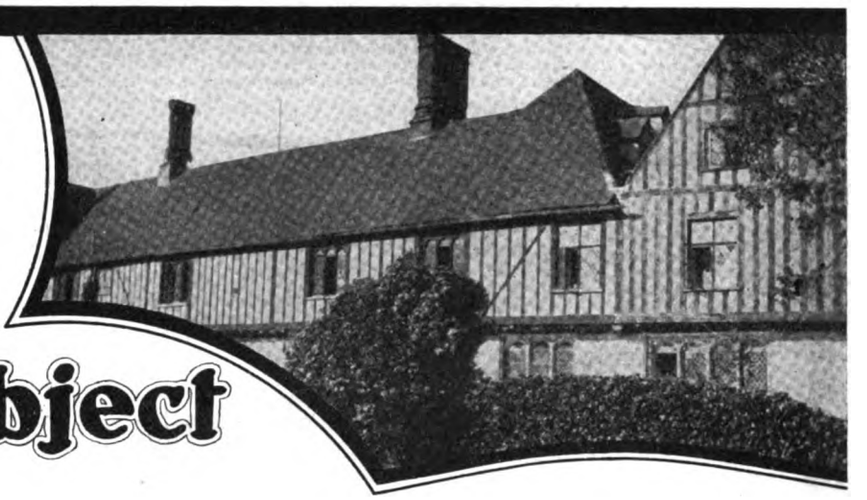
New Light on an Old Subject



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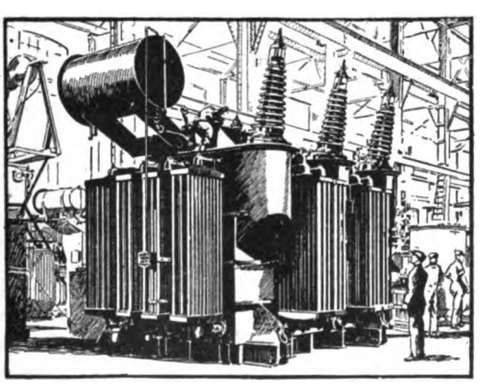
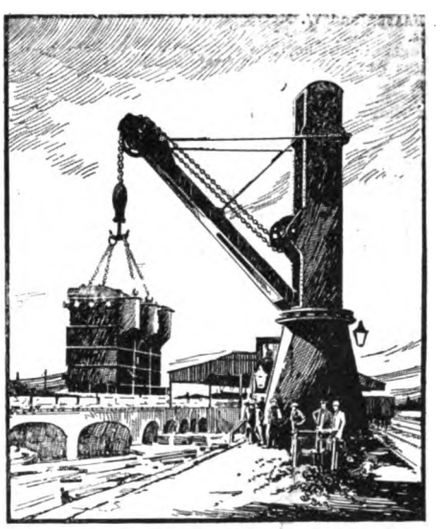
Berry Transformers

for test pressures up to 300,000 volts are now being shipped abroad in weights of the order of 60 tons.

The factory at Hayes is adapted for building all sizes and types of transformers.





The British Electric Transformer Co. Ltd. Hayes, Middlesex, England.

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PATENT RECORD.

The following information is prepared from the Illustrated Official Journal (Patents) by permission of the Controller of H.M. Stationery Office. Printed copies of full Patent Specifications, when accepted, may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at 1s. each.

Specifications Accepted.

304 432 G. E. Taylor and Electrical Furnace Co., Ltd. High-frequency coils for electric induction furnaces. (1/12/27.)
304 448 General Electric Co., Ltd., H. C. Turner and A. Sherwin. Electric switches. (30/12/27.)
304 458 Birmingham Electric Furnaces, Ltd., and A. G. Lobley. Annealing and other furnaces, muffles, and the like. (11/1/28.)
304 469 F. Casardi and R. Sarti. Receiving apparatus employed in wireless telegraphy and telephony. (19/1/28.)
283 902 Metropolitan-Vickers Electrical Co., Ltd. Electrical power systems for ship propulsion and other purposes. (19/1/27.)
283 973 Telephon-Apparat-Fabrik E. Zweitusch and Co., Ges. Telephone systems. (22/1/27.)
304 474 H. H. Berry. Electric fires or radiators. (23/1/28.)
304 483 Walker, Hunter and Co., Ltd., and J. Walker. Electrically heated ovens. (28/1/28.)
304 487 C. French. Electromagnetic apparatus for use in the reception or reproduction of sound. (31/1/28.)
304 493 E. S. Ali-Cohen. Electric cables. (13/2/28.)
288 965 Soc. des Etablissements Industriels de E. C. et de A. Grammont. Ionic valve with two anodes and two grids. (16/4/27.)
287 087 British Thomson-Houston Co., Ltd. Electric vacuum tubes. (14/3/27.)
304 511 Electrical Improvements, Ltd., and L. C. Grant. Sound reproducing horn. (15/3/28.)
288 142 Electrical Research Products, Inc. Method of and apparatus for switching reproducers from one device to another. (1/4/27.)
290 597 Soc. Anon. Hewittic and M. Demontvignier. Means for operating mercury switches. (16/5/27.)
288 289 Siemens-Schuckertwerke. A.G. Short circuit proof safety fuse cartridge with an overload lag. (9/4/27.)
288 326 Metropolitan-Vickers Electrical Co., Ltd. Electric circuit breakers. (6/4/27.)
290 281 H. Guillou. Radio-electric insulating supports. (12/5/27.)
292 139 Siemens-Schuckertwerke A.G. Electric furnaces for annealing metals. (15/6/27.)
290 297 Akt.-Ges. Brown, Boveri et Cie. Mercury vapour rectifiers. (13/5/27.
292 462 De Forest Phonofilms, Ltd. Picture projection and sound reproduction apparatus. (18/6/27.)
291 107 International General Electric Co., Inc. Transformers. (27/5/27.)
291 401 Pathe Cinema, Anciens Etablissements Pathe Freres. Incandescent electric lamps for projection apparatus. (1/6/27.)

Applications for Patents.

January 11th.

1 070 A. Joffe. Electric valves. (14/1/28, Germany.)
1 071 A. Joffe. Influencing electric currents by light rays. (14/1/28, Germany.)
1 078 J. Lucas, Ltd., and O. Lucas. Vehicle electric lamps.
1 059 Siemens-Schuckertwerke A.G. Vacuum vessels with contact devices. (12/1/28, Germany.)
1 027 C. C. B. Webb. Electric clocks, etc.
1 022 F. H. Wingrave. Luminous electric signs.

January 12th.

1 200 Benjamin Electric, Ltd., and G. Campbell. Mounts for thermionic valves etc. (31/5/28.)
1 163 British Electric Pari-Mutuel, Ltd. Totalisators, etc.
1 195 S. G. S. Dicker (N. V. Philips' Gloeilampenfabrieken). Means for measuring electric power.
1 151 C. W. Fraser and W. McGeoch and Co., Ltd. Globe fittings for electric lamps.
1 177 H. F. Joel. Controlling flow of current.
1 158 C. Lorenz Akt.-Ges. Electric train lighting systems. (26/1/28. Germany.)
1 178 S. Prob and Sunderland Forge and Egineering Co., Ltd. Electric motor controllers, etc.
1 183 British Thomson-Houston Co., Ltd. Rotors for dynamos. (13/1/28, U.S.),

January 14th.

1 283 A. Bennett. Electrical equipment for vehicles.
1 326 E. A. Beer. Wireless aerials.
1 337 O. O. F. Bergmann. Indicators for electric llghting systems.
1 316, 1 317 Brandes, Ltd. Electromagnetic sound reproducer. (12/6/28, U.S.)
1 318 Brandes, Ltd. (Brandes Laboratories, Inc.). Electromagnetic sound reproducer.
1 266 British Thomson-Houston Co., Ltd. Elastic fluid generators. (13/1/28, U.S.)
1 211 W. Brooke. Control of electric motors.
1 342 S. G. S. Dicker (N. V. Philips' Gloeilampenfabrieken). Electrical speed regulating apparatus.
1 208 H. M. Dudgeon and T. C. E. Rowland. Braking gear of electric vehicles.
1 293 C. J. Feeny (C. R. Goss). Electrical inductances.
1 252 General Electric Co., Ltd., and C. W. Stopford. Resistance elements.
1 335 C. F. Johnston. Contact breakers.
1 325 H. Leben, A. Reyrolle and Co., Ltd., and E. W. M. Scott. Electric protective systems.
1 294 D. von Mihaly. Amplifier for photo-electric currents.
1 311 W. Otto. High frequency apparatus. (14/1/28, Germany.)
1 262 Siemens and Halske A.G. Circuit diagram for supervision of power distributing installations. (14/1/28, Germany.)
1 305 Soc. Anon. des Ateliers Heuze, Malevez et Simon Reunis. Circuit breaking device. (14/2/28, Belgium.)
1 268 Soc. Anon. R. Ardigo Brevetti, I.G.S. Protective systems for underground cables. (14/1/28, Italy.)
1 683 Soc. des Etab. Ducretet. Wireless apparatus. (17/1/28, France.)
1 351 Soc. d' Etudes et de Construction d' Appareils de Telemecanique. Transmission adapted to be thrown into gear electromagnetically. (14/1/28, France.)
1 215 W. H. Tait. Device for improving mechanical properties of electro-deposited metals.
1 267 H. E. Warren. Electric clock systems. (24/1/28, U.S.)
1 336 A. West, A. West and Co., Ltd. Electrical connections.
1 337 A. West and Co., Ltd. Indicators for electric lighting systems.

January 15th.

1 467 Bergolz Bros. and Co. and F. and I. Bergolz. Receptacles for desk telephones.
1 416 British Thomson-Houston Co., Ltd., H. S. Clifford and E. D. Regis. Electrical contacts.
1 366 G. H. Nkep and Switchgear and Cowans, Ltd. Electric switchgear.
1 432 A. E. O'Dell (Deutsche Telephonwerke und Kabelindustrie A. G.). Remote control indicators. (24/10/27.)
1 389 W. Pansegrau and Ultra Heilstrahlen-Apparate A.G. Lighting device for arc lamps.
1 373 A. Reyrolle and Co., Ltd. and E. W. M. Scott. Electric protective arrangements.
1 422 F. A. Robinson. Light sensitive cells.
1 423 A. A. Thornton (J. R. A. Willey). Anti-microphonic valve holders.
1 424 A. West, A. West and Co., Ltd. Thermal switches, etc.
1 465 Western Electric Co., Ltd. (Electrical Research Products, Inc.) Sound recording.
1 385 G. P. Woodbine. Supporting shades on electric lamp holders.
1 369 A. C. Wynne. Electric couplings.

January 16th.

1 597 Automatic Telephone Manufacturing Co., Ltd., and M. O. Williams. Generation of pulsating electric current.
1 518 Benton and Stone, Ltd. and C. E. Milner. Electrical heating device for cooling water systems of engines.
1 557 British Thomson-Houston Co., Ltd. Continuous windings for electrical apparatus. (21/1/28, Italy.)
1 480 H. E. Dance. Apparatus for graphically illustrating variation in product of two sinusoidal alternating magnitudes of equal frequency.
1 571 H. C. Harrison and St. Helens Cable and Rubber Co., Ltd. Electric cables.
1 517 Highfield Electrical Co., Ltd. and F. W. Highfield. Protective means for electric motors.
1 575 A. Imhof, Trub, Tauber and Co. Device for feeding l.t. apparatus, etc. (10/8/27, Switzerland.)
1 540 C. Lorenz A.G. Synchronous transmission of movements. (17/1/28, Germany.
1 515 Metropolitan-Vickers Electrical Co., Ltd. Electric control devices. (16/1/28, U.S.)
1 549 J. R. Quain. Electric switches.
1 509 L. A. Ramsden. Electric illuminating apparatus.
1 570 Siemens-Schuckertwerke A.G. Safety device for earthed distributing systems. (3/3/28, Germany.)

COMING EVENTS.

Friday, February 22nd-Friday, March 1st.

British Industries Fair.—London and Birmingham.

Saturday, February 23rd.

Association of Mining Electrical Engineers (South Wales Branch).—Cox's Café, Queen Street, Cardiff. Annual dinner. 6.30 *p.m.*

Association of Supervising Electrical Engineers.—Hotel Cecil, Strand, London. Annual dinner.

Monday, February 25th.

Electrical Contractors' Association. (Ealing Sub-Branch).—Ordinary meeting.

Institution of Electrical Engineers (North-Eastern Centres).—Armstrong College, Newcastle-on-Tyne. Paper by Mr. R. W. Gregory on "Electric Supply to the Rural Districts of England." 7 *p.m.*

Sheffield Illumination Society.—Lecture Hall, Fargate. Lecture on America. By Mr. J. F. Colquhoun. 8 *p.m.*

Tuesday, February 26th.

Electrical Contractors' Association (Birmingham Branch).—Ordinary meeting.

Electrical Contractors' Association (Chesterfield Sub-Branch).—Ordinary meeting. Falcon Café.

University of London.—Institution of Electrical Engineers, Victoria Embankment, London. Lecture III (Course of five lectures on "High Voltage Cables" by Mr. L. Emanueli. 5.30 *p.m.*

Institution of Electrical Engineers (East Midland Sub-Centre).—College, Loughborough. Paper by Mr. J. H. R. Nixon on "Motor Converters." 6.45 *p.m.*

Institution of Electrical Engineers (North Midland Centre).—Hotel Metropole, King Street, Leeds. Paper by Mr. R. A. Chattock on "The Modern Use of Pulverised Fuel in Power Stations." 7 *p.m.*

Institution of Electrical Engineers (North Western Students' Secton.)—Engineers' Club, 17, Albert Square, Manchester. Paper by Mr. T. A. Long on "The Loading of Transformers on a Thermal Basis, with Special Reference to Temperature Indicators." 7.15 *p.m.*

Electrical Power Engineers' Association.—Junior Institution of Engineers, 39, Victoria Street, London. "Survey of Modern Steam Power Plant Practice: Station Efficiency." By F. Nicholls. 7.15 *p.m.*

Paisley Association of Electrical Engineers.—Town Hall, Paisley. Lecture and Visit: "Paisley Abbey." 7.30 *p.m.*

Tuesday, February 26th-Friday, March 8th.

Ideal Home Exhibition.—Olympia.

Wednesday, February 27th.

Batti-Wallah's Society.—Hotel Cecil, Strand, London. Luncheon. 12.30 for 1 *p.m.*

Electrical Contractors' Association (Belfast Branch).—5, Bedford Street. Ordinary meeting. 3.30 p.m.

Electrical Contractors' Association (Croydon Sub-Branch).—Ordinary meeting.

Polytechnic.—School of Electrical Engineering, 307-9, Regent Street, London. Lecture IV (Course of eight lectures) by Mr. E. S. Ritter on "Picture Telegraphy." 5 *p.m.*

Institution of Electrical Engineers (South Midland Centre).—Midland Institute, Birmingham. Joint meeting with the Midland Centres of the Institutions of Civil and Mechanical Engineers. 7 *p.m.*

Thursday, February 28th.

Institution of Electrical Engineers.—Institution, Savoy Place, Victoria Embankment, London. Faraday lecture by Mr. Ll. B. Atkinson on "How Electricity Does Things." 6 p.m.

Institute of Patentees.—Caxton Hall, Westminster. Lecture by Prof. A. M. Low on "The Future." 8 *p.m.*

Friday, March 1st.

Batti-Wallah's Society.—Hotel Cecil, Strand, London. Annual Dinner and Dance.

University of London.—Institution of Electrical Engineers, Victoria Embankment, London. Lecture IV. (Course of five lectures) by Mr. L. Emanueli on "High Voltage Cables." 5.30 *p.m.*

Institute of Transport (Manchester, Liverpool and District Section).—Midland Hotel, Manchester. Annual Dinner. 6.30 *p.m.*

Finsbury Technical College Old Students' Association.—Trocadero Restaurant, Piccadilly, London. Annual dinner. 6.30 for 7 *p.m.*

Joint Delegation of the Local (Yorkshire) Associations of the Institutions of Civil, Mechanical, Electrical, Municipal and County, Locomotive and Structural Engineers.—Great Northern Hotel, Leeds. Fourth Joint Delegation Dinner. 6.30 for 7 *p.m.*

Institution of Electrical Engineers (Meter and Instrument Section Meeting).—Paper by Mr. W. Lawson on "The Rotor Bearings of Electricity Meters." 7 *p.m.*

Saturday, March 2nd.

Royal Institution of Great Britain.—21, Albemarle Street, London. Lecture by Sir Ernest Rutherford on "Molecular Motions in Rarefied Gases." 3 *p.m.*

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THE ELECTRICIAN

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[Closed on Saturdays in accordance with the "Five-Day Week" plan adopted by Benn Brothers, Ltd., and its associated organisations.]

No. 2648. [No. 9. Vol. CII.] Friday, March 1, 1929. Annual Subscription, 25s Overseas, 30s.

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Current Topics.

The British Industries Fair.

If the notion that overseas buyers are more prominent during the first week of the British Industries Fair than in the second week has any foundation, the attendance of foreign visitors at the Electrical Section at Birmingham this year must have been very small. Although, at the time of writing, there are several days to go before the Fair closes its doors, we gather that but little export business has been secured. If we say that we are not surprised, and that we have repeatedly urged that February is a most unsuitable time for an exhibition of this kind, our vigorous support of the Fair—as it is, and not as it should be—will serve to acquit us of any unfriendly intention towards a show which may not only equal, but outshine the older and better patronised Continental trade fairs. In any case, criticisms have been specially invited by the Fair Management Committee, and it is to be hoped that exhibitors and others having views on the future conduct of the Fair will lose no time in making them known, so that prompt action may be taken in directions where changes are indicated. The all-important question of the date of the Fair, is, we imagine, not solely in the hands of the Birmingham authorities, but even if it is not, a strong demand from Birmingham for a later date could hardly be ignored by the Department of Overseas Trade, in London. The points for and against a February Fair are well known, and have been repeatedly set forth in these columns, but we may remind the February-ites that the case for a later Fair is overwhelmingly proved by the differences between the size of the steamship passenger lists in February and those in May or June.

Assuming that this big obstacle is satisfactorily disposed of, future Fairs should be made much more readily accessible to visitors. The stranger, visiting the Birmingham Fair for the first time, must needs be very keen and observant if he is to reach his goal. He cannot book straight through to the Fair by rail from London. He must, on arrival at Birmingham, take another ticket for the privilege of travelling the remaining few miles to Castle Bromwich in slow, crowded and under-heated trains. On arrival at the Fair, he must give up the portion of his invitation ticket containing the railway and 'bus time tables, and, as the invitation only holds good for one day, he must either pay 2s. 6d. for each subsequent admission, or by some devious way obtain a further supply of tickets. And when he gets inside, he finds the place thronged with members of the public on sight-seeing bent, who impede progress and divert the attention of stand staffs from legitimate nquirers.

Export Trade and Luncheons.

The most important criticism, however, is more fundamental than any of the foregoing points, important as they are. It is that—so far as the Electrical Section is concerned—the original purpose of the Fair has been lost sight of. Elaborate arrangements are made for the reception and entertainment of the numerous associations connected with the electrical industry, and electrical luncheons are held, at which platitudinous remarks about the progress of electricity are offered to people who have heard it all before. There is no mention made of overseas trade, and, worse still, there are no such organised efforts of pedestrianism and mastication arranged for the benefit of those hardy visitors who have braved the rigours of an English February in their anxiety to come and give us their orders. No doubt the electrical exhibitors are delighted to see members of the I.M.E.A. and other associations, but such visitors at an export exhibition are but poor substitutes for the foreign buyers, especially as they are all easily reached in the ordinary way by the normal sales organisations, without necessitating the expense of a fortnight's exhibition. If British electrical manufacturers wanted to attract members of British electrical associations, they could obviously do it much more easily with an electrical exhibition occupying the whole of a conveniently-placed building, instead of a corner of one that is most inconveniently situated. If the Fair is to grow on the electrical side, these domestic visits and pow-wows must be relegated to the background, and some definite and vigorous attempt made, not only to get the overseas buyers to come to the Fair, but to make them welcome when they are here.

General Election and Trade.

No business man needs to be told that General Elections are a severe hindrance to trade, but many do not seem to realise that the ill effects of this political upheaval can frequently be tempered by suitable advance planning. Mr. H. W. Roberts, in his E.D.A. Sales Conference paper, made timely allusion to the need for the adoption of extra vigorous sales methods to counteract the upsetting tendencies of the coming Election, and we hope that his reminder will not pass unheeded. Meanwhile we gather that some members of the I.M.E.A. are somewhat anxious to learn whether their Annual Convention, arranged to be held

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during the week commencing June 3rd, will clash with the Election. It is impossible at this stage to say whether it will or will not, but the uncertainty is most unsettling to the many bodies which, like the I.M.E.A., must book up accommodation and make plans for important business conferences several months ahead. If we are not careful to prevent it at the outset, this uncertainty regarding the date of the polls may be seized upon in various directions as an excellent excuse for holding up business which would normally be placed at that time. Even if "business as usual" during June is regarded as a hopeless ideal, a little extra effort during the intervening three months should go far towards restoring the normal trade balance.

Electrical Salesmanship.

For some considerable time past we have shown dissatisfaction not only with the lack of salesmanship in the electrical industry, particularly on the domestic side, but also with the machinery now available for inculcating a vigorous selling policy amongst the younger members of the industry. Realising that expressions of dissatisfaction alone are of little constructive value, we have published special articles on various phases of selling activity, and all primarily designed to make it easy for people to buy. As a further step in the development of this policy, arrangements have been made for a series of articles dealing in a practical way with the problems of electrical selling. All of these articles will be written by men with successful experience of selling, and there will be none of the stunt methods which have done such disservice to the business of selling in the past few years. The series opens in this issue with a strong plea for the initiation of a vigorous attack on the home electrical market, which we hope will not pass unregarded. We have the goods, and we have a wonderful field. It is ours for the selling.

Spring Cleaning Whitehall.

It may be a pose that impels the most expensive constitution in the history of the world to display to those who pass along Whitehall on the 'bus-tops after dusk so much obsolete lighting equipment. Lamps of initially low wattage, which have many times outlived their reputed life of a thousand hours, in conjunction with the old-fashioned opal shades which no self-respecting business establishment would harbour, "shine" pitifully upon the passer-by as if to invite his commendation of such obvious economy in the expenditure of public funds. The amount of money we pay for the pleasure of providing congenial work for the denizens of Whitehall is so great that an additional expense of a few hundreds of pounds would meet with little opposition, and might, like virtue, provide its own reward in the form of increased efficiency, and certainly improved health in the Civil Service. Put more selfishly, it would furnish a nice little order for some ambitious electrical firm. In addition to lighting, some of our super-salesmen might also provide equipment for removing accumulated dust from the pigeon-holed documents which may not be removed for dusting, and for general cleaning, and thus give to our Government offices at least an appearance of efficiency.

Ideal Homes—Real or Imaginary?

The 1929 Ideal Home Exhibition which opened at Olympia, London, on Tuesday, again includes a number of electrical labour-saving devices, and other domestic equipments of electrical interest. The electrical stands, which are referred to elsewhere in this issue, are more attractive than ever, but it is regrettable that once again the specimens of "ideal" homes, erected in one section of the exhibition, are still without those electrical facilities which are so essential in the really ideal home. The houses to be seen in the village of "Welcome-in," are for the most part lighted by electricity—and that somewhat crudely—but it seems obvious that electricity was only employed more as a matter of convenience to the exhibitors than for any other purpose. Most of these houses contain both gas and coal fires. It is true that one house has been fitted with an electric fire, but those concerned must be rather ashamed of their revolutionary conduct, as the fact is not mentioned in the catalogue. In the description of the same house, however, reference is made to the presence of gas fires. Year by year, with monotonous regularity we find ourselves making the same sort of criticism of this feature. Certain obstacles which existed some years ago are still trotted out to excuse electrical backwardness in a section of the exhibition which attracts many thousands of the general public, but no attempt is made to do anything. Experience with the W.O.B. Campaign clearly showed how easy it is to secure the co-operation of builders, furnishers and other traders in the equipment of model electric houses, and we suggest that time spent in conferences to discuss how the E.D.A. can help in extending the use of electricity would be more profitably occupied in erecting at least one electrically-equipped house at the Ideal Home Exhibition. It is realised that the E.D.A. has to cover a wide field on a ludicrously small financial backing from the industry, but the opportunities at Olympia are so great and the cost so relatively small that E.D.A. might have kept the electrical flag flying on this occasion. A large and rapidly increasing proportion of the public has convinced itself that homes without electrical service are hardly habitable. It goes to Olympia to see the last word in home design and equipment, and finds as examples, homes in which electricity is only conspicuous by its absence. They must wonder what is wrong. So do we.

Country House Fires.

As the unfortunate series of railway disasters which have occurred in this country during the past few months is regarded in some quarters as a cyclical sequence, possibly the same theory may be fitted to the causation of country house fires. Though we say it with bated breath, expecting a sudden change in the luck, we have noticed of late a considerable improvement in the imaginative power of the daily Press in its efforts to fix the responsibility for the many outbreaks which have been reported. The "fusing of an electric wire" theory seems to have been abandoned, but whether this is due to certain educative electrical propaganda efforts, or to realisation of the monotony of frequent repetition of the above-quoted phrase, we are unable to offer an opinion. Whatever the reason for the changed position, we are glad to see growing, if belated, recognition of the fact that fires have other causes.

All-Electric Offices.

The applications of electricity in the service of mankind are nowhere better appreciated than in the chemical industry. Many have been the speeches by chemical leaders, which have paid tribute to the electrical engineer, and many are the products which the chemist is able to produce by electrical means. As if to look to its own comfort, Imperial Chemical Industries, Ltd., has now built for itself an "all-electric" house of the most modern type, introducing into its appointments all those electrical devices which commercial experience has shown to be indispensable to real comfort. The lighting of the building is by "artificial daylight" throughout, while the stairways, halls, etc., are lighted through special "laylights." The board rooms are illuminated by electro-mechanical devices, which, used in conjunction with dimmers, cause the ceiling laylights to supply illumination of almost any required candle-power. We understand that natural lighting is dispensed with in the corridors, special ceiling panel lighting being used in its place. "Artificial sunlight" windows are provided, while the main doors on the Millbank front are opened and closed by means of push-buttons actuating a series of small motors. The building may be said to approach the ideal in so far as office accommodation is concerned, and shows that British architects are at last beginning to realise that the electrical engineer has designed, and is still designing, equipment which will lend additional beauty, convenience and comfort to whatever structure may be inspired by the set-square and mallet.

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ELECTRICITY COMMISSIONERS' REPORT.

Organisation of National Schemes to Occupy Five Years—Production of Electricity at Stations Included in Returns Doubled since 1920-22.

SOME of the salient features of the eighth annual report of the Electricity Commissioners were dealt with in our issue of February 22nd. We give below an abstract of the report, which is published by H.M. Stationery Office (3s. net).

In their prefatory remarks, the Commissioners point out that, in preparing the regional schemes, they have envisaged in each case that a period of some five years will be required for the construction of the main transmission system by the Central Board, for the complete or partial standardisation of frequency where a change-over is involved, and for the bringing of the scheme into full operation. While economies will be brought about in particular areas as the work of construction proceeds and progresses, it is evident that the benefits of the far-sighted basis of development laid down by the Act of 1926 can only accrue by stages. The full advantages cannot be expected to mature over the country as a whole for a number of years to come, even when allowance is made for the utmost expedition in construction, in the completion of all necessary arrangements, and for the concurrent carrying out of schemes in different regions.

It is necessary to emphasise this aspect of the matter and also the fact that the new schemes are not specifically concerned with supplies to private consumers, in view of misunderstandings which appear to have been prevalent that the Act of 1926 would result in the early provision of supplies by the Central Board to potential consumers in areas where electricity has not hitherto been available.

With regard to electricity supply in rural areas, the report points out that during the eight years which have elapsed since the reorganisation of supply was commenced on the basis of the Act of 1919, it has become increasingly evident that the centralisation of generation will require to be supplemented by improvement in, and co-ordination of, distribution if the opportunities for expansion presenting themselves to the supply industry are to be utilised to the fullest advantage. In comparisons which are made with other countries, there is often a failure to recognise that rural electrification in Great Britain must be governed by British conditions. A table of distribution of population in Great Britain shows that the rural areas comprise as much as 92% of the total area, but only contain 22% of the population, with an average density less than one-quarter of that of the country as a whole and less than one-fortieth of that of the urban areas.

It is apparent that the provision of an electrical service for small communities and individual farms and other premises located in wide areas having a low average density of population represents a substantially novel phase of electrical development in Great Britain, with problems differing in many respects from those normally associated with the development of undertakings in urban areas. Generally speaking, the potential load is much sparser in character, the distances concerned are much greater, the conditions of living are somewhat different, and the remuneration and spending capacity of the rural population are on a lower scale than obtains in urban centres.

Rural Supplements to Urban Loads.

The results already attained by a number of undertakers who are operating outwardly from urban centres go to show that a considerable measure of rural electrification is economically possible in cases where the rural load can be developed as a supplement to an urban load. Further experience is necessary, however, before it can be determined whether, and to what extent, the electrification of a wide rural area *per se* can be successfully accomplished without dependence upon an urban load as a nucleus.

Apart from the Central Electricity Board, the number of authorised undertakers in Great Britain holding powers to supply electricity at March 31st, 1928, was 643. Inclusive of the Central Electricity Board, and allowing for the cases of two companies with undertakings in England and also in Scotland, the number of separate undertakers at March 31st, 1928, was 642, a net addition of 19 to the number holding supply powers at the end of the preceding year.

In a previous report, approximate particulars were given of the extent and population of authorised areas of supply in England and Wales as at March 31st, 1924. A more detailed analysis extending to Great Britain as a whole, with special reference to the position in the rural portions of the country, was commenced during the past year in connection with the investigations of the Conference convened by the Commissioners to consider the question of electricity supply in rural areas.

This analysis has been compiled in a form which shows in respect of every local government district in the country its area and population, the name of the authorised undertakers (if any) and the Order or Act authorising them to supply electricity. When completed, it will also embody a record showing whether a supply of electricity has been established or not yet commenced in the various districts. A table is given showing that the authorised distribution areas embraced over 92% of the cities and boroughs, 86% of the urban districts, and 58% of the parishes in the rural districts in England and Wales; and about 68% of the cities and burghs and 29% of the civil parishes (exclusive of burghs) in Scotland. The figures show that the authorised distribution areas in Great Britain at March 31st, 1928, covered about 89% of the urban areas containing upwards of 97% of the urban population; and nearly 42% of the rural areas containing upwards of 67% of the rural population.

Areas with Better Prospects Occupied.

The Commissioners state that it is clear that in the process of seeking statutory powers to supply electricity, the stage has been reached at which the majority of the areas possessing the higher average densities of population, and thus presenting the better prospects of development on a remunerative basis, have already become occupied. The unoccupied areas in which no supply of electricity has yet been authorised consist mainly of the more sparsely populated rural portions of the country amounting to 45% of the total area, but containing only 5% of the total population, with the low average density of fifty-six persons per square mile.

The rural areas for which powers were granted since 1920 account for upwards of 82% of the area and about 69% of the population of the rural distribution areas existing at March 31st, 1928. The figures also reveal the increasing sparseness of the rural areas for which supply powers have been sought in recent years, the average density of population in the rural areas of supply authorised prior to 1920 being of the order of 332 persons per square mile, as compared with 156 persons per square mile in the case of the rural areas of supply authorised subsequently.

The monthly returns rendered to the Commissioners in respect of the generating stations of authorised undertakers in Great Britain, including the voluntary returns in respect of generating stations owned by railway and tramway authorities and by a number of non-statutory undertakings, during the year ending March 31st, showed that 570 stations represented 9 927 850 630 units, with a fuel consumption of 9 034 323 tons of coal, 149 721 tons of coke breeze, and 40 107 tons of oil fuel. The returns bear evidence that there was a rapid recovery, as regards output and operating results, from the adverse effects of the prolonged coal strike in the preceding year. The output (units generated) showed an increase of nearly 18·7% on the figures for 1926-27, the larger output being obtained by an increase of only 5·4% in the amount of coal and coke consumed. The resumption of more normal conditions was also accompanied by a falling off in the use of oil fuel at generating stations, the consumption in 1927-8 amounting to 40 107 tons, as compared with 145 911 tons in 1926-27.

Notwithstanding the restrictions on the industrial demand for power supplies and the retarding effect on the rate of growth of output caused by the fluctuating conditions of trade and industry during the past eight years, the preceding figures and those given in prior reports show that the production of electricity at the stations included within the scope of the returns has practically doubled since 1920-2. They also show that there has been an all-round increase of the order of 54% in the amount of electricity produced per ton of coal and coke consumed for that purpose, as compared with the technical practice in 1930-21.

An analysis of the generating stations to which the par-

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ticulars relate shows that of the 570 stations, 251, or 44% of the total, generated less than 1 000 000 units each during the year, while 400 stations, or 70·2% of the total, generated less than 10 000 000 units each. The remaining 170 stations with individual outputs of 10 000 000 or over were collectively responsible for as much as 93·6% of the total units generated.

With regard to the sale of electricity in Great Britain by authorised undertakers, local authority undertakers sold 4 330 641 132 units, and company undertakers 2 519 521 676, the total of 6 850 162 808 showing an increase of 87·9% on the 1922 figures.

A comparative table shows that there was an increase of about 19·6% in the sales of electricity by authorised undertakers as compared with the figures for 1926. On the basis of the estimated total population of Great Britain at the end of 1927, namely 44·18 million, the sales of electricity from public sources of supply in that year thus represented an average consumption of 155 units per head of population.

The operations of privately owned plant do not come within the scope of the statistical returns which the Commissioners are empowered to obtain under the Electricity (Supply) Acts, and no official records are available as to the annual consumption of electricity generated by such plant.

Plant for Industrial Purposes.

A valuable indication of the extent of the electrical generating plant installed for industrial purposes in 1924 in factories and other works in Great Britain is afforded by the preliminary reports on the third Census of Production, 1924, issued by the Board of Trade during the past year. An analysis of the particulars relating to electrical and mechanical equipment contained in these reports is given in a memorandum forming an appendix to the present report.

The figures show that the industrial generating plant installed in 1924 amounted to about 2 564 000 kW, as compared with 3 943 000 kW in the case of authorised and non-statutory electricity undertakings supplying mainly for sale to the public. The generating resources of trade and industry in that year thus represented an addition of about 65% to the resources of electricity supply undertakings.

The preliminary reports do not embody particulars of the production of electricity in 1924 from the generating plant of industrial organisations, but indicate that the returns received by the Board of Trade under that heading will be summarised in an analysis of the final results of the census.

At the date to which this report is made, the representations received by the Commissioners were under consideration. Dealing with the adjustment of production costs for selected stations, it is stated that the question of the allocation of production costs as between fixed and running costs was given preliminary consideration by the Commissioners at an early stage, in view of its bearing upon the preparation of the financial estimates for inclusion in the supplementary particulars put forward in support of the regional schemes. It was appreciated by the Commissioners that the subject presented difficulty and lent itself to a divergence of views; and this was rendered evident by a study of the bases of allocation adopted in practice or proposed by a number of the leading electrical engineers. In order to obviate delay in the preparation of the schemes, the Commissioners accordingly found it necessary to make use, for purposes of illustration, of a basis of allocation for which they considered the best justification could be shown on the data then available.

The Commissioners subsequently pursued their investigation of this matter and of the related question of adjustment in accordance with power factor, with the object of determining whether practical bases of allocation and adjustment could be devised to give equitable results as between the Central Board and the owners of selected stations under all conditions of load factor and power factor. In the course of this investigation, the Commissioners came to the provisional conclusion that the necessity for a regulation prescribing variations in the fixed kilowatt charges component in accordance with the magnitude of the maximum demand of the supply taken was not likely to arise, at any rate until after some years' experience of the actual working of the regional scheme. These matters were still under consideration at the date to which this report is made.

The aggregate capacity of the generating plant for new stations and extensions of existing stations sanctioned by the Commissioners during the year 1927–28 amounted to 668 357 kW. While the amount of plant sanctioned for new generating stations was greater than in the previous year, the amount sanctioned for extensions of existing stations was smaller by about 118 000 kW.

Of the generating plant sanctioned during the past eight years, approximately 57·9% was for stations belonging to local authority undertakers; about 34·5% for stations of company undertakers; and about 7·6% for stations owned by railway and tramway authorities and non-statutory undertakings.

During the year ending March 31st, 1928, the Commissioners issued consents (9 to authorised undertakers and 6 to non-statutory undertakings) in respect of the establishment of new generating stations, representing the initial installation of plant having a total rated capacity of 246 642 kW.

During the past year, consents to the extension of existing generating stations were given by the Commissioners to 61 authorised undertakers, and in 11 further cases to railway and tramway authorities and non-statutory undertakings. A complete list of the undertakers and authorities concerned, indicating in each case the total capacity of the generating plant sanctioned, is set out in an appendix to the report. The appendix also contains a supplementary statement of consents previously recorded but subsequently amended or cancelled.

The sanctioned extensions represented, in aggregate, a plant capacity of 421 715 kW. The division of the total as between the various authorities was as follows, namely:—Local authority undertakers, 237 480 kW; company undertakers, 143 811 kW; railway and tramway authorities, 40 000 kW; and non-statutory undertakings, 424 kW.

Consents authorising the installation of 10 000 kW or more of new generating plant in existing stations were issued to 16 authorised undertakers and two railway authorities, these consents accounting for 323 000 kW or approximately 76% of the above-mentioned aggregate. In six instances sanctions were given to the installation of 25 000 kW sets.

At the commencement of the year under review, 95 applications for special orders under Section 26 of the Act of 1919, relating to the establishment or extension of distribution undertakings, etc., were under consideration by the Commissioners. During the year 80 further applications were received, and one of the applications previously made was divided by the Commissioners into two parts, thus making a total of 176 applications under consideration.

During the year, the Commissioners made special orders in respect of 81 of the applications before them, all of which orders had been submitted to the Minister of Transport for confirmation by March 31st, 1928. Of the 80 applications received during the year, 39 related to the establishment of new distribution undertakings and 36 to the extension of existing areas of supply. As in previous years, a noteworthy feature of many of the applications was the large extent of the proposed areas of supply. There was again a pronounced element of competition between applications, as many as 24 of the applications lodged during the year competing with other applications.

Special Orders Approved.

Inclusive of certain orders confirmed by the Minister during the period covered by the previous report, 70 special orders in all were submitted to and approved by Parliament during the year under review.

At the commencement of the period covered by this report, 170 applications for sanction to borrowing were under consideration by the Commissioners; and during the year under review, 768 further applications were received. Sanctions, either in full or in part, were issued by the Commissioners in 751 cases. The total amount of the loans sanctioned during the year, less certain cancellations, was £18 020 063, representing an increase of over 17% on the figure for the preceding year. The amount under "other purposes" of the loans sanctioned in 1927–28 for wiring installations for consumers' premises and for the purchase of domestic apparatus and appliances for hire or hire-purchase was £539 404, the corresponding figure for the previous year being £400 941.

Of the total sum of £102 587 184 sanctioned in the course of eight years, approximately 43% was for the provision of plant (generating plant, boilers, condensing plant, motors, converters, transformers, switchgear, etc.), about 39% for mains and services (main transmission lines, overhead lines and underground mains, services, etc.); and the remainder for a variety of other purposes (land, buildings, and other permanent works, meters, wiring, domestic apparatus, etc.), including the acquisition of established undertakings.

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ELECTRICITY SUPPLY AND THE CONSUMER.

A Critical Examination of Points Raised by Dr. Lulofs—Views on the Quantity Tariff —Important Data Omitted from Commissioners' Statistics.

By J. RUTHERFORD BLAIKIE.

DR. LULOFS, Director of the Amsterdam Electricity Works, recently contributed an article to THE ELECTRICIAN on "Domestic Tariffs." This article contains many notable features in the method of analysis of costs; but unfortunately the difficulties of the translator and one or two printer's errors leave the reader in some doubt as to complete comprehension. If I have fully understood the analysis, the following principles emerge :—

1. The load factor, or number of hours used, is averaged for 120 000 consumers of the domestic dwelling class, for lighting only. With the load factor fixed, one kW of demand can be represented by a definite number of kWh sold, and therefore the capital charges can be expressed at per kWh sold. The kW demand is only recognised in the generating plant, h.t. mains, and h.t. (10 000-3 000 V) transformers.

2. The capital charges for l.t. mains, transformers (3 000-220 V) services, etc., are charged directly on the kWh sold, and not per kW demand, on the grounds that length is a much larger factor in the cost than cross section. Dr. Lulofs discusses the varying costs depending on varying lengths of consumer's frontages, but finally decides on adopting an average length per consumer. It will be observed that the deletion of this heavy charge from the usual kW demand system of analysis considerably reduces the effect of load factor, i.e., the difference in a few points in load factor makes a very small percentage difference in the estimated costs.

3. Coal, station wages, and repairs are all included in generation costs, forming the usual "running charge" per kWh. There is no "standing" coal, which again reduces the effect of load factor.

4. Management, insurance and distribution wages are charged per consumer.

Quantity Tariff for Lighting.

With this analysis, so far as lighting is concerned, it will be seen that all capital charges can be added to the generation costs at per kWh sold, and the fixed charge is made per consumer. This latter charge works out at 30·8 shillings per annum and the kWh rate as follows :—

Average hours of use per annum, 1 570.	
Capital cost per kW plant generating station per annum	£2 15 0
Capital cost per kW plant h.t. mains and transformers per annum	1 9 4
Total	£4 4 4

At per kWh sold, 1 570 hours, the aove amounts divided by 1 570.

	Per kWh sold.	
Generating station	0·421d.	
H.T. mains and transformers	0·224	0·645d.
L.T. mains and transformers	0·264	
Generation (coal, etc.)	0·330	0·594d.
		1·239d.

With these data we have a quantity tariff for lighting.

kWh per annum.			Cost per kWh.
	Standing charge, 30·8s. per annum	369·6d.	
50 at	1·239d.	61·9	
		431·5	8·63d.
	Standing charge	369·6d.	
100 at	1·239d.	123·9	
		493·5	4·935d.
	Standing charge	369·6d.	
131 at	1·239d.	162·3	
		531·9	4·06d.
	Standing charge	369·6d.	
200 at	1·239d.	247·8	
		617·4	3·087d.

It may be remarked here that the hours of use, viz., 1 570 per annum, is very high, but it should be pointed out that the number of consumers on this undertaking is greatly in excess of our experience, and that the average consumer is very much smaller.

1926.	No. of Consumers.	Max. Demand.	kW per Consumer.
Amsterdam	148 700	57 000kW	0·348
Glasgow	65 674	91 700kW	1·39
Liverpool	41 762	73 684kW	1·76
Birmingham	37 101	113 650kW	3·2
Sheffield	31 348	76 614kW	2·44

It may be that with such a very large number of small consumers that the diversity factor amongst them is much higher than our experience suggests. It is instructive to note how far British undertakings are behind in the matter of consumers.

Having got so far, it is disappointing to find that Dr. Lulofs does not further consider a quantity tariff; to quote the words of the article, he says :—

"And now we must ask ourselves whether it is right, when fixing tariffs, to treat each consumer individually, and keep the lighting price demanded in line with the costs, i.e., inversely proportional to the extent of the consumption, or to put all lighting consumers (dwelling-houses) in one group and charge each consumer the average kWh price. The latter system is usual, and, in fact, justified; it constitutes a social tariff, and other arguments (which can hardly be gone into now) support the maintenance of this as a general principle."

How is this question answered in Great Britain? All our load factor enthusiasts, disregarding the extent of the consumption, and reckoning only on the load factor, stoutly maintain that it is right to charge the individual in accordance with a load factor analysis. And probably a great number of those who have lapsed from this procedure have only done so on account of difficulties with consumers, and still base their price on the average load factor of their consumers, as ascertained from a load factor analysis. There may be in certain cases a small extra discount for quantity; but I think it may be said that this is pure guesswork, and not the result of analysis.

We will now return to the problem of other domestic supplies in Amsterdam. So far as I can gather, Dr. Lulofs suggests that the amount covering generation and l.t. mains, 0·594d., roughly 0·6d., will suffice for all extra kWh supplied to consumers who have already paid for the kWh used for lighting at the price as shown by the analysis. There is no mention of diversity factor or the coincidence of time in these supplies.

Suitable Diversity Factor.

As we argue the case in this country, there must be something for extra capital charges on generating plant and h.t. mains. By supposing a suitable diversity factor, we might make a similar amount suffice. For example, suppose we say that for each kW that appears on the station peak load, say 3 500 kWh are sold, the costs per kWh would appear as follows :—

	Per kWh sold.
Generating station (capital)..	0·187d.
H.T. mains and transformers	0·1
Generation (running coal only) say..	0·2
Leaving for l.t. transformers	0·113
	0·6d.

We might assume that the l.t. mains remained the same, the only difference to the system being additional feeding points with extra transformers. There is also a possibility that extensions in plant and h.t. mains might cost less than the average existing plant, on account of larger units.

From Dr. Lulofs's findings he proposes two forms of tariffs :—

1. All lighting kWh at about 4d. plus profit, and all heating and power kWh at 0·6d. plus profit.

2. Some fixed charge based upon the fixed charge per consumer, plus the estimated charge for generating plant and h.t. mains re-

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quired for the lighting of any particular consumer, plus all kWh used at 0·6d. plus profit.

The method proposed for estimating the lighting consumption of any consumer is similar to our own "floor space" modified by the "status" of the consumer, which qualification rather suggests our "rateable value" system.

It is also stated that two rate meters allowing current at night for water storage heating at 0·396d. per kWh are proving popular.

The data in the original article is given in shillings and decimals of a shilling, which I have converted to pence, and, so far as the figures are available, the capital and generating costs compare reasonably with our own, except perhaps in l.t. mains, from which I presume that some distribution in Amsterdam is by means of overhead wires, without many restrictions for the protection of other services.

For generation, compare Amsterdam at 0·33d. with Glasgow at 0·29d., Birmingham at 0·4d., Sheffield 0·33d., and Liverpool at 0·45d.

In the fixed charge per consumer, however, British costs are generally much higher, perhaps due to a lower state of development, i.e., fewer consumers, and possibly due to considerable quantities of distribution being d.c. Nevertheless, Sheffield appears to have achieved a lower cost in this respect than Amsterdam, at 30·8 shillings per consumer.

Generally speaking, the article emphasises the importance of taking into consideration the amount of the consumption per consumer, a point that I have stressed for the last three years in other articles. Data concerning the number of consumers does not appear to be appreciated here, and is still curiously missing from the Electricity Commissioners' statistics.

From an interesting diagram in the article it is seen that the smallest consumers, to the number of 10 000 only, produce a revenue averaging about 15 shillings each, and up to 52 750 consumers the average revenue does not exceed the calculated standing charge of 30·8 shillings per annum, "so that more than a third of the consumers just bring this amount in, without paying for their current at all, let alone giving a profit."

In these circumstances, one may ask: Why go to the trouble and expense of assessing consumers for their lighting? Why not consider a quantity tariff such as was described in the issue of THE ELECTRICIAN for November 21st, 1927, which seems likely to give at least the same degree of equity, and in addition, to satisfy the ordinary man's demand for "Equal quantities of the same article at the same price."

ALIGNMENT COSTS CHART.

A Convenient Method for Effecting Rapid Comparisons.

By W. A. BARCLAY, M.A.

WHERE an electricity supply authority has alternative methods of charging for current consumed, the question is often asked: "Which of the methods is preferable in the individual case?" As an example, the following scale of charges may be cited:—

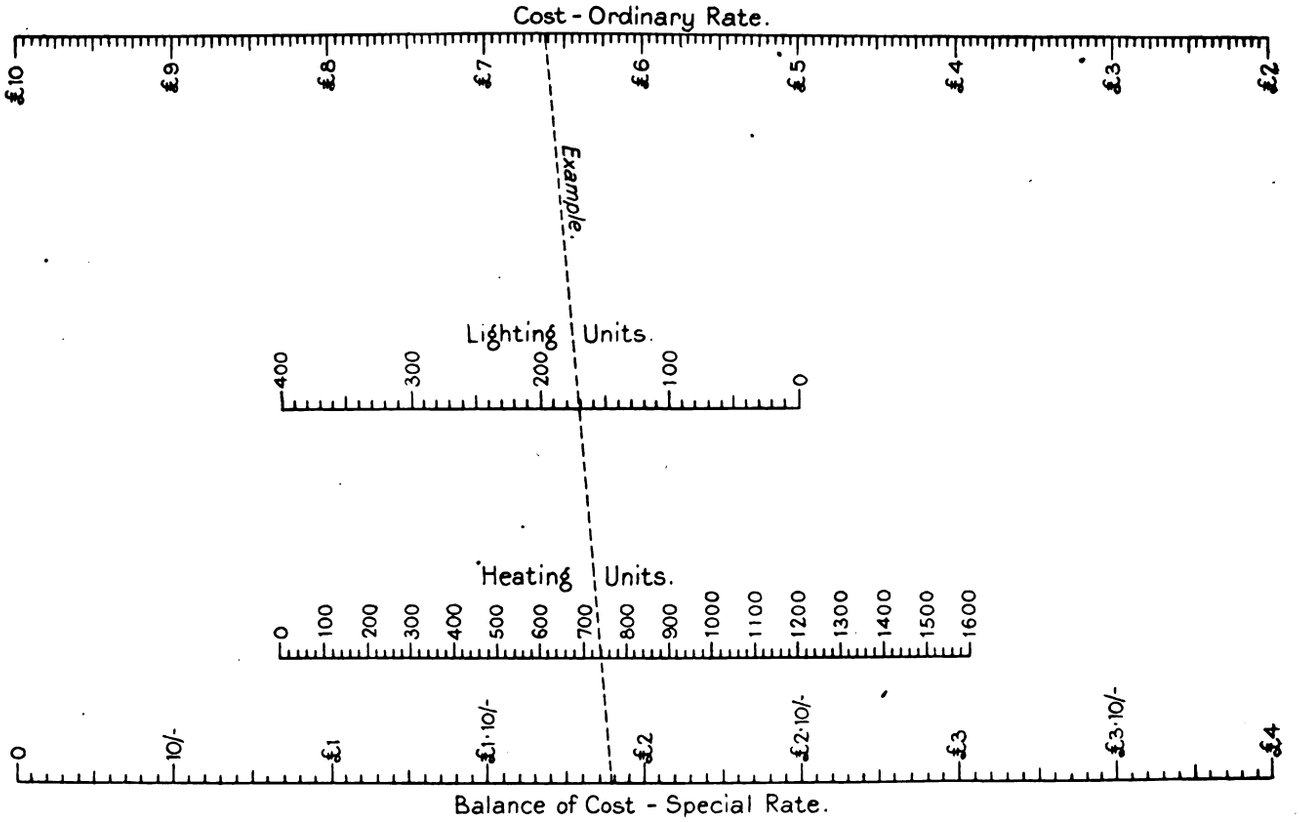
(a) *Ordinary Rate.*—5d. per unit for lighting, plus 1d. per unit for heating.

(b) *Special Rate.*—A fixed sum, plus a balance of ½d. per unit for both lighting and heating.

In order to compare the costs at these two rates, the accompanying alignment chart was prepared. The two centre scales show units of heating and lighting used. If a straight line be placed across these scales at the particular values of the units consumed, it will meet the left-hand scale at the cost at the "ordinary" rate, while it will also meet the right-hand scale at the balance of cost at the "special" rate. It will be noted that but one setting of the index line is required to obtain both these results. To the figure shown on the right-hand scale will, of course, fall to be added the fixed sum agreed on in the particular case, usually some fixed percentage of the rental.

An example of the use of the chart may be given. If 170 units are taken quarterly for light, and 740 for heating, the cost at the ordinary rate is immediately read off at £6 12s. 6d., while the balance of cost at the special rate is just under £1 18s. (*vide* dotted line on the diagram). If the fixed quarterly sum payable is, say, £4, it will be seen that the special rate, being in all £5 18s., is the more profitable for this particular consumer.

The chart thus presents in convenient form a very rapid means of comparing costs. It should be added that other scales of cost corresponding to other methods of charging might easily have been included in the same diagram. Such additional scales would, doubtless, be of interest to supply authorities as a ready means of comparing several different systems of charging for current. It was, however, thought best not to complicate the present diagram by the inclusion of such scales, though the writer will be pleased to supply them if sufficient interest warrants.



The scale, described in the accompanying notes, which has been designed to facilitate rapid comparison of costs.

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WOOD-POLE STRENGTH TESTS.

Is the Rigid Formation Method Inaccurate?—The Opposing Moments of Force—Bringing Maximum Fibre Stress into Play.

By WILLIAM T. TAYLOR, M.Inst.C.E., M.I.E.E.

IF we are to judge from a paper recently read by Mr. Woodhouse before a meeting of the I.E.E., it would appear that we have not only been making inaccurate wood-pole line calculations, but it would also seem that wood-pole tests made on the basis of rigid foundation are inaccurate. The truth of these two statements can be gathered from the following notes, which are directly adverse to the wood-pole strength methods recommended by Mr. Woodhouse.

In the first place, it is necessary that we properly prepare the whole, so that we are assured of testing the true strength of the pole, conforming to accepted good practice—i.e., assured that the foundation is both strong and stable properly to allow of the *true strength* (the maximum internal moment) of the pole to be tested.

In a pole the lateral pull has a tendency to overturn the pole, and is resisted by the internal stress in the pole timber. There is tension on the side away from which the pole is being forced, and compression on the other side. This results in two opposing moments of force, one external and the other internal. The external moment referred to here is the force applied in lbs. multiplied by the height of this force from the ground-line; the internal moment is the timber fibre stress multiplied by the section modulus. As the two opposing moments of force are equal to one another, we can represent this condition by equating to zero

$$ph - f(\pi d^3/384) = 0$$

or

$$ph - 0{\cdot}00818fd^3 = 0$$

and for $f = 7\,800$ lbs./sq. inch, we have

$$ph - 63{\cdot}8d^3 = 0$$

where

p = transverse force applied, in lbs.; h = height of application of load above ground-line, in ft.; f = fibre stress of timber, in lbs./sq. inch.; d = diameter of pole at ground-line, in inches; $\pi = 3{\cdot}1416$; $\pi d^3/384$ = section modulus.

The accepted fibre stress value (7 800 lbs./sq. in.) *times* the section modulus (d^3 0·00818) are not necessarily the *true* figures, but the former has been accepted for this country for red fir, and the latter has been accorded universal acknowledgment for round poles. As the product of these two factors gives the maximum internal moment it is quite evident that we must introduce a factor of safety. In the opinion of the writer, assuming in the first place that the assumed fibre stress value is reasonable, we are safe in working to a factor of safety of 2·5; the said factor of safety taking the form

$$F = \frac{M'}{M''} = \frac{\text{maximum internal moment}}{\text{external moment}}$$

This maximum internal moment is developed when the timber is stressed to its maximum fibre stress.

It is important to note that, for a given transverse force per pole and span, the factor of safety will vary: (*a*) . . . directly as the span length; (*b*) . . . inversely as the wind load; and (*c*) . . . directly with the fibre stress of the timber. Thus we may readily arrive at a fundamental basis to discuss the best possible changes in regulation loading conditions.

Internal Moment of Timber.

We must keep in mind that pole foundation is distinct from pole timber strength. The real strength should be (and is always) calculated on the maximum internal moment of the pole timber. And it is no more than plain common reason to expect the other strengths upon which the *pole* strength depends, such as the foundation, to be at least as strong as the pole itself. Hence, we start with the pole timber not with the foundation, and, in making tests for a pole, we must test the true pole-strength and have the foundation more than strong enough to give the *true strength* of the pole timber—i.e., produce the maximum internal moment with the above ground part of pole set according to accepted good practice for the conditions to be met, just as in actual practice. The true tests depend entirely on the internal moment referred to here, and can be obtained only by having a foundation strength and stability at the very least sufficient to take care of the true maximum permissible external moment of the pole when *self*-supported.

Taking a 10·0 inch diameter red fir creosoted pole at ground-line, the maximum internal moment is

$$M = 63{\cdot}8d^3 = 63{\cdot}8 \times 10^3 = 63\,800 \text{ ft. lbs.}$$

The fibre stress value for this moment is taken at 7 800 lbs./sq. inch. In practice, however, the external moment must always be somewhat below this figure. For this country, at the present time it is 3·5 times *less* which gives us an allowable external moment of only 18 230 lbs./sq. in., equivalent to the actual transverse force on the pole and span in lbs. times the height of its application above ground-line in feet, or the maximum permissible external moment for a *self*-supported pole. But, staying this pole, which is sounder and more economical, will permit the safe use of a factor of safety of 2·0 or less, or the equivalent conditions put in another way.

This wooden frame was felled, trimmed and erected in a fresh green state over 20 years a go, and is still standing. The beam formula calculation for the poles (legs) was used in those days and found to be as reliable then as now. The writer was held directly responsible for the operation of the entire 60 000V hydro-electric system.

We therefore see that for every case the maximum internal moment of the timber cannot be reached, for the simple reason that calculations are made for lateral pull which limits us to a force something like 3·5 times *less* than the "supposed strength" of the timber used, assuming the value 7 800 for fibre stress to be accurate.

No matter whether the support be of wood, steel or reinforced concrete (single or compound), or a steel or wooden structure or frame, the foundation must be strong and rigid enough to allow of the full (true and effective) maximum fibre stress of the timber to come into play when under test conditions arranged to conform to accepted good practice where such a character of loading is expected to occur. Obviously, a building may crack or collapse due to a movement of its foundations, but we cannot justly say the building is weak—exactly so with the pole, and, as an advantage over a building, we can stay the pole, and in this way assist the foundation strength for a given lateral pull, or we may increase the lateral pull (the external moment) for the same foundation strength. Hence, we are justified in lowering the factor of safety when using stays, which again brings up the proposed value of 2·5 as against a very detrimental value for factor of safety if we accept the test figures which are given by Mr. Woodhouse.

The writer's views are therefore diametrically opposite to those of Mr. Woodhouse, which condition indicates grave error somewhere.

It seems evident from the said paper referred to above that Mr. Woodhouse recommends and/or believes in testing (or in the strength of) an unsupported wood pole so that its strength is approximately *one-fifth* (1/5th) that of the same pole tested with immovable foundation (such as the Wade test of 1907), or tested so that neither the maximum nor the truly allowable external moment can be attained.

On the other hand, the writer believes in testing an unsupported pole so that its strength is approximately *five* times that of the same pole tested according to Mr. Woodhouse, and also, in testing a supported pole installed according to good practice, to have a strength more than *five* times that of the same pole tested according to Mr. Woodhouse.

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IRONCLAD SWITCHGEAR.

Some Advantages of the Vertical Draw-Out Type—Characteristics of Equipments for Low and Medium Pressures—Savings in Space.

SWITCHGEAR of the draw-out type has become a recognised standard for ironclad switchgear. Almost all the leading switchgear makers have their standard range of this gear, but it was not until recently that the vertical draw-out, came into its own, though at least one maker of oil switchgear had a range of this vertical type in pre-war days.

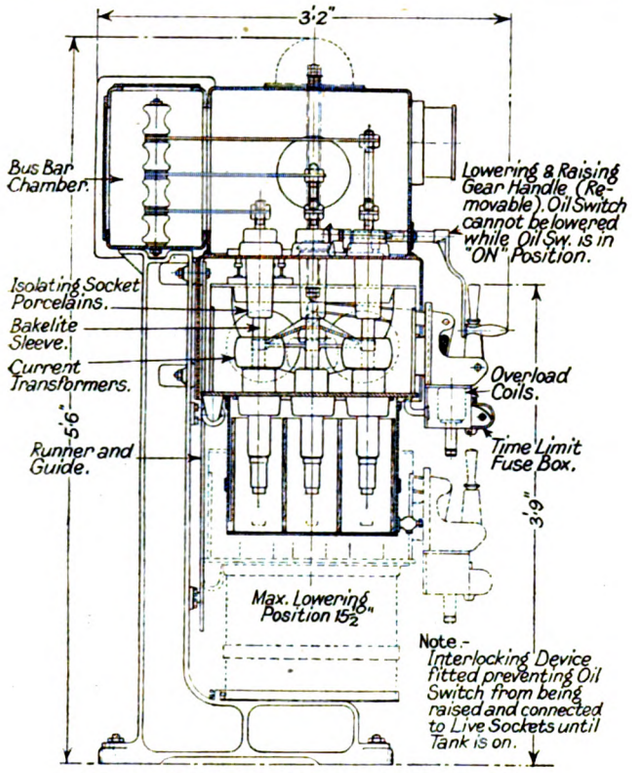

Fig. 1.—Side view of unit showing overall dimensions.

In Fig. 2 we illustrate a range of industrial units recently installed in a rubber works by J. G. Statter and Co. The total capacity of the board is 1 500 kW. The voltage is 416, and the current capacity of the units, of which there are fifteen, ranges from 300 to 750 A.

One advantage claimed for the equipment is saving in floor space. The unit requires no more floor space when open for inspection, and therein scores over the horizontal draw-out. The makers claim other advantages, but let us consider the "space claim" in relation to the example illustrated. The pitch of the units, measured centre to centre, and including the space allowed for cable dividing boxes between each, is 2 ft., and the total depth, back to front, is 3 ft. 2 in. It must be admitted that this shows economy in floor space for units carrying 750 A and requiring no more space when opened up.

Another practical advantage claimed is that the handling of the tank is all accomplished by the raising and lowering gear, the one gear serving both for inserting and withdrawing the plugs, and also lifting and lowering the tank. The latter is lowered into a kind of "dock."

If it is not required to take the tank away, it remains in its "dock" whilst the switch is wound up out of the oil to a position clear of the tank where it may be operated, inspected, adjusted, and even have new spark tips fitted. It cannot be plugged on to the busbars until it has been lowered into the tank, the tank refixed and the switch opened. Then, and then only, can the switch be plugged on to the busbars.

To go back to the point at which the switch had been drawn out of the tank while the latter rested in "dock," the runners upon which the tank bottom rests are 6 in. above the floor level. If it is desired to take the tank away, a Slingsby trolley can be pushed between the pedestals of the unit and underneath the tank. It is then only necessary to raise the deck, and the tank can be wheeled away.

Fig. 1 shows a side elevation of a unit, partly in section. It will be seen that the oil switch stems enclosed in massive porcelain insulators pass through the switch plate into the mid chamber. They are then shrouded in bakelite tubes, leaving only the plug ends bare. These are shrouded in deep porcelain insulators, which enclose them completely until they are withdrawn from their sockets and made dead.

Current transformers of the straight-through type, with porcelain centre bushes, are slipped over the bakelite shroudings and fixed in that position.

In the middle chamber all the live parts are completely shrouded in insulating material; and no exposed live conductors are permitted, except in the top chamber which is protected from the switch tank by two cast-iron plates. The exposed conductors are guarded from any explosive action which may take place in the switch tank, and where exposed conductors occur full B.E.S.A. clearances are provided for.

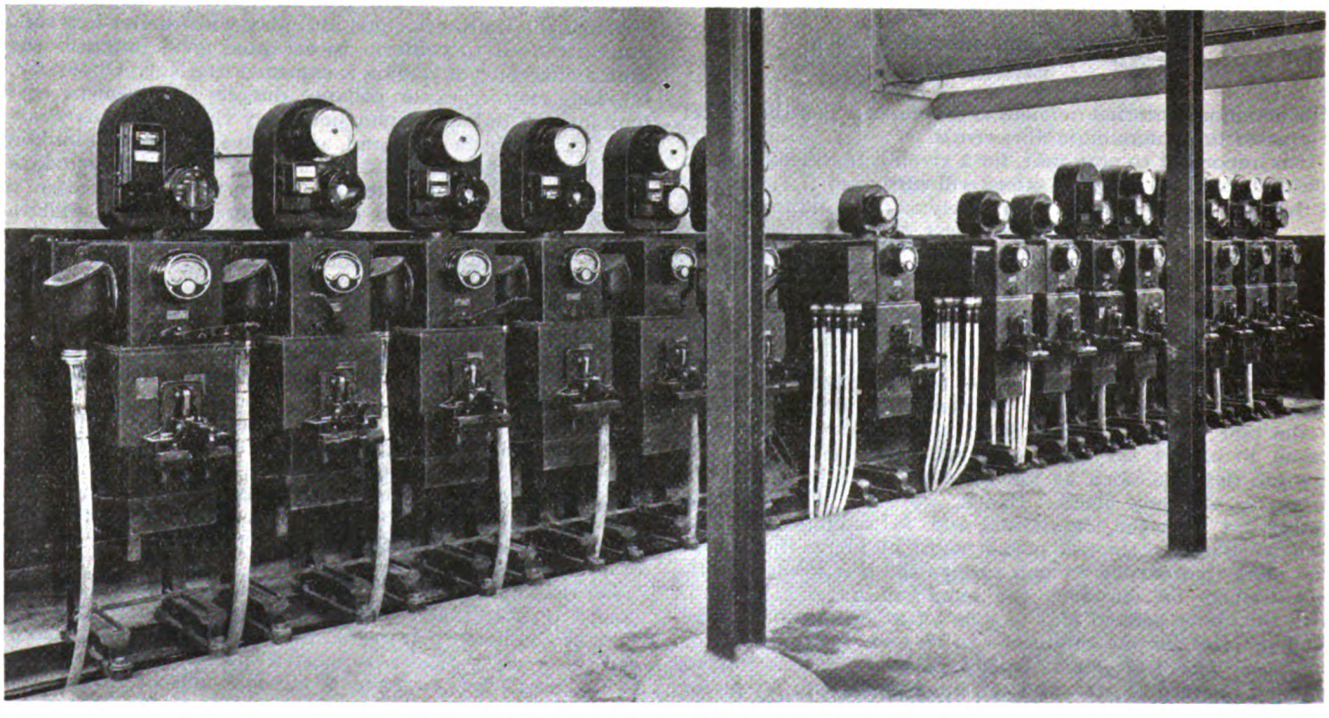

Fig. 2.—A bank of 15 vertical draw-out units installed in a rubber works.

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MARINE ELECTRICITY.

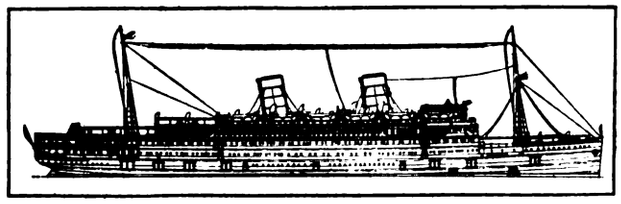
Further Thoughts on the Fitting of Electric Propulsion to the Largest and Fastest Ships Exemplified by a 100 000 H.P. Layout—Compactness of Arrangement Secured by Horizontal Drive to the Generator Sets.

By A. C. HARDY, B.Sc., A.M.I.M.E. (Author of "Motor Shipping," "Merchant Ship Types," etc.)

SHIPOWNERS are interested in electricity for propulsion purposes because they can see certain advantages to the passenger from the comfort point of view as well as, on the largest ships, a very real and helpful solution to the problem of how to handle their ever increasing auxiliary loads. As far as the largest and biggest ships are concerned, the builder of marine internal combustion engines is beginning to think about electric propulsion because he sees in marine electricity his best possible approach to the highest of powers (100 000 H.P. and over) and the fastest of mercantile speeds (21 knots and over). And in truth he has a very good selling point because he can offer the shipowner the superlative economies of the Diesel engine for ships to which they would not otherwise be applicable.

If we want to discriminate between Diesel-electric and turbo-electric propulsion for large passenger ships, we may definitely say that at the present time there is no definite swing of the pendulum in either direction. It is currently reported that the new White Star liner of over 100 000 H.P. will be a Diesel-electric ship, whereas a new Cunard mammoth which unquestionably must be laid down before long will, according to many accounts, be turbo-electric. The "Viceroy of India" is going to show to European shipping what the all-electric ship is capable of from a propulsive performance view-point, just as the big I.M.M. Atlantic-Pacific liners showed American shipping men—apparently with good effect—what American marine electricity was capable of producing. I say "with good effect" advisedly, because of the recent very important contract which has been placed with the Newport News shipyard by the Ward Line for New York-Havana service. Comment on this ship was made in my last article.

Apropos of high-power installations, however, it may be regarded as of some importance that a well-known firm of marine Diesel engine builders has just published plans for a Diesel-electric passenger liner of 100 000 H.P. This will show an interest in marine electricity on the part of firms in the marine prime mover industry. The firm in question is the Doxford Company of Sunderland, and their lay-out is reproduced herewith. It comprises, as will be seen, sixteen two-cycle opposed piston six-cylinder Doxford heavy oil-engines, arranged in groups and coupled to 4 300 kW generators. The engines have a cylinder diameter of 24 in., and a combined stroke of 72 in. and operate normally at 150 r.p.m. The engines are of airless injection type, and hence need no injection air compressors. Being of two-cycle type they need scavenge arrangements, but these are of separately driven rotary type arranged on flats in the two auxiliary engine-rooms between each pair of main engine rooms. These auxiliary engine rooms are of two deck arrangement, the space at tank top presumably being used for pumps and other auxiliary machinery. Five generator sets are arranged in the forward engine room, six in the centre engine room,



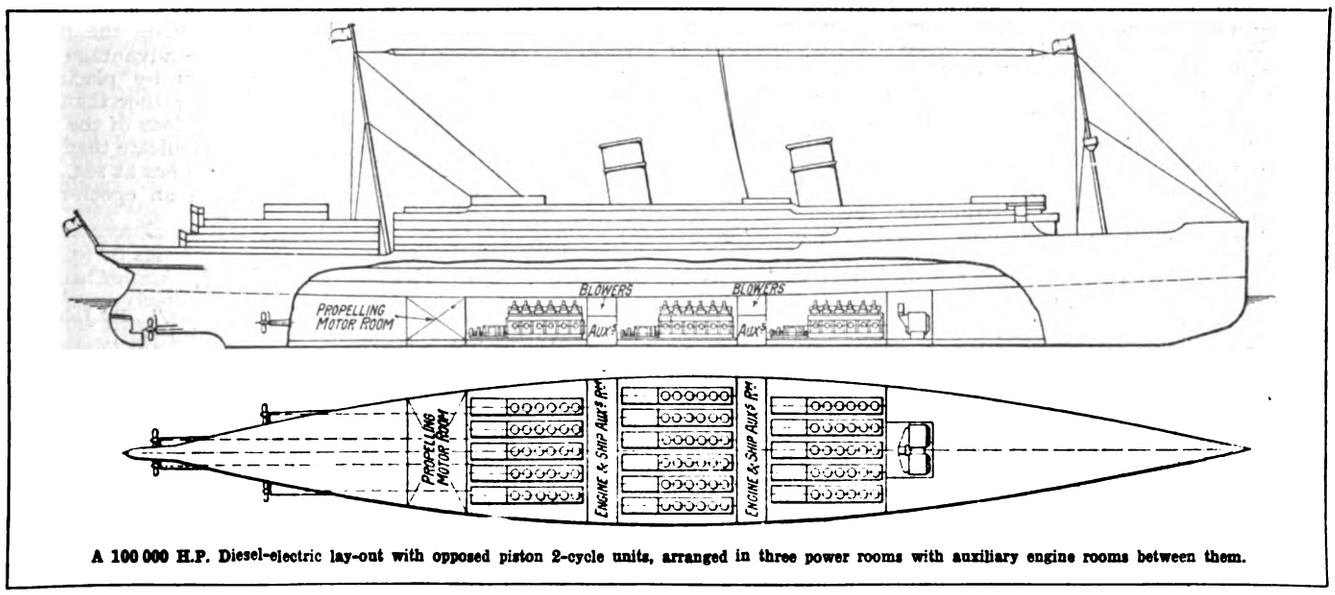
One of the two 16 000 H.P. turbo-electric liners building in America for New York-Havana service as she will appear when completed in December 1930. These vessels serve as an indication of the rapid strides which have recently been made in marine electricity.

and five in the aft engine room. A large propelling motor room is abaft the after engine room. The total shaft horse-power is arranged on four shafts, but we are not told how many motors are arranged on each shaft.

The particulars furnished are somewhat sketchy, but they are at any rate sufficient to show that the total space taken up is not excessive, certainly no greater than that absorbed by a corresponding boiler and turbine arrangement of the days before electric propulsion came into its own. At a guess, too, I should say that it would not be greater than that taken up by a turbo-electric plant with boilers. The lay-out is entirely hypothetical, but is important as indicating that large scale high power electric propulsion is definitely coming into prominence. It is unquestionable that with this arrangement there would have to be more than one motor per shaft. This is inevitable with a very large electrical ship. If conjectures *re* the powering of the new White Star liner are correct, each shaft (of four) will have no less than six motors per shaft—each of about 7 500 H.P. This is purely a matter for arrangement and convenience, although naturally there is an upper limit per motor as regards size. In some comparatively small electric vessels, such as New York harbour ferries and tugs, the power is split up between two motors.

On the "Viceroy of India" there are two propeller shafts, each driven by a single 8 500 H.P., 3 150 V motor, turning at 109 r.p.m. It is interesting to contrast the propulsion arrangement of this ship with that of the new American Ward liners, one of which is illustrated in profile herewith. Unfortunately similar detailed information on the new Grace electric liners has not yet been generally released. The table on the next page contrasts their characteristics in tabular form.

Both the new Ward liners and the "Viceroy of India" are



A 100 000 H.P. Diesel-electric lay-out with opposed piston 2-cycle units, arranged in three power rooms with auxiliary engine rooms between them.

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examples of fast up-to-date passenger carriers, and the two former vessels will be among the most luxurious ships running out of New York. They will have a displacement of 15 830 tons on a mean draft of 26 ft., and will carry some 6 840 tons of cargo, for the handling of which there will be fourteen electric winches, each driven by a 25 H.P. motor. The anchor windlass s driven by a 75 H.P. electric motor, and there are also two electric capstans. Two steam turbines of 8 000 H.P. each are direct-coupled to two a.c. generators of 6 100 kW each, which supply current to two 8 000 S.H.P. propelling motors. These, presumably, are arranged in the main engine-room as in the " California " and as in the " Viceroy of India."

RECENT FAST ELECTRIC SHIPS CONTRASTED.

	" Viceroy of India "	Ward Liner.
Dimensions	612 × 78 × 82	482 × 70·75 × 39
Speed	19	20
Screws	2	0
Tonnage	19 700	11 300
Power..	17 000 S.H.P.	16 000 S.H.P.
Turbo-alternators ..	9 000 kW	6 100 kW
Boilers	6 Yarrow	6 B. and W.
Pressure	350 lb./sq. in.	300 lb./ sq. in.

It is a somewhat interesting development that one of the earliest talking points in favour of electric propulsion was that considerable gain in space for cargo could be accomplished, because the motors could be arranged right in the stern of the ship on a short shaft. As a matter of fact, the gain in space was not appreciable, whereas the inconvenience that the engineers found in having to go up on deck, walk aft, and descend again into the motor room was considerable. The " Viceroy of India " and most electric ships now building have full-sized shaft tunnels. The Diesel-electric fruit-carrying ship " La Playa," was the last ship in which this arrangement was adopted. In order to get to the propelling motor, one had to walk aft into the poop and to descend via some very narrow uncomfortable steel ladders into a none too roomy " V " shaped compartment where the propelling motor was situated.

The Most Compact Electric Arrangement.

Actually one of the most compact Diesel electric lay-outs in small ships and, if the power can be achieved, in large ships, is by means of a horizontal Diesel engine drive to the generators. So unusual is this idea that, if carried to its logical conclusion on certain ships, it bids fair to usher in a new era in ship construction because of the novelty in deck arrangement which it permits. It has been postulated, and is now generally accepted, that electric propulsion is applicable either to ships of very high power or to ships of high auxiliary requirements, such as insulated fruit and meat ships. These ships have three and four tiers of 'tween decks, and in fruit ships especially these 'tween deck spaces are made as long and continuous as structural strength considerations will permit. These 'tween deck spaces, except perhaps the top-most space, are only continuous on either side of the machinery space vertical bulkheads. The higher the prime movers driving the generators the more (vertical) space taken up by machinery space. A turbo-generating set is very compact and economical in head room. What, however, is gain in headroom by the turbine is lost by the boiler uptakes, and the boilers themselves. The vertical Diesel engine is apt to be somewhat greedy in head room also. So that if one is out for compactness of machinery space, the horizontal Diesel prime mover has everything in its favour, and permits, other things being equal, possibly two further tiers of 'tween decks being continuous all fore and aft. What this means in extra carrying space can be readily appreciated by glancing at the profile of any refrigerated ship.

The horizontal Diesel engine, however, is a newcomer to marine work and hence is being regarded somewhat askance by the shipping world. Actually it made its first appearance as a direct drive prime mover for the refrigerating plant on some large motor liners built for the Nelson Line, and these first units were built by the Premier Gas Engine Co. of Nottingham. From this beginning has gradually been evolved the idea of applying them to drive generators. A lay-out has been prepared which is of no little interest. Four 8-cylinder, 4-cycle *vis-a-vis* Diesel engines, each developing 1 000 H.P., are coupled to a generator and exciter, and supply current to a propelling motor. The idea is only schematic, but capable of considerable development.

A similar but somewhat smaller installation fits very nicely into a Diesel-electric ship of " La Playa " type. This ship is 325·2 ft. by 48·1 ft. by 28·3 ft. moulded dimensions, and as completed she had four 825 B.H.P. Diesel generator sets running at 250 r.p.m. The main Diesels in height rise to the first tier of 'tween decks. None of the 'tween decks are continuous all fore and aft. An arrangement with horizontally-driven generator sets would permit of four 800 H.P., 4-cycle engines each driving generators at 225 r.p.m. and delivering the same power to the shaft as with the existing sets. The length of engine space would be 60 ft., the width would be the width at tank top space, and the minimum head room above tank tops would be 10 ft. Thus, in effect, it would then be possible to make all three insulated tiers of 'tween decks continuous all fore and aft with a corresponding increase in carrying space which can be easily calculated, allowing only for a small narrow trunkway running up to the top deck for access and ventilation. . . . The possibilities of marine electricity in association with this form of drive are great but the problems associated therewith are those of prime mover construction rather than of electrical arrangement.

The Flexibility of Marine Electricity.

Electricity is conspicuous by the compactness with which it can be generated and the ease with which it can be led from place to place and tapped as required. No electrician needs to be told this, but it is a truth which is far from generally recognised in the marine world. A case has recently occurred at sea which proves very definitely that had electricity been used no delay need have taken place. A Liverpool-Isle of Man packet was homeward bound in the recent severely cold weather when her steering gear jammed and went out of action, presumably due to the fact that the oil in parts of the telemotor system literally froze. Several hours' delay was occasioned by the engineers having to dismantle part of the gear. An all-electric gear would continue in operation irrespective of the state of the weather. From a switchgear point of view an all-electric steering gear has received from marine men the reputation of complicatedness, but in a well-equipped ship there should be no difficulties whatever. An increasing number of vessels are going to sea fitted with this type, and with each ship there is an increase in confidence for this type compared with the electro-hydraulic type.

There are many advantages which the electric motor of to-day has compared with the steam engine—for auxiliary work. Mr. G. J. Scott touched on some important points in a recent paper which he read before the Institute of Marine Engineers, dealing with the design of marine auxiliaries. One of the chief advantages he touched on was the extremely large overload capacity of the d.c. electric motor for short periods, which qualification for capstans, winches, and windlasses is invaluable. The electric motor is always ready to run at full load and even overload at a few seconds notice: the steam engine only if steam is kept in the feed pipes. The paper is full of interesting information and well repays study.

The increase in the number of electric winches and electric deck auxiliaries during the past few years has been enormous, and the flourishing and yet, perhaps, embryonic state of this branch of the industry is shown by the many different designs and arrangements of deck auxiliaries now on the market. There is a growing tendency, too, to take advantage of the flexibility which marine electricity offers by placing the controls for winches in strategic positions rather than fixing them down to one place by physical conditions of the winch. These and other matters would appear to indicate that we are still only at the beginning of the electrical era at sea. That is why the " Viceroy of India " is such an epoch-making development.

Books Received.

" The Discovery and Use of Industrial Wastes." By John B. C. Kershaw. With a Foreword by Sir Max Muspratt. (London: Ernest Benn, Ltd.) Pp. xvii+212. 25s. net.

Monographs on Physics: " The Spectroscopy of the Extreme Ultra-Violet." 2nd edition. By T. Lyman. (London: Longmans, Green and Co.) Pp. vii+160. 10s. 6d. net.

" Science Abstracts." Sections A and B, Vol. 31, Part 10. No. 370. (October 25th.) Issued by the Institution of Electrical Engineers. (London: E. and F. N. Spon.) Single numbers, 3s.; annual subscription, 30s.; or 50s. for both sections.

" Science Abstracts." Secs. A. and B. Vol. 32, No. 373. (January). Issued by the Institution of Electrical Engineers. (London: E. and F. N. Spon.) Single Numbers, 3s.; annual subscription, 30s. or 50s. for both sections.

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THE BRITISH INDUSTRIES FAIR.

A Brief Review of Some of the Electrical and Radio Exhibits at the White City Section of the Fair—Extensive Range of Measuring Instruments.

THE London section of the British Industries Fair draws to a close to-day, Friday, simultaneously with the Birmingham section, and though the bulk of the heavy electrical exhibits were to be seen at Castle Bromwich, there were nevertheless many items of electrical interest in London.

In order that overseas readers may have a complete record of the Fair we follow our last week's description of the Birmingham section with a brief review of the electrical exhibits in London. Many of the exhibitors in this latter section were wireless manufacturers and some of these only showed apparatus which has been previously described in connection with the last National Radio Exhibition, where such is the case the items have been omitted, as have also many of those electrical exhibits which have been dealt with in previous issues.

J. G. INGRAM AND SON (Hackney Wick, London, E.9). The exhibits on this stand comprised rubber gloves and gauntlets for the electrical industry certified as having withstood tests up to 10 000 V. This firm also undertakes the covering with rubber of box spanners and other tools used in electrical engineering.

MESSRS. ERNEST TURNER (Chiltern Works, 55/73, Totteridge Avenue, High Wycombe, Bucks.) This exhibit consisted of a comprehensive range of electrical measuring instruments from 2 in. diameter to 7½ in. diameter, together with portable and laboratory apparatus. It included thermo-couple instruments with internal and external couples, vacuum thermo-couples, voltmeters incorporating Westinghouse rectifiers, etc.

THOMAS DE LA RUE AND CO., LTD., (190, Shernhall Street, London, E.17). Here was shown a comprehensive display of bakelite, fireproof and plastic mouldings. The importance of the exhibit was demonstrated in the moulding-in of numerous metal parts.

GALSWORTHY, LTD. (16, Newman Street, London, W.1). The main features here were table and floor standard shades, including several models in two new materials, one of which was a reproduction of calf skin vellum. The registered name for this is "Vellumac," and it is claimed to be cheaper than vellum, while heat or damp do not affect it.

THE SHOREDITCH WOOD TURNING CO., LTD. (147, Hackney Road, London, E.2), showed Chinese lacquered wood floor and table standards and shades.

THE EVER READY CO. (GREAT BRITAIN), LTD. (Hercules Place, London, N.7). Apart from the display of hand lamps, torches, etc., shown in the Hardware Section at Birmingham, this firm devoted considerable space in the London section to wireless batteries of every type, both secondary and primary, together with a range of measuring instruments.

THE ACCURATE RECORDING INSTRUMENT CO., LTD. (Manor Road, Teddington). Here were shown steam, vacuum, etc., pressure gauges, thermometers, pyrometers and similar recorders.

Electrical Advertising Signs.

THE "ATTRACTA" ELECTRICAL CO. (2 and 3, Titchfield Street, London, W.1). The exhibits here were made up of electrical advertising signs and spectacular lighting effects.

BAIRD AND TATLOCK (LONDON), LTD., (14-15, Cross Street, London, E.C.1) exhibited a wide range of electrical and physical instruments.

BAKELITE, LTD. (68, Victoria Street, London, S.W.1). Mouldings and moulding powders, with samples of various types were the main attraction, together with demonstrations.

I. CALVETE, LTD. (11, Little Saint Andrew Street, London, W.C.2.) displayed "Thermical" diathermy apparatus for medical and surgical diathermy, Dr. Hofmanen closed arc lamps for ultra-violet radiation, the "Swift-Icall" hair-dryer, incorporating luminous heat and low-pressure air, in a specially designed helmet, as well as standard lines of "Solart" arc lamps, "Icalite" luminous heat ray lamps, switchboards for galvanic and faradic currents, and for electrolysis and cautery treatments, electric vibratory massage apparatus, hot air douches, high frequency machines, permanent hair waving apparatus, etc.

GOODWORKS, LTD. (Retreat Place, Homerton) claim to be the originators and believe themselves to be the only manufacturers of electric table standards and candlesticks which embody real elephant ivory, and their exhibit showed their products.

BOWER ELECTRIC (1926), LTD. (27, Ridinghouse Street, London, N.1) exhibited Neon tubes, and Neon tube advertising signs, including the patented "Neosyne."

THE FULLER ACCUMULATOR CO. (1926), LTD. (Woodland Works, Chadwell Heath, London, E.) showed a full range of all types of accumulators, including a series of unspillable types.

A new a.c. microammeter with readings up to 750 mA, by Ferranti, Ltd.

BERRY'S ELECTRIC, LTD. (85-86, Newman Street, London, W.1). This exhibit was similar to that at Birmingham, comprising domestic equipment, ironclad switchgear and "Berrylite" signs.

BIRKBY'S, LTD. (Liversedge, Yorks). This stand was almost a duplicate of that at Birmingham and featured "Elo" synthetic resin mouldings.

JOSEPH BOURNE AND SON, LTD. (Denby Pottery, near Derby). Among the exhibits shown by this firm were electrical insulators and battery jars.

BUROVOX, LTD. (Craven House, 121, Kingsway, London, W.C.2). Loud-speaking telephones for all purposes were shown in a variety of types.

H. CLARKE AND CO. (MANCHESTER), LTD. (Atlas Works, Old Trafford, Manchester). The exhibits here included pure mica tubes, micanite, "Atlas" varnished cloth, adhesive tapes, micafolium, vulcanised fibre, Egyptian and Indian cotton tapes, presspahn, leatheroid and pirtoid, "Atlas" coils, centre-tapped, double-tapped and short-wave, battery eliminators, a.c. and d.c., and a variety of windings of interest to the electrical industry. This latter interest has been extended to work outside radio requirements.

THE DOWSING RADIANT HEAT CO., LTD. (91-3, Baker Street, London, W.1). The firm showed a wide range of electrical domestic appliances including heaters, cookers, radiators, irons, etc.

HAILWOOD AND ACKROYD, LTD. (Beacon Works, Morley, Leeds). This stand, as at Birmingham, was used for the display of lighting fittings in glass, and miners' lamps.

IDEAL HOME ELECTRICAL APPLIANCES, LTD. (45, Great Ormond Street, London, W.C.1.) The features on this stand were mainly "artificial sunlight" apparatus, violet ray equipment, hair dryers, etc.

INDURITE (Byron House, 7, St. James's Street, London, S.W.). Moulding powders of interest to the electrical industry formed the chief exhibit.

JOHNSON, MATTHEY AND CO., LTD. (78-81, Hatton Garden, London, E.C.1). This company specialises in precious metals and a number of contacts, screws, etc., of interest to electrical and radio manufacturers were displayed.

THE M.L. MAGNETO SYNDICATE, LTD. (West Orchard, Coventry). Rotary transformers and motor generator sets for anode and filament supply to power amplifiers for radio,

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public address, etc., were the chief exhibits, while mouldings and moulding powders were also included.

GEORGE NOBBS, LTD. (87-89, Cleveland Street, London, W.1). The exhibits here included thermostats, water heaters, hot plates, electrically-heated incubators, furnaces, etc.

SUNVILITE, LTD. (Fitzroy Chambers, 5-8, Whitfield Place, Tottenham Court Road, London, W.1). The exhibits on this stand were devoted to ultra-violet ray and infra-red equipment for medical and home use.

One of the portable receivers shown by Whittingham, Smith & Co.

E. K. COLE, LTD. (Ekco Works, London Road, Leigh-on-Sea) showed a wide range of mains-operated devices for use in radio reception.

SELECTORS, LTD. (1, Dover Street, London, W1.). The item of chief interest here was a short wave three-valve set with a wavelength range of from 15 to 100 metres. Other sets shown were of the portable type.

ERIC J. LEVER (TRIX), LTD. (8/9, Clerkenwell Green, London, E.C.1) exhibited a portable 5-valve equipment which may, if desired, be operated from the mains, the connection being made by a plug and socket device which automatically cuts out the h.t. battery within the cabinet.

THE NEOPHONE RADIO MANUFACTURING CO. (9/10, Little St. Andrews Street, St. Martin's Lane, W.C.2) showed a cone loud speaker diaphragm of vulcanite moulded on fabric. This, it is claimed, is durable and non-hydroscopic.

THE BROWNIE WIRELESS CO. OF GREAT BRITAIN, LTD. (Nelson Street Works, Mornington Crescent, London, N.W.1). Apart from the already well-known range of "Brownie" products, there was also shown a range of "Dominion" receivers.

A. C. COSSOR, LTD. (Cossor House, Highbury Grove, London, N.5) had on view the "Melody Maker" receiver, valves, transformers, a.c. mains units, trickle chargers, frame aerials, motor lamps, medical lamps, etc.

THE DUBILIER CONDENSER CO. (1925), LTD. (Ducon Works, Victoria Road, London, W.3) exhibited a complete range of electrical condensers, including types for use in radio transmitters, receivers, wired wireless and other apparatus, and condensers for the improvement of power factor, for line protection, for laboratory use, etc. Condensers of the dry electrolytic type were also shown. A variety of wireless components were exhibited, of particular interest being the "Toroids." The "Westminster" screen grid portable radio-gramophone was shown, together with voltage regulators, rheostats, diode voltmeters, wavemeters, etc.

THE ORMOND ENGINEERING CO., LTD (199/205, Pentonville Road, London, N.1). This stand was devoted to the display of radio components and sets of every type, including parts.

J. DYSON AND CO., LTD. (2, Coleman Street, London, E.C.2) exhibited "Godwinex" 5-valve portable receivers, battery eliminators for a.c. and d.c. mains, "Airmax" coils, 6-pin and 2-pin types, microtune variable condensers, and a new model 5-valve oak cabinet portable set.

THE WATMEL WIRELESS CO., LTD. (Imperial Works, High Street, Edgware). The exhibits of this company included complete wireless receivers of the cabinet and table types, together with a comprehensive range of components.

TRUPHONIC, LTD. (121/123, Rosebery Avenue, London, E.C.1) exhibited a 5-valve "Meloset" receiver, together with a 4-valve screen grid model complete with turntable, both sets being portable.

THE LOEWE RADIO CO., LTD. (4, Fountayne Road, Tottenham, London, N.14. Two interesting exhibits here were the local receiver type OE 333, which embodies the new multiple valve and a cone loud speaker finished in mahogany with an artistically designed silk front. A larger cone speaker suitable for use in public buildings is also manufactured.

"M.P.A." WIRELESS, LTD. (62, Conduit Street, London, W.1) displayed a range of products varying from the "Ethatrope," a mains driven, valve-amplified gramophone, to the "Plaque" speaker.

AUXEL TIME SWITCHES, LTD. (45E, The Mall, Ealing, London, W.5). Here were shown radio programme selectors, 6-valve self-contained receivers and loud speakers.

CELIBRITONE, LTD. (Commerce House, 72, Oxford Street, London, W.1). Electrical gramophone reproducing machines in three models, and combined radio and gramophone instruments were presented in a variety of styles of cabinet work. Wireless sets including 5-valve portables, public address systems, amplifiers, loud speakers, electrical pick-ups, microphones and eliminators completed the exhibit.

MESSRS. C. CRESWICK ATKINSON (356, High Street, Bedford) displayed a range of "Reliance" wireless receiver models.

THE MULLARD WIRELESS SERVICE CO., LTD. (Mullard House, Denmark Street, London, W.C.2), as in previous years, again exhibited a full range of P.M. valves, transmitting, modulating and rectifying, "Pure Music" speakers, "Permacore" transformers, etc.

THE FORMO CO. (ARTHUR PREEN AND CO., LTD.), of Crown Works, Cricklewood Lane, London, N.W.2, exhibited a comprehensive range of components and constructor sets.

BELLING AND LEE, LTD. (Queensway Works, Ponders End). This firm's well-known indicating terminals were shown, together with a new counter-display device to simplify stocking and displaying the terminals by dealers.

WHITTINGHAM, SMITH AND CO. (110, Kew Green, London), exhibited "Portadyne" model "H" receivers in walnut cases and "Portadyne Juniors." The latter are available in lizard and blue fabric finish.

THE IGRANIC ELECTRIC CO., LTD. (149, Queen Victoria Street, London, E.C.4), The wide range of components, sets, radio-gramophone equipments, etc., which were shown at the National Radio Exhibition, were again featured at the Fair. Short wave receivers were given prominence, and those employing h.f. amplification are available with wavelength ranges as low as 10 metres. "Igranikit" constructor outfits were shown in both battery and main designs. Gramophone electrical reproducing apparatus was shown in great variety, many of the models being suitable for use in public halls, cinemas, etc. Battery eliminators, transverse current microphones, and general radio components completed a very comprehensive exhibit.

Meter Equipment.

FERRANTI, LTD. (Hollinwood, Lancs). Apart from h.t. supply equipment for mains operation, the well-known valve-tester and multi-range d.c. testing set, this firm showed a centre-zero microammeter with ranges of 250/0/250 mA. This instrument is of use for works testing where the greater accuracy of the reflector-galvo is not necessary, but where rapidity of working is essential. The instrument is suitably mounted on a pedestal base and is provided with two pin jacks. Another interesting instrument by this firm is also for measuring a.c. in micro-amperes, and the makers point out that whilst there was initially no call for such an instrument numerous uses have already been found, the most important being for telephone measurements, both by actual telephone engineers and for associated work such as electrical gramophone reproduction. It is being applied by chemists to a.c. electrolytic bridge work while for general electrical laboratory work it becomes nearly as useful to the research worker or experimenter as is the moving-coil galvanometer on d.c. work. The instrument consists of a standard moving coil movement of either 2½ in., 3¼ in. or 4 in. dial size, fitted with a Westinghouse copper-oxide rectifier, suitably compensated to have a negligible temperature error. The range is to 750 mA, and the scale is said to be nearly linear from about 50 mA upwards. The voltage drop is low for the range, and is about 0·25 V at full scale reflection. Its impedance is not constant for different frequencies, and further, the impedance decreases as the current increases. The useful frequency range is from 20-4 000 cycles, serving therefore the double purpose of being suitable for all power frequencies as well as telephonic frequencies; its error does not exceed 2% at 4 000 cycles compared with the calibration at 50 cycles.

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ELECTRICAL SALESMANSHIP.

Morals to be Drawn from the Prince's Speech—Why not Cultivate the Home Market?—Examples of Inefficient Salesmanship—Importance of Thriving Home Trade.

By "SALES MANAGER."

HIS Royal Highness the Prince of Wales has every reason to be satisfied with the results of his important speech at the Mansion House on the occasion of the banquet held to mark the opening of the British Industries Fair. He desired to concentrate attention on our selling methods and he has certainly succeeded in doing so.

That his criticism of British selling methods overseas was largely justified is common ground amongst those who have travelled; and the fact that we have retained so large a volume of our export trade in the face of growing competition is a sign that our goods are right and our customers loyal. But even our pre-war figure will not permit a real measure of prosperity to be enjoyed by this post-war generation.

It cannot be emphasised too strongly that the Prince was not only looking at the markets of the world. There has been a general tendency in the Press and elsewhere to assume that our salesmanship only needs improving for the increase of overseas trade. Various daily papers have published a symposia of opinions on the royal speech, but these all overlook the weakness of salesmanship in many directions in the home market.

Let us look at some of the more important lines of imports. Take one line in the electrical trade—the electrically-driven suction cleaner. The homes of this country are full of American-built sweepers. In the gas industry, a considerable proportion of the domestic fittings are of German origin and in the electrical industry no small percentage of the smaller lines are imported.

Go where you will, into whatever industry you like, and you will find that the salesmanship put behind these foreign manufactures has more than a little to do with their success.

In this connection one of our ablest thinkers has made an interesting point. "Why not," he asks, "develop to its full capacity the home market? It is no unusual sight to see a manufacturer moving heaven and earth to get business overseas, whilst in a radius of fifty miles from his factory gates there is a highly receptive market almost untouched."

We have been an exporting nation ever since the industrial revolution began to make its effect felt, and the glamour of world-wide distribution has tended to obscure our realisation of the immensity of our home market of some 45 000 000 people, each with many needs to be met and desires to be fulfilled.

The case for the cultivation of the home market in the electrical industry can be made out with no great effort. It is an admitted fact that electrically the nation is well behind the times, and the remedy can only be supplied by those to whom the development of electrical appliances is of past consequence—the manufacturers.

Improving Selling Methods.

To no group does the Prince's admonition apply with greater weight than it does to the electrical trade and it is the purpose of these articles to show how selling methods may be improved, how new fields of electrical usage may be exploited, how the age of electricity may be an accomplished fact in this country instead of a happy phrase of immense value at public and other banquets.

So far as the export side of the electrical industry is concerned, the figures are by no means unsatisfactory. Indeed, in this department of our business there is much to be admired and many lessons can be given to other industries as to the methods of securing overseas business and what is even more important, holding it against all comers.

It is the home market that has been the Cinderella so far and perhaps the simile will prove to be a happy one. The time may come when the fairy coach will be heard and the sister who has had so little attention may become the belle of the ball.

After all, there are many, many things much more difficult to sell than electrical equipment. There is still a considerable amount of novelty about electricity as an industrial force, and as a concomitant of modern existence.

There are said to be 30 000 000 consumers of gas, with some 9 000 000 meters in use. How do these figures compare with their electrical equivalents? Of the 10 000 000 or so homes in this country something like 75% still remain without any sort of electrical service in spite of the fact that the availability of electricity supplies is continually increasing.

It is agreed of course, that as a public utility electricity is comparatively a newcomer. But the advantages of electricity are so many and so obvious that lateness in the field does not provide a serious handicap if only the merits of electricity are advocated effectively and continuously. The growth in gas consumption in this country is in fact a high tribute to efficient salesmanship, and in this regard salesmanship itself may well be defined.

Briefly, salesmanship consists in creating a desire and then satisfying it. The creation is one thing—the satisfaction quite another. We must get more efficiency into our ways of providing electrical service if we are to come into the electrical age.

A Personal Case.

I have a case in mind, and it is by no means unique. I bought a house some eight months ago, and four months afterwards I sent a cheque to the local electricity supply undertaking to pay for the laying of a cable. Simultaneously I gave an order to an electrical installation contractor to wire the house and put in fittings. I hope to move into the house next week; but I shall have to buy paraffin lamps because the cable is not laid and the fittings are not finished.

I take leave to say that the gas undertaking would have had its work completed long before this. As it is, the only people who have functioned to time are the Post Office Telephone Department. The new telephone instrument has been ready to connect since Christmas when the house was to have been ready for occupation.

This is only one trivial example, but it is certainly significant. It shows a lack of salesmanship in the real sense of the word. I get no satisfaction if I telephone the electricity undertaking, and my letters *always* seem to miscarry. In fact, I could almost regret ordering electrical service in preference to gas—the cost of laying cables was approximately the same as that of laying gas pipes.

Again, taking the personal example, not a soul has been near me from the electricity undertaking to see if I want fittings or lamps or shades or anyone of the hundred delightful things which a supply of electricity makes available.

It so happens that my present house has gas only, and so I am at the moment a buyer of all things electrical—a fact that efficient sales management on the part of the local electrical concern should have ascertained as soon as my cheque for putting in the supply was received.

Some readers may say that this case of mine is exceptional. That there must be some local reasons why I have been—to use the colloquialism "messed about." But *is* mine an exceptional case? Does there not still remain a good deal of casualness concerning the customer's point of view that is reminiscent of the days when it represented something in the nature of a favour to allow a man electrical service?

I do not think we have yet come to a realisation of the possibilities of the home market, and until we do we cannot hope to tackle it with anything like the success we have met with overseas.

It is desirable to emphasize this point: a thriving home market must be of invaluable assistance to the export trade in the electrical, as in other industries. Big turnover means a general reduction in overheads all the way round, and the lower our costs of production the greater our competitive ability in every market we seek to enter.

Let us develop the big potential market we have here at home simultaneously with the continuation of our successful attack on the markets of the world and we shall have the British electrical industry on a basis of such prosperity that the electrical age will be a phrase with a new meaning—a phrase that denotes a higher standard of personal, civic and national well-being.

In a subsequent article, I propose to outline some of the methods whereby the home electrical market may be cultivated with advantage.

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THE IDEAL HOME EXHIBITION.

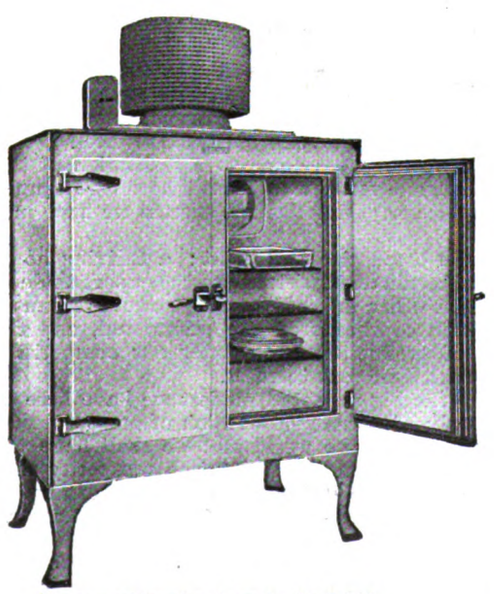
Items of Electrical Interest at the Olympia Show—New Refrigerators, Dish Washers, Cookers, and Other Domestic Equipment.

THE Ideal Home Exhibition which opened at Olympia, London, on Tuesday, again includes a number of stands devoted to domestic electrical appliances and equipment. The centre piece of the exhibition is an electrically-operated fountain put into operation by the BRITISH THOMSON-HOUSTON CO., LTD. This fountain has a lower basin of 30 feet diameter mounted 14 feet above the ground, with a tower in the centre supporting a further basin, 16 feet in diameter. In this upper basin are five banks of nozzles, the water from which is controlled both as to height and variation by automatic devices. At one moment water from the centre nozzle is projected to a height of nearly 60 feet above the ground, and at the next the jet recedes to within a few feet of the basin. Similarly, the other nozzles and sprays are controlled so that there is a continuous sequence of jets which rises at regular intervals to a height of 30 feet. These jets produce a cascade, which is subjected to rapidly-changing colour effects, produced by means of a battery of 30 B.T.H. floodlight projectors concealed beneath the water in the upper basin. In operation there are six changes in the water effects in eight minutes, while twelve different colour effects are produced every minute. In addition to the illumination of the cascade formed by the water jets, further effects are provided by the illumination, in changing colours, of the water flowing over the weir from the upper to the lower basin. This is achieved by means of 120 colour-sprayed Mazda lamps. All the apparatus for operating the fountain, consisting of a motor-driven centrifugal pump for producing the required water pressure, the electric flashing devices for controlling the colour and water effects, electrically-operated water valves and switchgear for controlling the floodlights, is housed in the central tower, the whole being remote-controlled from a push button station situated, in this case, in the supporting structure. The electrical and water connections were carried out by GRIERSON, LTD., Bloomsbury Square, London, W.C.1.

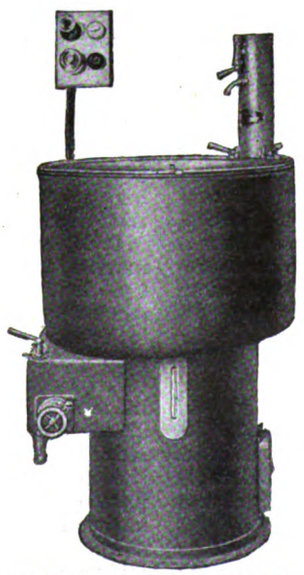
The exhibits on the stands reveal many new electrical appliances including a new range of fires by the GENERAL ELECTRIC CO., LTD., an automatic cut-out kettle, and a new wash boiler. This same firm is also showing new types of cookers in different sizes. A novelty exhibit on the stand is a large model of the automatic cut-out section of the new kettle. A demonstration kitchen, and a range of "architectural" lighting fittings are included, while the stand itself is so arranged that a clear view of the whole is seen from all angles. The stand takes the shape of an octagonal kiosk, with a pillar of light as the centre motif.

As in past years, the exhibition includes a wide range of vacuum cleaners by all the well-known makers, as well as refrigerators, small domestic appliances and so on. These have all been previously described in THE ELECTRICIAN, and though further description is not necessary, such stands as those occupied by HOOVER, LTD., the BRITISH VACUUM CLEANER AND ENGINEERING CO., LTD., VAMPIRES, LTD., the ELECTRIC APPLIANCES CO., LTD., the TELLUS SUPER VACUUM CLEANER, LTD., VAC-TRIC, LTD., MARCO REFRIGERATORS, LTD., KELVINATOR, LTD., L. G. HAWKINS AND CO., LTD., ELECTROLUX, LTD., and FRIGIDAIRE, LTD., are all worthy of the attention of the trade.

Among the new cookers at the exhibition may be mentioned the "Colonial" shown by the JACKSON ELECTRIC STOVE CO., LTD. This comprises an oven with cooking space 13½ in. high by 13¼ in. wide by 15½ in. deep, loaded to 1 650 W, and fitted with a drop-down door. The oven is surmounted by a hob fitted with a grill-boiling plate of 1 800 W and two hot-plates of 1 500 W each. All the units mentioned are arranged for 3-heat control by switches and fuses fitted in the control space on the side of the cooker. Both the oven and hot-cupboard are fitted with white panels mottled grey inside. Electric cookers are also shown by L. G. HAWKINS AND CO., LTD., a special demonstration kitchen being attached to the stand. The same exhibit includes washing and ironing demonstrations. Domestic labour-saving devices and cookers are the chief items of interest on the stand of the REVO ELECTRIC CO., LTD., in addition to fires and small appliances and water heaters. The well-known laundry equipment, cookers, and small appliances of THE HOTPOINT ELECTRIC APPLIANCE CO., LTD., are again featured, demonstrations being an added interest. The outstanding feature of the exhibit of the HURLEY MACHINE CO., is the new combination—washer, wringer and automatic ironer for domestic use. This machine claims to combine in one unit all the advantages of three separate machines. The new Thor vacuum cleaner is also shown. On the stand of THE BRITISH THOMSON-HOUSTON CO., LTD., is shown a range of automatic electric refrigerators, several models being in operation. A visit to this company's stand is well worth while, for there are, in addition to electric lighting equipment, a number of new fittings. Another interesting exhibit is the "Bulle" clock, shown by the BRITISH HORO-ELECTRIC, LTD. This is driven by a small renewable dry battery which is as accessible as is that of an electric torchlight. Electric pads and blankets are again to be seen on the stand of THERMEGA, LTD., while artificial sunlight equipment is featured by ELECTRO RAYS, LTD. A new studio lamp for photographic purposes is shown by PHILIPS LAMPS, LTD., together with a comprehensive range



The new refrigerator shown by the British Thomson-Houston Co., Ltd.



The "Pixie" electric dish washer by The General Electric Co., Ltd.

The "Colonial" cooker of the Jackson Electric Stove Co., Ltd.

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of all lamps including those for special purposes. The "Photomirenta" lamp shown claims to simplify and lessen the cost of night portraiture for amateur and professional photographers and renders the use of magnesium and arc lamps unnecessary. It consists of a 500 W gasfilled opal lamp, having half the bulb silvered to form a mirror, thereby increasing the intensity of light in one direction.

The RELIANCE TELEPHONE CO., LTD., is giving at the show demonstrations of automatic exchange telephone systems. The auto-intercommunication system has been designed for use in offices, works, banks, hospitals, etc., and is suitable for installation from two lines upwards. The "G.E.C automatic" private exchange telephone systems are represented on the stand by 25 line and 50-line exchange units, but larger equipments are, of course, made by the company. A number of useful telephone accessories are also shown, such as a range of "Magnet" extending arms; hygienic glass mouthpieces, phonopads, etc.

Country house lighting sets similar to those displayed at the British Industries Fair are shown by PETTERS, LTD., while in the village of "Welcome In" may be seen examples of inter-room telephones by BUROVOX, LTD., country house lighting sets by the KOHLER CO., LTD., "Cosyglo" fires by SIEMENS ELECTRIC LAMPS AND SUPPLIES LTD., fittings by GALSWORTHY, LTD., FALK STADELMANN AND CO., LTD., and MODERN ELECTRIC HOMES, LTD.

CORRESPONDENCE.

The Editor welcomes the free expression in these columns of genuine opinion on matters of public interest, although he disclaims responsibility alike for the opinions themselves and the manner of their expression.

"Glass Insulators."

[TO THE EDITOR.]

SIR,—We have noted Mr. North's reply in your issue of February 22nd, to the various criticisms of his article on "Glass Insulators," and we regret we have to trouble you again to correct further mis-statements.

It is regrettable that Mr. North should attempt to criticise a product about which he shows such an apparent lack of knowledge. In justice to ourselves and other porcelain manufacturers, we should like to take this opportunity of informing Mr. North that insulators are glazed with the sole object of presenting a smooth surface to which dirt will not readily adhere.

Mr. North is wrong in saying that the glaze may conceal porous porcelain. The opposite is nearer to the truth, because porosity, which is nearly always due to underfire, is very often indicated by the appearance of the glaze.

With regard to the temperature cycle test, the fact that insulators which pass this test can withstand the application of a flashover voltage for five minutes without breakdown is sufficient proof that they have suffered no damage. Mr. North has not informed us whether a glass insulator is capable of withstanding this test.—We are, etc.,

TAYLOR, TUNNICLIFF & CO., LTD.

Eastwood, Hanley, Staffs.
February 25th.

Overhead Electric Lines.

[TO THE EDITOR.]

SIR,—Will you please allow the writer space to accurately present mal-interpretations he gave on page 271, Jl. I.E.E., of February, 1929. In the first column of page 247 it is stated: His tests are quite as important as those described in the present report, because they give the limit for a rigid base, whereas the present report gives the same tests . . . . This should read: The Wade tests are more important than those described, because they give the true internal moment of pole by using a rigid base, whereas the present report gives certain tests for . . . . .

Also in the right column of page 247 (same distance up the page) which reads: If we want to get the maximum strength, not maximum possible bending moment. . . . This should read: If we want to get the maximum strength or maximum possible bending moment. . . . It would also seem necessary to add that my remarks had nothing to do with the use of sawn wood, nor with concrete foundations, and about as little with stays. They refer almost exclusively to the testing of a wood pole or a frame so that its true strength is obtained. Surely Mr. Woodhouse does not recommend sawn timber for a pole, which latter is one leg of a frame? Surely he does not consider a wood pole foundation (such as a concrete foundation for a wood pole) that completely stops drainage and ventilation from the pole, to be satisfactory? And, surely he would stay, or stub-stay or strut or support in some way a pile or a frame subjected to the lateral pull (or a longitudinal pull) of the character referred to in the paper as actual practice, etc., and, surely he would divert any such dangerous point of the line where it is impossible to support it for any reason whatsoever? Surely, good practice can be interpreted as the highest strength at reasonable cost, and highest strength surely means greatest safety? Hence, interpreting the three conditions mentioned, is it not evident that the best practice demands that we use the natural grown and trimmed and treated tree, not sawn timber; avoid any type of foundation that rapidly causes decay or rapidly decreases the pole-timber factor of safety, such as a solid concrete foundation does; and always use supports (stay or stub-stay or stub or any other means) where the transverse force is of the nature referred to by Mr. Woodhouse. These three conditions would therefore seem to differ widely from the views expressed by Mr. Woodhouse.—I am, etc.,

WILLIAM T. TAYLOR.

London, N.2.

Qualification for Wireless Trade Membership.

[TO THE EDITOR.]

SIR,—Your correspondent "Amused," in the issue of your journal of February 15th, has apparently been indirectly hit by the well-known figure who is the anathema of the established wireless retailer—"the dabbler." That epithet, it should hardly be necessary to explain, personifies the thousands, perhaps the tens of thousands, of mechanics, railwaymen, employees of shipyards, engineering firms, etc., who have been, and, in the main still are, obtaining trade discounts.

They are wage earners in most cases, and consequently have no rent, rates, taxes or overhead charges to pay. In the great majority of cases they have only the slightest smattering of technical knowledge, but they manufacture sets of sorts and sell them. Let it be added that they carry no stock in the ordinary sense of the word.

Some little time ago a questionnaire circulated by the W. R. A. elicited the fact that established retailers variously estimate that they are losing from one-third to one-half of their trade through the operation of these individuals.

Now, it will be seen that the broad distinction between responsible dealers and dabblers is that the former occupy business premises and carry a stock, and that the latter do not.

In order to meet the paramount need of excluding non-trade competitors it is hard to conceive how any other methods of differentiation could be devised. Once the stock-in-trade condition is modified the field is immediately widened, and numerous undesirable elements might endeavour to find their way inside.

Your correspondent may accept our assurance that the W. R. A. does not encourage applications for membership from the types of shopkeeper he enumerates, and that it *does* regard technical ability as a highly desirable attribute.

So far as this Association is concerned, however, every application is considered on its merits, and the specially appointed Election Committee has full discretion to extend the scope of eligibility in cases where circumstances appear to warrant such a course, although it must be stated that trade references are essential.—We are, etc.,

CLIFFORD AND CLIFFORD,
Hon. Secretaries, Wireless Retailers' Association.

70, Finsbury Pavement,
London, E.C.2.
February 18th.

POINTS OF VIEW.

What we need in the present economic conditions is Home Rule in industry.—*Sir Harold Bowden.*

* * *

I think that a good deal of the prejudice against tramways is based on the fact that the L.C.C. is not paying a profit.—*Mr. L. E. Harvey.*

* * *

The business man tries to cut down costs as low as possible, but the sane manager is not afraid of spending money on the most efficient machinery.—*Lord Eustace Percy.*

* * *

The electric theory of matter, the theory of relativity, and the quantum theory are effecting a change in one's general outlook, as distinguished from the changes in conception and method within physics.—*Prof. A. Wolf.*

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"PROSPERITY."

I.E.E. President's Prescription at Batti-Wallahs' Luncheon.

NEARLY 130 members of the Batti-Wallahs' Society and their guests were present at the Society's February luncheon at the Hotel Cecil, London, on Wednesday, Mr. R. W. Hughman (the president) in the chair. The guests included, in addition to Lt.-Col. K. Edgcumbe, president of the I.E.E., no fewer than four ex-presidents of that Institution.

After the very witty speech of introduction by Mr. Hughman, Col. Edgcumbe, the guest of the day, might have had some difficulty in getting back to "Prosperity," the subject of his address, but he effected the transition in a very happy way. Prosperity, he said, had come to be regarded as synonymous with high pay and low prices, but the only real measure of properity was the amount of products which an average day's work would provide. The figure reflected by real wages varied enormously in various countries, and the answer to the question why did it vary, was that it was axiomatic that a nation could not consume more than it produced. The politicians naturally obscured the issue in various ways, but it was impossible to get away from the fundamental fact that the average man could only consume what the average man produced.

It was quite clear that in order to increase productivity, i.e., the real wages, there must be an increase in the commodities we produced.

In his presidential address to the I.E.E. he had shown that the proportionality between real wages and productivity in a number of countries lay almost in a straight line.

It followed that unemployment would water down the output of those who were employed, and thus reduce the prosperity of the nation. On the other hand, an increase in output naturally increased the prosperity of the country.

When he asked an American what was the reason of their prosperity, he had replied with the one word: productivity.

Logically, if we increased the production of all goods equally, there would necessarily be a surplus of some things. A readjustment of labour was, therefore, necessary.

Putting aside all views on the merits and demerits of Free Trade or Protection, Col. Edgcumbe thought there would be general agreement that at a time when unemployment was rife in the country we should not continue to import so many manufactured goods as we were now importing. If we could reduce our imports of manufactured goods by £140 000 000 a year we would practically solve the unemployment problem. At the very worst, such action would mean an increase of about 2d. in the £ to all of us on our purchases. As the first step to prosperity was to do away with unemployment, this was a small price to pay.

This done, we should increase our output in every possible direction, for there was little doubt that the demand would come. But we must not count on Governments for assistance. It was difficult to imagine that politicians would have much success in the building of turbo-alternators, but they knew no less about that work than they did about economics, and if put to it, would probably do far less harm in that sphere than they were doing at present.

Viewed in the light of recent improvements in the coal and the iron and steel trades, the decrease in the numbers of unemployed during the present year, to say nothing of the winning of four Test matches, Col. Edgcumbe thought the outlook was fairly promising.

Disraeli had said that success depended upon constancy of purpose, and if only we could determine the purpose about which we wanted to be constant, we would have little to fear from competitors. His suggested purpose was: "Boost Home Output, and Buy British Goods."

It was announced at the luncheon that Sir Hugo Hirst will be the guest of honour on April 25th.

MARCONI PATENTS.

On Wednesday, in the Chancery Division, Mr. Justice Luxmore had before him two petitions by Marconi's Wireless Telegraph Co., Ltd., against decisions of the Comptroller-General and Assistant Comptroller-General of the Patent Office, in favour of the Brownie Wireless Co., Ltd., and the Loewe Radio Valve Co., Ltd., concerning royalties.

It was pointed out that the appeal was against the decision of the Comptroller-General and the Act said it should be an appeal against the "Tribunal Order." That order had not been drawn up. His Lordship directed the appeals to stand over.

NEWS IN BRIEF.

AN assistant electrical engineer is required by the Madras and Southern Mahratta Railway Co., Ltd.

During January, Burnley Electricity Department fixed, on hire or hire purchase, 114 radiators and cookers.

Telephonic communication between Turin, Italy and Buenos Aires, a distance of 6 500 miles, has been established.

Douglas Corporation has decided to adopt electric light at the abattoirs and to invite tenders for the installation work.

Teddington U.D.C. is about to instal an electric syren at the Council offices, for summoning the Fire Brigade, at a cost of £95.

Portsmouth electricity department is to carry out re-wiring of electric circuits at the Guildhall, at an estimated cost of £1 472.

Croydon Electricity Committee recommends the acceptance of tenders for the erection of sub-stations amounting to £412 10s.

Glasgow Health Committee recommends the installation of three-phase X-ray equipment at Ruchill Hospital, at a cost of £2 000.

Glasgow Electricity Committee recommends the acceptance of tenders for the erection of sub-stations at Cathcart Road and Ledard Road.

Mr. F. Westlake Parkinson addressed members of the Belfast Insurance Institute last week on "Electrical Wiring in Relation to Fire Hazards."

Tenders have been received for the electrification of the Heluan railway line to Cairo. The lowest was that of the English Electric Co., £261 573.

The Great Western Railway Co. is to provide private siding facilities at Stourport for the Shropshire, Worcestershire and Staffordshire Electric Power Co.

Blackburn T.C. has decided that 202 working-class dwellings which are being erected in the town, shall be equipped for gas and electricity, at a cost of £1 111.

Rotherham Health Committee recommends the provision of ultra violet light treatment at the Cranworth Road child welfare centre, at an estimated cost of £150.

Sunderland Town Council has decided that the electricity and tramways departments shall pay next year £5 000 each to the rates in respect of "monopoly value."

At last week's meeting of Bristol Corporation Housing Committee it was reported that provision had been made for wiring a number of houses for electric lighting.

Douglas Electricity Committee has authorised the Borough Electrical Engineer to arrange to exhibit at the Trades Exhibition at Villa Marina, at a cost not exceeding £200.

With the object of improving facilities for handling increasing import traffic of Sunderland, the River Wear Commissioners have recently installed four new five-ton electric cranes.

Bolton Electricity Committee is dealing with an assisted wiring scheme and also a proposal for the hiring of meters for electrical advertising signs, shop window lighting, etc.

It is stated that electricity required at the "Forum" Cinema, Villiers Street, London, is being produced by an independent plant at not more than a halfpenny per kWh.

The Governors of Southwell Minster Grammar School have received the approval of the Board of Education to the expenditure of £74 on an electric light installation in the school.

The fourth Palestine and Near East Exhibition will be held in April at Tel Aviv. There will be sections for electrical and wireless goods. Particulars from Mr. G. Bradlaw, c/o Palestine Electric Corporation, 3, Bedford Square, London, W.C.2.

The Scottish Students' Section of the Institution of Electrical Engineers met last week at the Electric Lighting Service Bureau, Trongate, Glasgow, when an address was given by Mr. W. Imrie Smith on "Modern Illumination and its Development."

The London County Council (Co-ordination of Passenger Traffic) Bill and the London Electric Railways (Co-ordination of Passenger Traffic) Bill were read a second time in the House of Commons on Tuesday, and it was decided to send the former to a Joint Committee of Lords and Commons.

At the recent annual dinner of the members of the Portsmouth Area of the Electrical Power Engineers Association, Mr. A. V. Sendell, vice president of the Association, said the National Executive had at last amended a rule of the Association so that the engineer engaged in the manufacturing industry was entitled to become a member.

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PERSONAL.

MR. J. W. Simpson, formerly town clerk of Thornaby-on-Tees, has been appointed secretary of the I.M.E.A.

St. Helens Town Council has increased the salary of the borough electrical engineer, Mr. Robert Lee, from £800 to £850 per annum.

Croydon Electricity Committee recommends that the salary of Mr. A. C. Cramb, borough electrical engineer, be increased from £1 500 to £1 600 per annum.

Stockport Town Council has appointed Mr. William Leighton Chubb, of Stoke-on-Trent, as mains superintendent. There were 63 applicants for the post.

Lord Birkenhead will be the principal guest of the British Electrical Development Association at the annual dinner to be held at the Piccadilly Hotel, on March 14th.

Mr. Colin Cameron Kirby (Salford electricity works) and Mr. Frank Morgan (West Midlands Joint Electricity Authority) have been elected as associate members of the Institution of Civil Engineers.

Mr. Ralph Lomax, borough electrical engineer, Stockport has resigned, and at his request has been paid six months' salary in lieu of notice. The post is to be advertised, the commencing salary being £1 000 per annum.

Mr. J. W. Fawcett, electrical engineer to Holmfirth Urban Council, has resigned, and accepted the position of resident engineer with the South East Yorkshire Power Co.

Barrow-in-Furness Corporation is recommended by the Standing Sub-Committee to increase the salary of Mr. H. R. Burnett, borough electrical engineer, from £850 to £900 per annum.

We regret to announce that Mr. F. H. Nalder, of Nalder Bros. and Thompson, Ltd., has been seriously ill, and has been confined to his house for over two months. We understand he is making satisfactory progress, and wish him a speedy recovery.

The Lord Provost's Committee of Edinburgh T.C. has agreed to recommend that the freedom of the city be conferred on Sir Alfred Ewing, whose decision to retire from the Principalship of Edinburgh University at the end of the academic year is announced.

At Liverpool University last week, Mr. S. E. Britton, chairman of the Liverpool Centre of the I.E.E., who presided at the annual Faraday lecture, presented Mr. W. Phœnix, of the Warrington Electricity Supply Department, with the Cooper's Hill War Memorial prize (bronze medal, certificate, and money award) for a paper on electricity in agriculture.

The 23 applications for the post of general manager and engineer to the Sunderland Tramways have been reduced to four, and the applicants have been asked to interview a sub-committee. The short list is Mr. C. I. Baker, general manager, Ashton-under-Lyme Tramways since 1922; Mr. C. A. Hopkins, general manager of Wigan Tramways, motors, and trolley-'bus undertakings; Mr. Harry Clayton, general manager of Preston Tramways since 1922; and Mr. H. W. Snowball, rolling stock superintendent, Sunderland Tramways, since 1926.

Obituary.

MR. C. F. WILKINS, on February 21st, managing director of Muirhead and Co., Ltd., Elmers End, Beckenham.

LADY LODGE, wife of Sir Oliver Lodge, on February 20th, in her 78th year. She had been married to Sir Oliver 51 years, and had reared a family of 12.

MR. F. HILL, engineer and manager, Hammersmith (London) electricity department, from pneumonia, on February 13th. Mr. Hill, who was 54 years of age, was engaged in the Bristol electricity department until he entered the Hammersmith Council's service in 1897. He succeeded to the position of engineer and manager, upon Mr. Bell's resignation about five years ago.

MR. THOMAS DUNCAN, at Los Angeles, aged 63 years. Born and educated in Scotland, Mr. Duncan removed to America in 1883. Three years later he entered the works of the Sun Electric Co., Woburn, Mass. In 1887 he became connected with the Fort Wayne Jenney Electric Light Co., and in 1890 he joined the meter department of the Thomson-Houston Electric Company at Lynn, Mass. At the close of the same year he returned to Fort Wayne to take charge of the meter-testing department of the Fort Wayne Electric Light Co. and his first meters were put on the market in 1895. Mr. Duncan became meter engineer for the Siemens and Halske Electric Co. of America in 1898. After the General Electric Co. absorbed the Siemens-Halske Co. he organized the Duncan Manufacturing Company and in 1901 began manufacturing at Lafayette, Ind.

BUSINESS ITEMS.

E. R. MORTON, LTD., 117, Charlotte Street, London, W.1, have been appointed sole London agents for "Lustrolux" electric lamps and valves.

The new showrooms of Best and Lloyd Ltd., at 40, Great Marlborough Street, London, W.1.

H. T. BOOTHROYD, LTD., Bootle, Liverpool, have opened a London office at 62, Great Russell Street, London, W.C.1.

SERVICE AND CO., LTD., electrical contractors, have opened new showrooms at 2, 3, 4 and 5, The Octagon, Plymouth, where a special window display is being made.

The business of JOHN PHILLIPS AND CO., 116/168, Walworth Road, London, S.E.17, has been transferred to BUCK AND HICKMAN, LTD., 2/8, Whitechapel Road, London, E.1, and Mr. Geo. L. Precious, proprietor of the former company, has rejoined the latter, where he was previously employed for 30 years.

IN PARLIAMENT.

Replies to Questions of Electrical Interest Asked in House of Commons.

ON January 31st there were 2 684 941 wireless receiving licences in force in Great Britain and Northern Ireland.

The Postmaster-General does not see his way to remitting the charge for a local call which is made when a telegram is sent by the telephone service.

About £12 400 000 of the £26 500 000 of share capital and reserves of the three telegraph companies embraced by the proposed Communications Co. represent reserves.

The number of prosecutions in 1928 for operating wireless apparatus without licences was 1 135 and convictions were obtained in all but seven cases. The total amount of fines recovered, including costs where granted, was £1 186.

Under the terms of the telephone agreements, a conversation can be terminated after six minutes. In practice, however, the restriction is only enforced when prolonged use of circuits causes inconvenience to other subscribers or where public call offices are concerned.

The cables and wireless merger company intends to acquire all the ordinary shares of the Eastern, Eastern Extension and Western Telegraph Companies. The share capital and reserves of these companies, according to their latest balance sheets, amount to rather more than 26½ million pounds.

The Government will not open negotiations with the new Communications Co. in regard to a transfer of the remaining inland telegraphs. The circumstances under which certain overseas services are to be transferred to a communications company have no analogy in the case of the inland service.

Replying to a question relating to the practice of demanding from subscribers making increased use of the telephone service a larger deposit, the Postmaster-General says the deposit is calculated at approximately two-thirds of the quarterly charges for calls. It is required mainly to help in financing the service during the period of credit.

The Minister of Transport is informed by the Electricity Commissioners that attention has been given to reports by Dr. Waldo, the coroner for the City of London, containing recommendations regarding electrical explosions and fire prevention, and that they are at present engaged upon the revision of the existing regulations for securing the safety of the public and for ensuring a proper and sufficient supply of electrical energy.

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THE SOCIAL SIDE.

THE A. T. M. Golf Club, whose membership is drawn from the personnel of the Automatic Telephone Manufacturing Co., held its fourth annual dinner on February 16th, at the Childwall Abbey Hotel, and Mr. T. A. Eades presided. Apart

Mr. T. A. Eades presenting the "Burch" trophies to the winners, Messrs. J. J. Langley and A. Speight, at the A.T.M. Golf Club dinner.

from some enjoyable musical items, a novel entertainment followed the dinner, taking the form of a film display showing well-known members of the club at the top of their form—and otherwise—on the Bowring Park Course. The prizes and trophies won during the season were presented by Mr. Eades, the various winners being as under:—"Tay-Mel" Cup, Mr. J. J. Langley; "Burch" Trophies (two ball foursome), Messrs. J. J. Langley and A. Speight; "Smith" Cup, Mr. R. C. Eastwood; "Niblock" Cup (mixed foursomes, Miss M. H. Kidd and Mr. R. E. Boyd; Captain's prize (bogey competition), Mr. R. E. Boyd; Lady Captain's prize, Mrs. R. E. Boyd; Mr. T. A. Eade's prize, Mr. F. M. de Borde; and the Gold Medal, Mr. A. G. Kidd.

Over 200 persons attended the concert and social of Blackpool Electricity and Tramways Employees' Institute. The M.C.'s were Mr. J. Appleton, sen., and Mr. W. Pratt.

The annual ball of the Liverpool Corporation Tramways Social and Athletic Society was held last week. As the number of employees and friends who attended was 3 000, the function was held on two evenings.

The Scottish Central Electric Power Co.'s operating staff recently held their annual dance in the Plough Hotel, Falkirk. The company numbered about 90, and Mrs. Brown, wife of Mr. H. Brown, assistant manager, distributed spot-dance prizes.

The annual dinner of the North Midland Centre of the Institution of Electrical Engineers will be held at the Hotel Metropole, Leeds, on March 12th. Lt.-Col. K. Edgcumbe will be amongst those present. Tickets, exclusive of wines, 12s.; students, 10s. Mr. H. Cecil, 36, Park Lane, Leeds, is hon. secretary.

At Barking electricity department's "Sparks" Social and Sports Club annual dinner, at the "Red Lion" Hotel, Barking, Mr. W. E. Kidner presided, in the absence of the president, Mr. W. Holmes, through indisposition. Mr. Kidner said he had inside information which enabled him to see that they would have a very prosperous year, so far as the undertaking was concerned.

The dinner of the Joint Delegation of the Local (Yorkshire) Associations of the Institutions of Civil, Mechanical, Electrical, Municipal and County, Locomotive and Structural Engineers will be held to-day (Friday) at the Great Northern Hotel, Leeds. Tickets (exclusive of wine, 12s. 6d.; student members, 10s.) from Mr. A. N. G. Wood, hon. secretary, 65-67, Prudential Buildings, Park Row, Leeds.

The Liverpool Electro-Harmonic Society will hold its annual "members' night" on March 22nd, when members of the Manchester Electro-Harmonic Society will be the guests. The function will take the form of a hot-pot supper and concert at the St. George's Restaurant, Redcross Street, Liverpool. Tickets may be obtained from the hon. secretary, Mr. E. G. Pulford, jun., of Messrs. Pulford Bros., Ltd., 104, Whitechapel, Liverpool.

THE A.S.E.E. DINNER.

Views on Multiplicity of Associations—Salesmanship and the Commercial Engineer.

THE annual dinner of the Association of Supervising Electrical Engineers was held on Saturday, February 23rd, at the Hotel Cecil, London, with Mr. S. B. Donkin in the chair.

Mr. A. H. DYKES, in proposing the toast of "Our Guests," pointed out that the presence of such guests as Sir Brodie Henderson, Sir Wm. Noble, Mr. G. Scott Ram, Lt.-Col. Kenelm Edgcumbe, and others, indicated the growing importance of the association, which, though only formed in 1914, had not only maintained its original ideals, but had assisted its members to improve their knowledge of electrical engineering, and established a satisfactory apprenticeship scheme, while in some cases, members of the association had delivered papers of importance, as well as contributed to the discussion of others. Though in his opinion it was a pity that all the engineering institutions were not one body embracing all classes of engineering, the part played by the Association of Supervising Electrical Engineers was something of a liason between the workers and those in higher authority, a liason, which, under present industrial conditions, was of extreme importance.

Sir BRODIE HENDERSON, President of the Institution of Civil Engineers, responded, and said that whatever may have been known of electricity before, it was only during the last fifty years that practical use had been made of it, and as great as had been its progress during those years, its future promised to be equally progressive. He did not agree that all engineering institutions should be grouped together to form one society, for though this was done to some extent in the United States, the conditions here, and the methods employed, were not the same.

Sir WILLIAM NOBLE also replied to the effect that though it would perhaps be convenient to have one engineering society in the country, progress had been such as to demand the present number of individual associations. The present Institution of Electrical Engineers, it would be remembered, started its life as the Society of Telegraph Engineers, but the progress made in the application of electricity as a power and lighting medium, introduced into the society papers subjects inappropriate to an association of telegraph engineers, with the result that telegraph engineers broke away from the parent body and formed their own association.

Lt.-Col. KENELM EDGCUMBE, President I.E.E., proposed the toast of "The Association," and explained his presence by the fact that the I.E.E. and the A.S.E.E. had much in common. He did not agree with the forming of new associations, for he believed that there were already too many, but of those that were necessary the A.S.E.E. was one of the most important. A point of considerable interest to him was the marked absence of unemployment among members. Trade unions as a whole had a tendency to level down wages, but the A.S.E.E. took the view of encouraging study and the acquisition of knowledge, and while this was the policy of the association, he believed that the industry would give its best support.

Mr. S. B. DONKIN, President of the Association, in reply, drew attention to the fact that the association was now 15 years old, during 11 years of which it had been a trade union. Its membership had steadily increased by about 10 per cent. each year, in spite of the high standard demanded of applicants for membership. The association was now represented on the I.E.E. Wiring Rules Committee, the B.S.S. Conduits Committee, and was now considering representation on the B.E.S.A. Accessory Committee. During the last two years, the association had produced the "Employers' Guide to the I.E.E. Rules," while further advances were made with the apprenticeship scheme. The Appointments Committee had done very useful work, and had, through the Employment Board, found employment for 500 men during 2½ years. With members' permission he proposed to present the association with a badge, the English motto for which would probably be "Ease to Progress."

Mr. L. W. MEDCALFE, Chairman of the Association, also replied, drawing attention to the remarks of the Prince of Wales on Salesmanship. He believed that the views held by the association were that though there was room for a number of non-technical salesmen, there must be for the utmost success what is termed the commercial engineer to form a link between the buyer and the producer. The A.S.E.E. had encouraged such engineers believing it to be in the best interests of the industry to do so.

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BUSINESS OPENINGS.

Latest Particulars of Electrical Engineering and Wiring Installation Contracts for which Tenders are being Invited at Home and Abroad.

WE give below the latest particulars of contracts for which tenders are invited. The closing date is given, when available.

VICTORIA PICTURE HOUSE, KETTERING.—Installation of electric lighting plant. Tenders to the Secretary, Gold Street, Kettering.

STOKE-ON-TRENT CORPORATION, March 1st.—Supply of overhead cables to X-ray block and laundry, Stanfield Hospital. Specification, etc., from the City Electrical Engineer; deposit £2.

WATFORD CORPORATION, March 1st.—Wiring of lighting and heating points in dwelling houses, in connection with house wiring schemes. Particulars from the borough electrical engineer, Mr. A. W. Barham, Cardiff Road, Watford.

CAMBRIDGE CORPORATION, March 2nd.—Twelve months' supply of electric lamps (schedule 16), etc. Forms of tender, etc., from the Borough Engineer.

CENTRAL ELECTRICITY BOARD, March 2nd.—Supply and erection of 33 000 V overhead line—Luton to Aylesbury—in connection with the South-East England Electricity Scheme. Specification (No. S.E.E.-S.L. 2) and form of tender from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, Charing Cross, London, W.C.2; deposit £2 2s.

CENTRAL ELECTRICITY BOARD, March 2nd.—Supply and erection of 66 000 V and other transformers in the London area, in connection with the South-East England Electricity Scheme. Specification (No. S.E.E.-L.T. 1) and form of tender from Sir J. R. Brooke, Secretary, Central Electricity, Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

SCARBOROUGH CORPORATION, March 2nd.—Manufacture and supply of e.h.t. switchgear (specification 3/29), l.t. switchgear (4/29), transformers (5/29), kiosks (6/29) and e.h.t. cable (7/29). Specifications from the Borough Electrical Engineer.

BROMLEY EDUCATION COMMITTEE, March 4th.—Electric lighting installation in Raglan Road Council School. Particulars from Mr. W. G. Trend, borough electrical engineer, West Street, Bromley.

CENTRAL ELECTRICITY BOARD, March 4th.—Supply and erection of 132 kV outdoor switchgear, for transforming stations, in the area covered by the North-West England and North Wales Electricity Scheme. Specification (N.W.E.-P.S.1) from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit, £2 2s.

CENTRAL ELECTRICITY BOARD, March 4th.—Supply and erection of 132 000 V transformers in connection with the North-West England and North Wales Electricity Scheme Specification (N.W.E.-P.T. 1) from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

DOVER HARBOUR BOARD, March 4th.—One year's supply of electrical sundries and cables. Particulars from the registrar, Mr. Rutley Mowll, Castle Street, Dover; deposit, 2s. 6d. for each schedule.

ERITH URBAN DISTRICT COUNCIL, March 4th.—Supply of h.t. and l.t. underground cables, joint boxes and other accessories during 12 months. Particulars and form of tender from the Electrical Engineer, Walnut Tree Road, Erith.

OBAN CORPORATION, March 4th.—Electric lighting work, in connection with erection of three-storey tenement at Soroba Road, Oban. Specification, etc., from the Burgh Surveyor.

SOUTHEND CORPORATION, March 4th.—Supply of 1 200 d.c. electricity meters. Full particulars from the Borough Electrical Engineer.

LEEDS CORPORATION, March 5th.—One year's supply of materials to the tramways and transport department, including electrical sundries, bitumen compound, electrodes, etc. Specification, etc., from Mr. R. L. Horsfield, general manager and engineer, 1, Swinegate, Leeds.

RACECOURSE BETTING CONTROL BOARD, March 5th.—Supply and erection of equipment for mechanical control of racecourse betting transactions in Great Britain. Specifications, etc., from Mr. J. R. Chambers, Secretary, 33, St. James's Street, London, S.W.1; deposit, £2 2s.

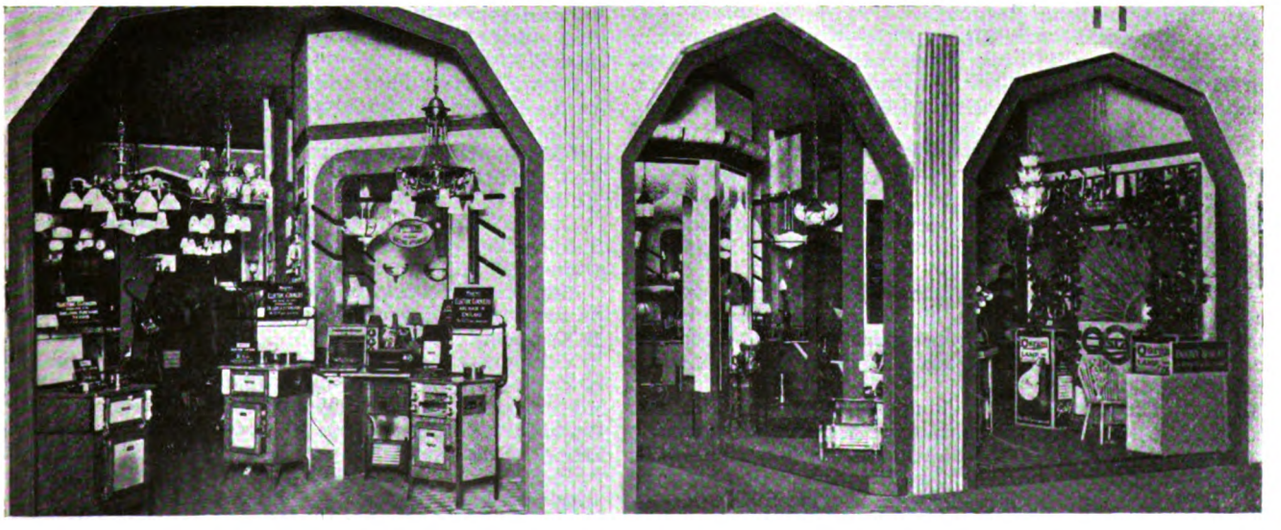
CENTRAL ELECTRICITY BOARD, March 6th.—Supply and erection of 66 000 V switchgear, for South-East England Electricity Scheme (London area), and supply and erection of 132 000 V transformers. Specification from Sir J. R. Brooke, Secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2.

CLACTON URBAN DISTRICT COUNCIL, March 6th.—Manufacture, supply and erection of two automatic, remote control, rotary converters; e.h.t. and l.t. switchgear, at Walton Road sub-station. Specification from the Electrical Engineer and Manager, 1, Arcade Buildings, Station Road, Clacton-on-Sea; deposit £1 1s.

HOLBEACH GUARDIANS, March 6th.—Electric light installation at the institution. Particulars from the clerk, Mr. S. S. Mossop, jun.

MANCHESTER CORPORATION, March 6th.—House wiring material, for assisted wiring and hired apparatus systems. Specification (No. 231) from Mr. H. C. Lamb, Electricity Department, Town Hall, Manchester; deposit £1 1s.

STOKE-ON-TRENT CORPORATION, March 6th.—Supply and erection of l.t. ironclad board, for power house extension,



THE stand of the General Electric Co., Ltd., at the Ideal Home Exhibition, which opened at Olympia on Tuesday. A review of the exhibits of electrical interest is given on page 270, while our comments on the absence of all-electric houses at the show are given on page 258.

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1929. Specification, etc., from the City Electrical Engineer; deposit £2.

CROYDON AND DISTRICT JOINT SMALL POX HOSPITAL BOARD, March 7th.—Electric light installation in the various buildings at the Sanatorium, Cheam, Surrey. Specifications, Mr. G. F. Carter, Town Hall, Croydon; deposit £3 3s.

STEPNEY (LONDON) GUARDIANS, March 7th.—Six months' supply of electrical fittings, etc. Forms of tender from Mr. S. McClelland, clerk, Administrative Offices, Bancroft Road, Mile End, E.1. Stamped, addressed envelope to be sent.

WALSALL AND WEST BROMWICH UNIONS JOINT COMMITTEE, March 8th.—Supply of electric fittings, etc. Forms of tender, etc., from the Clerk, 22, Lombard Street, West Bromwich.

LEEDS CORPORATION, March 9th.—Supply of single-phase (2 000 and 6 600 V), three-phase (6 600 V) and Scott-connected transformers, as required over a period of two years; and 11 000 V three-phase transformers (10 500 kVA), for early delivery. Specification from Mr. C. N. Hefford, Electricity Department, 1, Whitehall Road, Leeds; deposit £1 1s.

WARRINGTON CORPORATION, March 11th.—(1) Motors; and (2) transformers. Specifications from the Borough Electrical Engineer; deposit £1 1s. for each.

BELFAST GUARDIANS, March 12th.—Twelve months' supply of electrical fittings, etc. Forms of tender from Mr. R. H. Wilson, clerk to the Guardians.

MANCHESTER CORPORATION, March 12th.—Supply of trucks for electric tramcars. Specifications, etc., from the general manager, Corporation Tramways, 55, Piccadilly, Manchester.

ISLINGTON (LONDON) GUARDIANS, March 14th.—Six months' electrical supplies. Forms of tender from Mr. Albert King, Guardians' Offices, St. John's Road, Upper Holloway, N. 19. Stamped, addressed envelope to be sent.

NORTH BRITISH ALUMINIUM CO., LTD., March 12th.—Supply and installation of all material required for electric power and lighting distribution system, at the company's works, near Fort William, Inverness-shire. Specification, etc., from the Company's Offices, Adelaide House, King William Street, London, E.C.4.

SHEFFIELD CORPORATION, March 14th.—Buildings, civil engineering works and constructional steel work (specification B.M. 64); transformers (B.M. 66); pipework and valves (B.M. 69); e.h.t. three-phase switchgear (B.M. 71); battery locomotive and accessories (B.M.) 74). Specifications (deposit £3 3s. for each) from Mr. S. E. Fedden, general manager and engineer, Electric Supply Department, Commercial Street, Sheffield.

EDINBURGH CORPORATION, March 15th.—One 1 500 kW motor-converter, for Dewar Place sub-station. Specification from Mr. E. Seddon, engineer and manager, Electricity Department; deposit 10s. 6d.

BRADFIELD RURAL DISTRICT COUNCIL, March 18th.—Electric motors (with switchgear) for driving air compressors, at Pangbourne sewage works. Specification from the engineer, Mr. C. H. Stafford, 209, King's Road, Reading; or the Clerk, Town Hall Chambers, Reading.

EDMONTON GUARDIANS, March 18th.—Six months' supply of electric lamps, and X-ray, light, massage, etc., requisites. Forms of tender from the Clerk, 77, Bridport Road, Edmonton, London, N.18. Stamped addressed envelope to be sent.

Boiler Equipment.

LANCASTER CORPORATION, March 18th.—Two water-tube boilers, to evaporate 36 000 lb. of water per hour, with mechanical stokers, etc., at Caton Road generating station. Specification, etc., from the Borough Electrical Engineer; deposit £2.

NEWTON ABBOT URBAN DISTRICT COUNCIL, March 18th.—Supply of pumping and other equipment, with electric motors, control panels, etc., for sewer construction works. Specifications from Mr. F. W. S. Stanton, 5, Victoria Street, London, S.W.1.

CARDIFF CORPORATION, March 19th.—Supply of e.h.t. and l.t., paper insulated cables during 12 months, commencing April 1st (specification No. N 64), and supply and erection of natural draught cooling tower (specification N 65). Specifications, etc., from the City Electrical Engineer, The Hayes, Cardiff. Only members of the King's National Roll are invited to tender.

PADDINGTON (LONDON) GUARDIANS, March 20th.—Six months' supply of electricians' sundries, etc. Forms of tender from the Clerk, 313-319, Harrow Road, W.9. Stamped, addressed envelope to be sent.

STOURBRIDGE GUARDIANS, March 21st.—Supplies of electric lamps for six months. Particulars from the clerk, Mr. G. F. James, 12, Hagley Road, Stourbridge.

EDINBURGH CORPORATION, March 25th.—Supply of materails to the electricity department for 12 months, including cables, conduits, fuses and fuse boards, electrical material, electricity meters, meter boards, etc. Specification from the Engineer and Manager, Dewar Place, Edinburgh.

CENTRAL ELECTRICITY BOARD, April 15th.—Supply and erection of 33 000 V overhead transmission lines, in connection with the North West England and North Wales Electricity Scheme. Specification (No. N.W.E.-S.L.2) from Sir J. R. Brooke, secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

Overseas.

UNLESS otherwise stated, particulars of overseas contracts are to be had from the Department of Overseas Trade (Room 52), 35, Old Queen Street, Westminster, London, S.W.1. *Note.—An asterisk denotes that local representation is, in practice, essential.*

INDIA STORE DEPARTMENT, March 1st.—Supply of 200 000 insulators (schedule 1), 49 drums dry core telephone cable (schedule 2), and 500 tons g.i. wire (schedule 3). Forms of tender (5s. for each schedule) from the Director-General, Belvedere Road, London, S.E.1.

JOHANNESBURG MUNICIPALITY, March 4th.—Supply of 6 600 V switchgear (Contract No. 126). (Reference B.X. 5 087.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, March 5th.—Supply of seven single-phase 5 500 kVA transformers, for Waitaki power scheme, section 4. (Reference B.X. 4 873.)

EGYPTIAN MINISTRY OF THE INTERIOR, March 6th.—Supply and installation of underground and overhead cables, for transmission of current from Mit Chamr power works to the town of Kom el Nour. (Reference B.X. 5 074.)

JOHANNESBURG MUNICIPALITY, March 7th.—Supply of 15 miles of 0000 s.w.g. (0·4 in. diameter) round section h.d. copper trolley wire (Contract 128). (Reference A.X. 7 506.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, March 7th.—Supply of hydraulic accumulator, horizontal ram pump, electric motor, motor or belt driven air compressor, starter and control gear.

MAYO COUNTY BOARD OF HEALTH, March 9th.—Electric lighting installation at Creagh House, near Ballinrobe. Specification from Mr. T. Flanagan, county surveyor, Castlebar; deposit £2 2s.

YUGO-SLAV MINISTRY OF COMMUNICATIONS, March 10th.—Supply of various materials, including electric welding apparatus, machine tools, Diesel engine with electric generator and switchboard, two electric motors (25 and 20 H.P.), various electric generators and other electrical materials, for the River Shipping Board; telegraph and telephone materials, for the Construction Department; electric lighting sets for passenger coaches, for the Machinery Department, etc. (Reference C.X. 2 982.*)

POSTMASTER-GENERAL'S DEPARTMENT, Melbourne, March 12th.—Supply of telephone relays (schedule C. 408). (Reference B.X. 5 078.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, March 12th.—Supply of switchboard cords (P. and T. 151/1 247.). (Reference B.X. 5 017.)

CAPE TOWN MUNICIPALITY, March 15th.—Supply of metal-clad switchgear (specification 449/28). (Reference B.X. 5 004.)

CHILEAN MINISTRY OF MARINE, March 15th (extension of date).—Two electric travelling cranes, for Port of Valdivia. (Reference A.X. 7 353.)

VICTORIAN RAILWAY COMMISSION, March 15th.—Supply of armoured telephone cable (contract 4 2501). (Reference B.X. 5 126.)

VICTORIA ELECTRICITY COMMISSION, March 18th.—Supply of 1 300 strings of suspension insulators, 600 strings of tensioning insulators, 1 300 conductor suspension clamps, 350 conductor tensioning clamps, 50 semi-anchor clamps for "V" strings of insulators, 200 semi-anchor clamps for single strings of insulators, 475 earth wire suspension clamps and 125 earth wire tensioning clamps. (Reference B.X. 4 997.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, April 15th.—Conductor cords (No. P. and T., 151/1 319). (Reference B.X. 5 098.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, April 17th.—Supply of copper earthplates (specification 133). (Reference A.X. 7 556.)

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VICTORIAN ELECTRICITY COMMISSION, April 29th.—Supply of two or three steam turbo generator sets, with condensers, etc., for Yallourn power station extension (specification 29/7). (Reference B.X. 5 062.)

VICTORIAN ELECTRICITY COMMISSION, April 29th.—Supply of two swing hammer mills, with electric motors, for brown coal (specification 29/9). (Reference A.X. 7 434.)

TANGANYIKA GOVERNMENT, June 1st.—Concession for utilisation of Pangani River Falls for the development of electric power. Copies of the draft concession may be obtained from the Crown Agents for the Colonies, 4, Millbank, London, S.W.1.

STATE ELECTRICITY WORKS, MONTEVIDEO, July 8th.—Construction and equipment of 50 000 kW power station.

Tenders Accepted.

GENERAL POST OFFICE.—Edison Swan Electric Co., Ltd., dry cells.

NORTHERN IRELAND GOVERNMENT.—Edison Swan Electric Co., Ltd., supply of lamps.

DOUGLAS CORPORATION.—New Switchgear Construction Co., supply of feeder panel, £126.

STONE (STAFFS) GUARDIANS.—Langley and Co., electric light installation at Institution.

THORNABY-ON-TEES CORPORATION.—T. B. Watson and Son, electric light wiring of library, £87.

BURNLEY CORPORATION.—J. Bennie, Ltd., electric passenger lift at electricity showroom, £514.

EAST HAM CORPORATION.—English Electric Co., Ltd., supply of 1 500 kW motor converter, £4 370.

BEDFORD CORPORATION.—British Thomson-Houston Co., Ltd., supply of switchgear, £18 685. (Recommended.)

GENERAL POST OFFICE.—Standard Telephones and Cables, Ltd., automatic telephone equipment, for Newcastle-on-Tyne.

BRIGHTON CORPORATION.—Tudor Accumulator Co., Ltd., supply of battery, for sub-station at North Road, £6 812. (Recommended.)

FIFE EDUCATION AUTHORITY.—Scott and Co., electricians' work in connection with additions to Beath R.C. Secondary School, Cowdenbeath, £138.

LONDON COUNTY COUNCIL EDUCATION COMMITTEE,—H. J. Cash and Co., Ltd., electrical work at Hammersmith Trade School for Girls, £180.

GILLINGHAM CORPORATION.—Callender's Cable and Construction Co., Ltd., supply of cable, £7 807; Concrete Utilities, Ltd., cable covers, 9d. per yard.

FINCHLEY URBAN DISTRICT COUNCIL.—Premier Cooler and and Engineering Co., Ltd., construction of cooling tower and foundations, £2 336. (Recommended.)

GLASGOW CORPORATION.—Alexander Anderson, Ltd., electric lighting installation in grounds of the Mearnskirk sanatorium, £3 358 10s. 6d. (Recommended.)

CARLISLE CORPORATION.—British Thomson-Houston Co., Ltd., one 350 kW turbo-alternator, £3 061; Stirling Boiler Co., Ltd., supply of boiler house plant, £35 775.

GREAT WESTERN RAILWAY.—Tangyes, Ltd., provision of two electrically-driven pumps, for transit shed No. 2 dock, Barry; and two electrically-driven pumps at Southall.

FYLDE GUARDIANS.—P. J. Frampton, wiring and fitting the institution and offices for electric lighting, in place of the present gas lighting, £2 239. Ten tenders, ranging from £1 500 to £5 000, were received.

LONDON COUNTY COUNCIL.—Charing Cross Electricity Supply Co., Ltd., General Electric Co., Ltd., and Pirelli-General Cable Works, Ltd., improvement of electric lighting on the Victoria Embankment.

EAST HAM CORPORATION.—Brush Electrical Engineering Co., Ltd., supply of two spare tramcar trucks, £300; Bertram Thomas, supply of machine panel, £430; A. Reyrolle and Co., Ltd., supply of h.t. switchgear, £1 389; Taylor Bros., supply of 42 c.i. lamp columns, £3 5s. each. (All recommended.)

BIRKENHEAD CORPORATION.—English Electric Co., Ltd., supply of 300 kVA transformer, £157; W. T. Glover and Co., Ltd., (£312), Macintosh Cable Co. (£300), and British Insulated Cables, Ltd. (£138), cables; British Thomson-Houston Co., Ltd., supply of truck-type transformer cubicle, £131 12s.

ABERDEEN CORPORATION.—Brush Electrical Engineering Co., Ltd., construction of 12 new tramcar bodies and trucks; Electro-Mechanical Brake Co., resistances for same. The Brush Co. will be responsible for assembling the various portions of the cars. The total cost of the 12 cars will be £27 443. English Electric Co., Ltd., equipping 16 old cars with new motors, £6 823.

CHARING CROSS STATION.

Further Improvements on the London Underground Railways System.

APART from a few minor details, the new Underground station at Charing Cross is now complete. The station, with its three separate railways, handles over 100 000 passengers a day, which is considerably in excess of the traffic at any of the other tube stations. The various new features have been introduced piecemeal, and the result is virtually a new station capable of handling at least 50 000 000 passengers a year. The new Morden Tube, linked up with the Hampstead Line

New Booking Hall at Charing Cross Station.

by a short connecting tube, led to an additional traffic of about 26 000 passengers a day through the station exchanges, and the residents of Hendon and Edgware also made further claims upon the resources of the station, with the prospect of still further increases in traffic.

The work of reorganisation began in 1926 with the construction of a new circulating area beneath the District Railway tracks at a point where passengers could conveniently change between that railway and the Bakerloo and Hampstead Tubes below. Later came two new escalators which linked up the intermediate hall with the new south-bound platform of the Hampstead Tube. The next stage was the installation of two more escalators from the street level (Villiers Street) to the intermediate landing, making eight escalators in all. There are now no fixed stairways to negotiate.

A new booking hall, thrice as large as the old one, has been built. This has an area of 10 000 sq. ft., and it has a centre clerestory 18 ft. high and supported on massive steel columns encased with glazed terra-cotta tiles. The floor is paved with durus tiles. Automatic ticket machines are to be installed. In the new hall there will be 20 machines of the self-printing type, at which passengers will be able to help themselves. Change-giving kiosks, an inquiry office, and a special office for the issue of season tickets are additional new features. The station fronts to Villiers Street and the Embankment are floodlighted at night-time. The booking hall is illuminated by means of lamps situated outside the windows of the clerestory roof. Upon the site of the original booking office, in the Arcade, stalls are to be erected.

There is now being tried a system of coloured route signs for directing passengers. Thus, a passenger arriving by the Bakerloo and wanting Victoria will follow green lamps until he arrives at the west-bound platform of the District Railway. Similarly, a passenger arriving by the District Railway and wanting Piccadilly Circus will follow red lights to the Bakerloo north-bound platform. Or, if wanting Waterloo or Morden, he will follow dark blue lights until he arrives at the Hampstead south-bound platform. Another experiment which is being made at Charing Cross is that of employing small station names on the walls opposite the platforms.

The Minister of Transport has intimated that he is prepared to confirm Sunderland Corporation's Light Railways (Extension) Order, permitting an extension three-quarters of a mile in length, to Humbledon housing estate. The estimated cost is £20 266.

Salford Tramways Committee last week discussed proposals for establishing a Tramways and Omnibus Board, and it was decided to communicate with Eccles Corporation, and the Swinton and Pendlebury, Prestwich and Whitefield Urban District Councils on the subject. Difficulties have arisen in connection with motor-bus services in the districts mentioned, where the tramways are worked by Salford Corporation, and it is suggested that a satisfactory solution would be to combine the interests of all concerned.

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ELECTRICITY SUPPLY.

Stepney Generating Station Extension—Bacup Easy Wiring System—Liverpool Electricity Department Contributes £50 000 for Rate Relief—Nelson Electricity Committee and Uniform Prices—Switchgear for Bradford.

MANCHESTER Electricity Committee has obtained sanction for a loan of £10 000 for h.t. mains.

Bury St. Edmunds T.C. has applied for a loan of £4 180 for carrying out mains extensions.

Kettering U.D.C. has arranged to give a supply of electricity to Dingley Hall, the residence of Earl Beatty.

Islington (London) Electricity Committee has voted £12 000 for further replacement of h.t. and l.t. rubber insulated mains.

Stepney (London) B.C. is seeking a Special Order in connection with a proposed extension of the Limehouse generating station.

East Ham T.C. is to seek sanction from the Electricity Commissioners to the borrowing of £2 244 for extensions of distributing mains.

Llanidloes Electric Light Co. has asked whether Llanidloes Corporation desires to acquire the company's undertaking. The matter has been referred to the Lighting Committee.

Paignton U.D.C.has agreed to the application of the Brixham Gas Co., for authority to supply electricity to premises, outside its area of supply, in Dartmouth Road and Hookhills Lane.

Ealing T.C. have approved plans for a transformer station at the works of Raines and Co., St. Mary's Road, Ealing, and also for a transformer chamber in Keats Way, for the Uxbridge and District Electric Supply Co.

Bacup Electricity Committee has put forward a scheme for the execution of wiring on the instalment plan. Customers will be required to pay an additional 1½d. per kWh up to 200 kWh per £1 of capital expenditure on wiring.

Portrush U.D.C. has approved a specification for additional plant at the electricity works, estimated to cost £2 714, and a plan for the extension of the generating station to cost £750. The Commissioners are to be asked to sanction a loan of £4 200.

Having received sanction to borrow £1 300 for new electricity transformers and switchgear, Blackpool Electricity Committee now proposes seeking sanction for £8 000 to cover expenses in connection with the hiring of wash boilers, electric cookers, etc.

The electricity supply at Armitage, Staffs, was switched on last week by the chairman of the Parish Council, Mr. Thomas Farrington. The supply has been provided by the Trent Valley and High Peak Electricity Co., who held a two days' exhibition of electrical fittings in the parish room.

Worcester Corporation has decided to instal two 500 kVA Scott connected transformer sets, to cost £825 7s. 6d.; three 200 kVA transformers, £145 10s. each; and one 100 kVA transformer, £114 12s.; and to expend £2 000, in addition to £4 600 already spent, to carry on the work of the change over from d.c. to a.c.

Gravesend Electricity Committee has decided to inform the Joint Electricity Authority that it is not prepared to enter into any agreement involving the transfer or lease of its generating station or transmission lines.—The Corporation has obtained a Fringe Order for the supply of electricity to premises in Strood rural district.

Oldham Electricity Committee has received a letter from J. Brierley and Son, on behalf of the owners of several cotton mills, etc., with reference to the possibility of a reduction in the charges for electricity supplied to them, and it has been agreed that a sub-committee meet a deputation of the firms concerned to discuss the position.

The sum of £50 000 is to be devoted by the Liverpool electricity undertaking to the relief of rates. An endeavour made at last week's Council meeting to reduce the sum to £25 000, on the ground that the undertaking could not afford more in view of its contingent absorption in the Central Electricity's Board's scheme, was defeated.

Bebington and Bromborough U.D.C. has decided to light New Chester Road and the two by-path roads at New Ferry and Bromborough by electricity at an annual cost of £1 692, equivalent to a 2·1d. rate. The number of lamp standards to be used will be 108, and current will be supplied jointly by Birkenhead Corporation and Messrs. Lever Bros.

Ald. Smithson (chairman of the Nelson Electricity Committee) recently informed the Council that the Committee thought there should be no differentiation of price for electricity, and at the end of the year they would make such arrangements that there would be no preference either to large or small, but one uniform standard under which all would be treated alike.

Wellington (Somerset) District Electricity Co., has come to the conclusion that, owing to the situation which has arisen under the Electricity Acts, it would be unwise for the company to construct a generating station at Wellington, and it is arranging a bulk supply with the Whitehall Securities Corporation. Wellington U.D.C. has decided to inform the Commissioners of its desire to get its own supply in bulk and distribute it.

Stoke-on-Trent Electricity Committee seeks sanction for loans of £720 for mains extension, Marlborough Street, Evelyn Street and Goddard Street, Fenton; £800 in connection with supply to sewage works at Ford Green; £17,000 for e.h.t. feeder from Empson Street to Greenbank Road; £10 800 for cost of change over in various districts; £6 000 for mains extensions, Church Street, Longton, and £900 for mains extensions, Barlaston Old Road, Trentham.

Bermondsey (London) Electricity Committee reports that, in view of the altered conditions for the bulk supply of electricity to the Council from the London Electricity Supply Corporation, the Borough Electrical Engineer has been in communication with the London County Council with a view to the revision of the terms for the supply of current by the Council for the purpose of the tramways. The following terms have now been accepted by London County Council: The Borough Council to supply the necessary power, on the basis of a maximum demand of 1 000 kW at about 600 V, at 0.86d. per kWh delivered to the d.c. track switchboard, based on coal at 17s. 6d. a ton, subject to adjustment in respect of variations in the cost of coal.

Mr. H. E. Annett, borough electrical engineer, Bolton, is to report upon a scheme for the hiring of separate meters for electric advertising signs, shop window lighting, or similar purposes.—The Highways Committee has been informed that the Lancashire Electric Power Co., has applied to the Minister of Transport for consent to the placing of lines above ground between Chequerbent and Chorley, to supply electricity at 33 000 V, three-phase. The committee is to make representations to the company that the poles carrying the proposed wires over and across Lostock Lane should be placed at least 120 feet apart, and as nearly as possible 60 ft. from the centre of the present road.—Supplies of electricity in the Over Hulton district are to be afforded by means of overhead lines.

Bradford Electricity Committee has approved the scheme submitted by the Engineer for the reorganisation of e.h.t. switchgear at the Valley Road power station, at a cost of £75 460, and has authorised him to obtain tenders for the works. The steam-driven feed pump at Valley Road is to be replaced by an electricallg-driven pump at an estimated cost of £220. The Engineer has reported on the lighting of streets in districts of the city which are in the areas of supply of the Pudsey Gas Co., and the Drighlington and Gildersome Gas Light Co., and the Electricity Committee has decided to instal 622 electric standards, with time switch control, in place of 500 existing gas lamps, at an estimated capital cost of £10 415. The Electricity Committee has voted £20 000 for mains extensions.

The Post Office has applied to Tynemouth electricity department for a supply of current to several telephone kiosks. The Electrical Engineer recommends that the charge for supplying current and service for a 20 W lamp, but not including the lamp, be 30s. per annum, to be reduced to 10s. if the Post Office pay the Corporation £7, the cost of the service into the kiosk.—The General Electric Co. provided and erected the lamp columns and carried out the installation work on the length of the coast road which lies in the borough. The Borough Surveyor recommends that he be authorised to enter into an agreement with the company for the carrying out of the Grand Parade lighting if equally favourable terms can be arranged. The Electricity Committee has agreed, with the proviso that in the event of such terms not being obtained the Borough Surveyor shall obtain prices from other firms.

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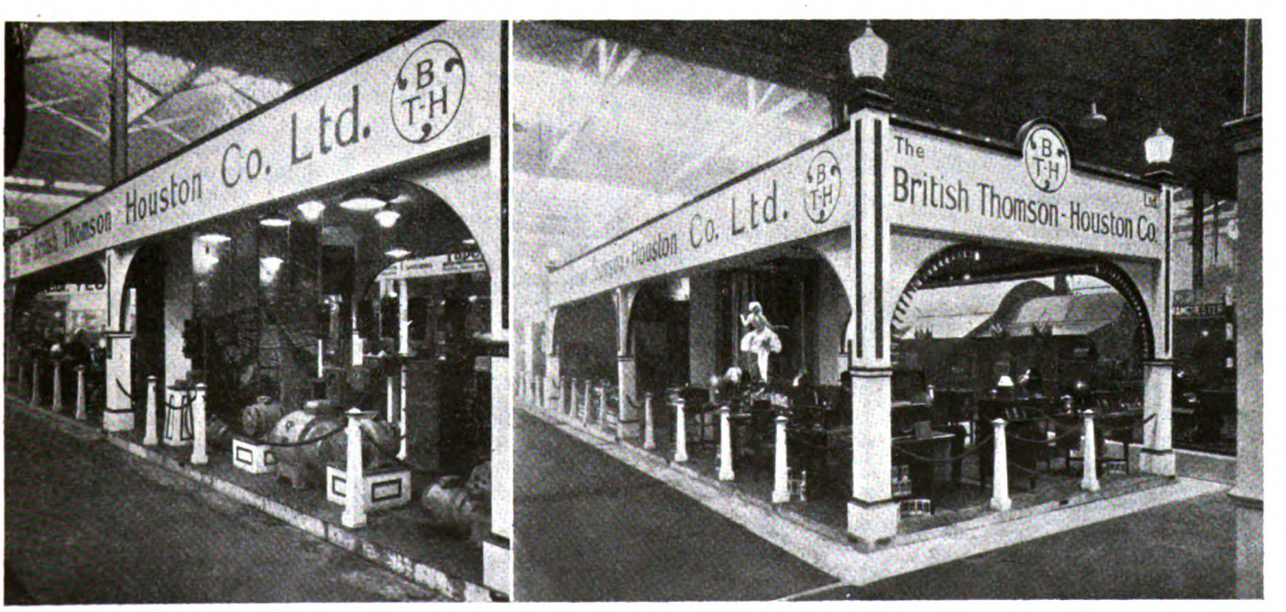
ELECTRICAL NEWS OF THE WEEK IN PICTURES.

Mr. C. W. V. Schaefer, whose death was announced last week, joined the Eastern Telegraph Co. in 1884 and became electrician-in-chief in 1923.

One of the century-old water wheels at the D. P. Battery Co.'s works at Bakewell, as it appeared during the recent severe frosts.

Sir Hugo and Lady Hirst, on board the s.s. "Tamaroa," upon their arrival at Southampton on February 22nd, from Australia.

Members and guests of the Association of Supervising Electrical Engineers, at the annual dinner, on Saturday, February 23rd, at the Hotel Cecil, London. Mr. S. B. Donkin, president of the Association, was in the chair, and the guests included, among others, Lt.-Col. Kenelm Edgcumbe, Sir Brodie Henderson, and Sir Wm. Noble. A report of the speeches is given on page 274.



Two views of the stand of the British Thomson-Houston Co., Ltd., in the Electrical Section of the British Industries Fair at Castle Bromwich. The picture showing the industrial exhibits includes some of the industrial lighting scenes which were a feature of the stand. These were specially designed to show in appropriate surroundings various types of lighting units.

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COMPANY NEWS.

Improved Prices of Manufacturers' Shares—Electrical Distribution of Yorkshire's Increased Profit—Utilities Power and Light Corporation's Debentures—Underground Railways' Annual Meetings—New Electrical Companies.

THE market for General Electric shares has turned again after the recent profit-taking, and a rise of half-a-crown during the past week has brought the price of the £1 share up to £3 15s. The £1 ordinary shares of Callender's Cable Co. and of W. T. Henley's Telegraph Works Company have each put on 1s. 3d., to £4 7s. 6d. and £6 1s. 3d. respectively; but British Insulateds at £4 15s. are 1s. 3d. down, and a fall of 1s. 6d. has brought down the quotation for Ever Ready shares again to 24s. County of London Supply shares have been sold, and the price has dropped from 56s. to 52s.

Last Annl. Divd.	Description.	This Week.	Last Week.	1926 to 1928. Highest	Lowest.
%	**Electricity Supply.**				
(*d*)	Brompton & Kensington Ord. ..	27/-	27/-	35/6	23/9
4	Central Elec. Sup. 4% Deb. ..	93	93	95½	88½
(*a*)	Charing Cross Elec. Ord. (£1) ..	26/6	26/6	51/-	24/3
4½	,, ,, ,, 4½% C.P. (£1)	17/6	17/6	18/3	16/6
(*e*)	Chelsea Elec. Sup. Ord.	27/-	27/-	45/3	24/-
10	City of Lond. Elec. L'ting Ord. ..	31/10½	31/10½	52/10½	26/-
6	,, ,, ,, ,, 6% C.P.	23/-	23/-	24/3	21/6
‡ 7½	County Lon. Elec. Sup. Ord. ..	56/-	52/-	68/6	25/9
6	,, ,, ,, ,, 6% C.P. ..	23/-	23/-	24/-	21/3
(*g*)	Kensington & K'bridge Ord. (£1)	27/-	27/-	27/6	23/9
(*b*)	Lon. Elec. Sup. Ord. (£1).. ..	27/6	27/6	37/6	23/-
9	Metro. Elec. Sup. Ord.	45/-	46/3	53/-	24/9
4½	,, ,, ,, 4½% C.P. ..	17/6	17/6	18/3	16/3
7½	N'castle & Dis. Elec. Ltg. Ord. ..	28/1½	28/1½	31/9	17/6
6	N'castle-upon-Tyne Elec.Sup.Ord.	26/3	26/3	30/3	19/3
6	N. Metro. Elec. 6% C.P.	23/-	23/-	23/9	20/10
6	Notting Hill 6% C.P. (£10) ..	10½	10½	11½	9½
(*e*)	St. James & P.M. Ord. (£1) ..	27/6	27/6	28/6	23/6
1/4½	Shrops.Worcs.&Staffs. Power B.Ord.	37/6	37/6	37/6	21/4
(*f*)	W'minster Elec. Sup.Ord. (£1) ..	27/-	27/-	52/9	24/-
4½	,, ,, ,, 4½% C.P. (£1)	17/6	17/6	17/10½	16/7½
8	Yorks. Elec. Power Ord.	36/-*	36/6	38/9	24/6
6	,, ,, ,, 6% C.P. ..	24/-*	24/6	26/9	20/7
	Railways and Tramways.				
8	Brit. Elec. Trac. Pfd.Ord. Stk ..	128	128	152	117
6	,, ,, ,, 6% Pf. Stk.	128½	128½	133	103½
4	Cent. Lon. Ry. Ord. Stk. (asstd.)	72*	73	72	54
4	,, ,, ,, 4% Deb.	81	81	83	77½
4	City & S. Lon. 4% Perp. Deb. ..	79½	79½	81	76½
4	Lon. Elec. Rly. Cons. Ord. Stk. ..	75½	75½	75½	42½
4	,, ,, ,, ,, 4% Pf. Stk.	74	75	77	68
4	,, ,, ,, ,, 4% Deb. ..	80	80	83	76½
5	Lon. & Sub. Trac. A. Deb. ..	97½	97½	97½	74
4	Lon. Un. Trams, 1st Deb. ..	61	61	63	39
4½	Met. Elec. Trams,4½% Deb. ..	70	70	73½	62
5	,, ,, ,, 5% Deb. ..	69½	69½	70½	65½
3	Met. Rly. Cons. Ord. Stk. ..	64½	65	81	54½
3½	,, ,, ,, 3½% Pf. Stk. ..	65	65	67	60½
3½	,, ,, ,, 3½% Deb. ..	71	71	73½	67½
4	Met. Dis. Rly. Ord. Stk.	80½	80½	77½	52½
4½	,, ,, ,, 4½% 1st Pref. ..	82½	82½	84	74½
6	,, ,, ,, 6% Perp. Deb. ..	116½	116½	118½	110
4	S. Met. Elec. Trams, 4% Deb. ..	70	70	70	64½
5	Uudergrouud Electric Rlys. Ord.	25/6	25/6	28/2	11/-
—	Yorks. (W.R.) Trams, Ord. ..	5/-	5/-	16/-	3/-
4½	,, ,, ,, 1st. Deb. ..	59	59	78	60
	Electrical Manufacturing.				
7	Brit. Elec. Transformer 7% C.P...	15/-	15/-	19/10	4/6
15	Brit. Insulated Cables Ord. ..	95/-	96/3	86/3	56/-
6	,, ,, ,, 6% C.P. ..	22/6	22/6	23/10	21/-
7	British Thomson-Houston Pref. ..	23/9	23/9	24/9	19/7
7	,, ,, ,, 7% Deb.	104½	104½	109½	102½
10	Brush Electrical Ord.	28/9	28/9	30/9	24/-
15	Callender's Cable Ord.	87/6	86/3	91/3	66/-
6½	,, ,, 6½% C.P. ..	25/-	25/-	25/9	22/-
7½	,, ,, 7½% B. Pref. ..	27/6	27/6	28/3	25/-
8	Crompton-Parkinson 8% Cum. Pf.	25/7½	25/7½	27/-	14/-
6	,, ,, 6% Cum. 2nd Pf.	19/-*	19/-	19/6	9/7
7½	Edison Swan Elec. Ord. (1st Pref.)	25/7½	25/7½	13/-	7/4½
5	,, ,, ,, 1st Deb. Stk.	86½	86½	92	81½
7½	Elec. Construction Ord.	23/9	23/9	32/6	23/6
7	,, ,, 7% C.P. ..	22/6	22/6	22/9	21/-
—	English Elec. Ord.	8/9	8/9	15/9	5/-
6	,, ,, 6% C.P.	9/4½	9/4½	18/9	7/-
7	Ericsson Telephones 7% Pref. ..	18/9	18/9	22/7½	17/6
35	Ever Ready (Gt. Britain) Ord. ..	24/-	25/6	92/3	18/1
6	Ferranti 6% Pref.	19/-	19/-	19/4½	16/9
7	,, 7% 2nd Pref.	19/-	19/-	19/3	13/9
10	General Elec. Ord.	65/-	62/6	46/6	26/6
‡25	W. T. Henley's Ord.	121/3	120/-	120/-	69/3
12½	Johnson & Phillips Ord.	38/9	38/9	67/11	34/-
7½	Lon. Elec. Wire. & Smith's Pref ..	23/9	23/9	25/-	22/3
7½	Siemens Bros. & Co. Ord. ..	30/-	30/-	36/6	24/9
10	Telegraph Const. Ord. (£12) ..	25½	25½	30½	20
	Telegraph.				
3½	Anglo-Am. Tele. Ord. Stk. ..	61½	61½	63½	56½
10	Eastern Ord. Stk.	265½	264½	273	135
3½	,, 3½% Pref. Stk.	68½	68½	70½	59
4	,, 4% Deb.	79½	79½	81½	74
10	Eastern Extension Ord. (£10) ..	26½	26½	27½	14
22	Gt. Northern Telegraph (£10) ..	33	33	43½	26
10	Indo-European (£25)	55½	54½	48½	30
20	Marconi's Wireless T. Ord. ..	81/3	78/9	84/4	12/-
12½	,, Int. Mar.	72/6	75/-	90/-	16/6
10	Western Tel. Ord. (£1)	26⅜	26½	27½	12½

(*a*) 1s. 7⅞d. per share. (*b*) £8 8s. 6.66d. per cent. (*c*) 1s. 6.949d. per share.
(*d*) 1s. 8.706d. per share. (*e*) 1s. 9.3d. (*f*) 1s. 0.912d. (*g*) 1s. 7.223d.
‡ Including 1s. bonus. * Ex dividend.

CLYDE VALLEY ELECTRICAL POWER CO.—Fin. div. on ord. shs. cap., 5%, makg. 8% for 1928, subject to tax.

POLPERRO ELECTRIC AND COLD STORAGE CO., LTD.—This co. recently offered for subscriptn. 5 000 shs. of £1 ea.

LIVERPOOL OVERHEAD RAILWAY CO.—Dividend for the year ended Dec. 31 at rate of 5% p.a., less tax, on pref. shs.

EVER READY CO. (GREAT BRITAIN) LTD,—An issue of 395 200 ord. shs. of 5s. ea. has been offered for subscriptn. during the past week.

ISLE OF THANET ELECTRICAL SUPPLY CO., LTD.—Div. on ord. shs. 4%, less tax, for year 1928. To gen. res. and depreciatn. £30 000.

KENSINGTON AND KNIGHTSBRIDGE ELECTRIC LIGHTING CO., LTD.—Directors recommend a blce. div. on £1 ord. shs. of 10·1811d. p. sh., makg., with intm. div., the standard div. for 1928.

ELECTRICAL DISTRIBUTION OF YORKSHIRE, LTD.—Pft. for 1928, £78 281, agst. £63 217, plus £18 723, agst. £15 837, brt. in. Div. on ord. cap. 9% less tax, of which 4½% was paid in Aug.; to res., £17 500; fwd. £21 905.

SOUTH METROPOLITAN ELECTRIC TRAMWAYS AND LIGHTING CO., LTD.—Blce. from workg. £65 783. Deductg. int., renewals, reserve, etc., leaves £26 491, plus £9 148 brt. in. Div. on cum. pref. 6% and on ord. 5%. Fwd. £11 139.

RUSHDEN AND DISTRICT ELECTRIC SUPPLY CO., LTD.—Gross rev. for 1928, £22 906, agst. £18 845; net rev. £6 864, agst. £5 649. Written off deb. stk. disct. and exes, £401; to res. £500. Fin. div. 4½%, makg. 8% for year. Fwd. £1 250.

UTILITIES POWER AND LIGHT CORPORATION.—This co. which has acquired all the common or ord. sh. of the Greater London and Counties Trust, offered, last Friday, $36 000 000 of 35-year 5% debs., with stk. purchase warrts. at 98%. Part of the proceeds will be used to withdraw 5½% debs.

NORTHAMPTON ELECTRIC LIGHT AND POWER CO., LTD.—Gross income for past year, £173 529, agst. £161 847. Net rev. £69 183, agst. £71 858. To depreciatn. £34 342, agst. £28 988. To gen. res. £8 000; to employees' benevolent fund £2 000. Fin. div. 5% on ord. shs., makg. 9% for year. Fwd. £9 690, agst. £9 910.

SMITHFIELD MARKETS ELECTRIC SUPPLY CO., LTD.—Net pft.. after provisn. for int. on deb. stk. etc., and placing £3 000 to deb. stk. redemptn. fund, £10 778, plus £2 531 brt. in. Deductg. intm. div. paid in Aug. 1928, leaves £11 509. Div. of 5% (1s. p. sh.) proposed for half-year to Dec., 1928, makg. 8% for year; to gen. res. £6 000; fwd. £2 509.

TORQUAY TRAMWAYS CO., LTD.—Pt. for 1928 £34 521. After deductg. deb. int. and amt. transferred to sinking fund for prior lien debs., there remains £27 921, plus £1 785 brt. in. To res. and renewals £9 711, provided for income-tax £4 400, for depreciatn. £117, and sick pay and pensions £191. Fin. div. 4% and bonus of 1% both tax free, makg. 9%. Fwd. £1 783.

LONDON UNITED TRAMWAYS, LTD.—Traffic receipts for 1928, £453 447, agst. £41 231. Opratg. exes. £392 456, increase £24 670; net receipts £60 991, increase £16 564. Other income £7 492, increase £134, makg. net income £68 483, increase £16 698. Deductg. fixed charges leaves £14 589, increase £17 034, which has been applied to reducing deficit brt. in. Deficiency carried fwd. £53 431.

METROPOLITAN ELECTRIC TRAMWAYS, LTD.—Traffic receipts for 1928, £679 369, increase £41 518. Other income £146 815, increase £9 000. Operatg. exes., £661 396, increase £8 841. Net income, £164 788, increase £41 677. Deductg. fixed charges £147 511, decrease £1 070, left £17 277, increase £42 747, which has been applied to reductn. of deficit brt. in, deficiency now carried fwd. being £80 827.

LANCASHIRE UNITED TRANSPORT AND POWER CO., LTD.—Gross pft. for 1928, £82 412. Traffic receipts, £350 576, increase £29 645; electricity sold and miscellaneous receipts, £27 538. Workg. exes., £247 116, cost of generatn., £8 041; gen. charges, £16 007; rent of leased lines, £4 538. Deductg. workg. exes., int., etc., on 1st mtge. deb. stk., depreciation on motor vehicles (£26 750) and provisn. of int., at 5%, on 2nd mtge. deb. stk. for 1928, leaves £12 554, which is carried fwd.

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METROPOLITAN ELECTRIC SUPPLY CO., LTD.—Gross rev. for 1928, £901 752, increase £18 818. Workg. exes. £564 136. increase £37 430. Net rev. £337 617, plus blce. brt. fwd, and int. and divs. from investmts. and allied undertakgs. makg. £480 755. After providg. for int. on deb. stks. and loans, sinkg. fund, div. on pref. shs. and other charges, there remains £222 149. Directors recommend div. at 12% p.a. on ord. shs., makg. 9% for year. Fwd. £87 149.

MIDLAND ELECTRIC SUPPLY CO., LTD.—Tradg. pfts. of undertakgs. owned and operated by co. for 1928, after paymt. of tax, amtd. to £306 510. To depreciatn. and res. of such undertakgs., £80 274. Blce. to credit of pft. and loss, includg. £4 106 brt. fwd., £217 811. Loan and deb. int., £23 605; to deb. redemptn. acct. £7 035; to investmt. res., £15 000, and intm. div. on 6% cum. pref. shs. for half year to June, 1928, £36 000. Divs. proposed: div. for half-year to Dec., 1928, on 6% cum. pref. shs., less tax, and div. of 6½% for year on ord. shs., less tax. Fwd. £5 676.

CROMPTON PARKINSON, LTD.—In order to correspond with the paymt. of the divs. on the 8% 1st pref. shs., the board in future propose to declare divs. on the 6% 2nd pref. shs. half-yearly, payable on March 31 and Sept. 30. The next half-year's div. should, therefore, be payable on Sept. 30. A half-yearly div. on the 8% cum. 1st pref. shs. at rate of 8% p.a. for six months ended Dec. 31, 1928, will be payable on March 31. A half-yearly div. on 6% cum. 2nd pref. shs. at rate of 6% p.a. for the six months ended Dec. 31, 1928, is now payable. Intm. div. on ord. shs. for six months ended Dec. 31, at rate of 22½% p.a. will be payable on March 31.

CHARING CROSS ELECTRICITY SUPPLY CO., LTD.—Gross earngs. of West End undertakgs. for 1928, £330 571, agst. £337 839; pft. £145 920, agst. £121 030. With int. and divs. accrued and amt. brt. in, total available is £238 493. Int. on deb. stk., etc., absorb £15 786, contributns. to sinking funds, etc. £40 491, and div. on pref. shs. £18 000. Fin. div. 10 1/8d. p. sh. on ord. shs. Fwd. £79 706, agst. £43 007. Gross earngs. of City undertakg. £345 939, agst. £354 527. Exes. £208 651, agst. £254 113; net earngs. £137 287, agst. £100 414. Includg. rent in respect of Bow generatg. station and trunk mains, etc. £60 943, and £1 472 brt. in, total available is £199 703. Int. on deb. stk. required £114 476, and div. on pref. shs. £18 000. Div. on ord. shs. equivalent to 10% on £350 000 and 7% on £200 000 absorbed £49 000. Fwd. £18 226.

SOUTHERN CANADA POWER CO., LTD.—A circular sent to the common shhldrs. states that at a special gnl. mtg. held on Dec. 21 last, it was the wish of all the shhldrs. present and represented by proxy to split the common shs. four for one, and to increase the cap. stk. to 500 000 common shs., and supplementary letters patent have been granted by the Secretary of State for Canada giving effect to these changes. The directors have, accordingly, authorised the Montreal Trust Co. and the Eastern Trust Co. to issue and register, in the name of hldrs. of no par value common stk. new certificates, on the basis of four shs. of new no par value stk. for each sh. of old no par value common stk. Shhldrs. are asked to send the certificates now held, with the necessary form (which accompanies the circular) filled up, to the Montreal Trust Co., 11, Place d'Armes, Montreal.

Company Meetings.

NORTH WALES POWER CO., LTD.—At an extraordinary meeting last Friday a resolution to reduce the capital from £1 000 000 to £808 058 10s. was passed.

TYNESIDE TRAMWAYS AND TRAMROADS CO.—At the recent half-yearly meeting, Mr. S. Hunter, who presided, said the deficit for the half year, after charging interest on mortgages, amounted to £2 530, which had been met by transferring £2 500 from general reserve. At a subsequent extraordinary meeting, the company's Bill in Parliament to authorise the abandonment of the tramways system and the substitution of omnibuses was approved.

MERSEY RAILWAY CO.—Mr. James Falconer, presiding at the meeting last Friday, said, after dealing with the financial figures in the report abstracted in our last issue, they had extended the cheap day tickets to passengers from all their stations, and had made them available at all hours of the day. Passengers carried during the year numbered 17 083 057, increase 68 795, and train miles were 486 085, increase 6 313, while the average number of cars per train had also been increased. The new electric pump had been satisfactory, and this had influenced them to place an order for a second electrically driven pump, the cost of which was estimated at £3 700. The report was adopted and the dividend approved.

METROPOLITAN RAILWAY CO.—Lord Aberconway presiding at the meeting on February 21st, said their gross receipts from railway working, etc., for 1928, were £1 606 966, an increase of £48 492, and expenditure was £1 116 424, increase £37 348. Other receipts amounted to £335 153, against £336 366 net. After deducting certain fixed charges, the net revenue for the year amounted to £780 612, compared with £765 866. After providing for interest on their debenture stocks and full dividend on the preference stocks, there was a balance available for dividend on the ordinary stock of £299 141, increase £35 317. In the first half of the year they paid an interim dividend at the rate of 1¼%, and they proposed now to pay a final dividend of 2¼%, making 3½% for the year, placing £10 000 to reserve, and carrying forward £23 888. Last year they paid 3%, placed a similar amount of £10 000 to the reserve fund and carried out £26 464. They were all the time modernising the electrical plant, and this enabled them to increase the output of current without raising the expenditure. At their electrical works at Neasden they had replaced another of the small 5 000 kW generating sets by an up-to-date set of 20 000 kW. The new machine had been in operation since last June, and had enabled them to effect considerable economies in coal consumption.

Distribution in London.

ST. JAMES' AND PALL MALL ELECTRIC LIGHT CO., LTD.—Mr. Gerald W. Balfour, presiding at the meeting on Tuesday, said the Board had now in operation certain static transformer sub-stations in the area, and they had in hand negotiations for the acquisition of further sites suitable for use as sub-stations. The directors were hopeful of securing sites at rentals which would still leave no doubt as to the economic value of the new system of alternating current distribution. The cost per kWh purchased from the London Power Co. fell from 0·8116d. in 1927 to 0·7944d. in 1928. Receipts from sales of electricity in 1928 were less by some £12 030 than in 1927, mainly due to two substantial reductions made in their tariffs during last year. Their output amounted to over 32 000 000 kWh against 28 000 000. Connections increased from 31 733 to 35 626 kW, equivalent to 12·27%. Their initial charge for lighting supply was from midsummer last reduced to 4d. per kWh, with a reduction to 3d. per kWh for any excess over 4 000 kWh in each year. The power charge was concurrently reduced to a flat rate of 1d. per kWh (the former fixed charge of 7s. 6d. per rated H.P. per quarter being at the same time withdrawn), and a special rate of ½d. was introduced for supply for water-heating purposes during off-peak periods. The introduction in the autumn of 1927 of a reduced rate of 2d. per unit for shop window lighting between 6 p.m. and 8 a.m. and throughout Sundays had been a phenomenal success, and many consumers who formerly failed to illuminate their shop windows after closing hours had taken full advantage of this reduced rate. They closed the year with a net profit of £103 851, against £123 933.

BAIRD TELEVISION DEVELOPMENT CO., LTD.—Sir E. Manville, presiding at the meeting last week, said that was the first annual meeting, and should have been held last autumn. Having regard to certain negotiations, the results of which it was hoped would have a material bearing on the company's policy in the future, the fixing of the date of the meeting was deferred from time to time. The progress made was remarkable, and beyond what they had expected. The images and scenes transmitted and received had attained a degree of perfection which was truly remarkable, whether transmitted over a metallic circuit or by wireless. They had already reached the stage when several figures could be seen simultaneously, and they had transmitted a small stage play. The Baird International Co. was in negotiation for the establishment of broadcasting of television on the company's system in most parts of the world, which he believed would rapidly lead to results of the utmost importance to them. Lord Ampthill, chairman of the International Co. was able to state at its statutory meeting last September that already a company to operate the Baird system had been formed in the U.S.A. in partnership with influential radio interests there. The company was installing transmitting and receiving apparatus in the chief Berlin wireless station. Some seven Continental broadcasting stations had invited the International Co. to instal transmitters for broadcasting television to the recipients of those stations. They had in course of manufacture some thousands of televisors which would be on sale to the public at moderate prices. A start was made at the commencement of the company's operations in the development of what they termed "phonovision," which, however, had

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not been proceeded with, owing to the necessity of concentrating all their efforts on the development of television for commercial purposes. There were other systems covered by the patents owned by the company, such as "Noctovision" and "Facsimile-telegraphy." Developments in these had been somewhat restricted, for the same reasons, although they had reason to believe that their system of Facsimile telegraphy would prove to be the fastest and most exact system extant. Baird television apparatus was now being installed at Radio Paris. The report and accounts were adopted.

POWER SECURITIES CORPORATION, LTD.—Mr. George Balfour M.P., presiding at the meeting last week, said the gross trading profit of £123 159, compared with £111 795 for the previous year, might be regarded as a satisfactory result, bearing in mind that they had left the profits from the contracting and engineering side of the business in the accounts of Balfour Beatty and Co., Ltd. Apart from the Lochaber contract, they had completed work in the Argentine, including two power station plants totalling 45 000 H.P. and in addition had dealt with a certain amount of plant and other works for Indian and African undertakings and a large volume of mixed construction work in Britain. The Grampians hydro-electric development was commenced during the early part of the year and was making rapid progress. During the year they delivered preliminary development plant under contract with the Madras Government, the principal works, for which they had the construction rights, having been submitted to the Government for final approval. They had at present in hand other engineering and construction work aggregating about 2¼ million pounds, which was all being carried out on a secure or fixed basis of remuneration, and, in addition, they had works of considerable magnitude to be taken in hand a year or two hence. They had handled during the year public issues of securities for electric supply and allied undertakings to an amount, aggregating some £3 000 000, for seven different undertakings, in addition to advances of a temporary nature. Investments stood at £797 885, against £695 404, an increase of approximately £100 000. The investments consisted of the share capital of Balfour, Beatty and Co., Ltd., holdings in electrical undertakings, Government securities and miscellaneous industrial holdings. Loans and participations amounted to £276 489, against £177 401. Income for the year amounted, including transfer fees, to £123 159, an increase of £11 363. There had been provided for taxation £19 481, against £9 772 and the balance carried to balance-sheet was £85 239, against £84 678. Adding the sum brought in from last year, £15 631, the total amount they had to deal with was £100 869. Preference dividend for the year, less tax, absorbed £28 000, transfer to reserve account £20 000, dividend equalisation account, £10 000, leaving £42 869. Directors proposed payment of dividend on the ordinary shares for the year 1928, at the rate of 7% per annum, leaving to be carried forward £14 869. The report and accounts were adopted.

UNDERGROUND RAILWAYS.—The annual meetings of the Metropolitan District Railway, London Electric, City and South London, and Central London Railway Companies were held on February 21st. Lord Ashfield was absent through ndi sposition, and his speech (which was read) stated the number of passengers carried during 1928 was 1 803 millions, an increase of 134 millions. The gross traffic receipts amounted to almost £15 000 000, and expenditure to £12 000 000, so that the net receipts were almost £3 000 000, or, to be more exact, £2 895 000, an increase of £266 000. For the first time they had been required to include in expenditure sums which previously had been treated as reserves, and deducted at a later stage. The sums so dealt with amounted to £160 000, in round figures, and, therefore, if they were to adjust the accounts to agree with those for 1927 the increase in net receipts would have been £426 000, instead of £266 000. Miscellaneous receipts amounted to just over £1 050 000, increase £27 000, so that altogether the amount of money at their disposal at this stage was increased by £453 000, or, allowing for an increase of £108 000 in the amount carried forward from 1927, £561 000. The dividend paid on the stocks and shares of the four railway companies was to be at the rate of 5%. Upon the railways the average cost of operation per car mile has fallen nearly 5%. It was estimated that in 1928 the total number of passengers carried in Greater London amounted to 3 989 millions, and of this total the passengers carried by their companies and the other companies with which they had close associations were 2 379 millions, so that they were responsible, directly or indirectly, for not less than 60% of the total passenger movement. They had strained their financial structure to the utmost to provide London with adequate transport facilities, and now they could do no more. They were compelled now to wait and demand that their finances should be put in a sound state. The remedy which force of circumstances compelled them to devise for themselves had now become the remedy which all those who are called in to treat the ills of London traffic prescribed. A wider common fund and a broader common management were now found to be the cure for the troubles which beset the outer suburbs. The immediate needs of London were underground railways, which would connect the newer suburbs at the periphery with the centres of commerce and trade. Many proposals have been discussed at inquiries held by the London Traffic Advisory Committee, and of these the most urgent would seem to be the extension of the Piccadilly section of the London Electric Railway in a northerly direction. This was the task they set before themselves as soon as they were able to raise the requisite capital. The report and accounts were adopted, and at special general meetings subsequently held the Bills now before Parliament were approved.

New Companies.

BORDER ELECTRICAL FACTORING CO., LTD.—Cap., £5 000. Electrical factors, etc. Reg. office: Collier Lane, Carlisle.

CALEDONIAN WIRELESS COLLEGES, LTD.—Cap., £2 000. To carry on business indicated by title. Reg. office: 24, India Street, Glasgow, C.2.

DERBY ENGINEERING CO., LTD.—Cap., £1 000. Electrical and general engineers, etc. Reg. office: Victoria Chambers, St. Peter's Churchyard, Derby.

HEARD AND PARTNERS, LTD.—Cap., £8 000. Mechanical, electrical and experimental engineers, etc. Solicitors: W. H. Court and Son, 7, Grosvenor Street, London, W.1.

"LOUD SPEAKER" CO., LTD.—Cap., £200. Manufacturers of and dealers in wireless and electrical apparatus and equipment, etc. Reg. office: 38, Palmer Street, Westminster, London, S.W.1.

JUNCTION ENGINEERING CO., LTD.—Cap., £1 500. To acquire business of mechanical and electrical engineer now carried on by A. T. Smee as "Junction Engineering Co," at 149a, Junction Road N.19.

MAYFAIR ENTERPRISES, LTD.—Cap., £1 000. Manufacturers of and dealers in gramophones, wireless, electrical and other instruments and apparatus, electrical engineers, etc. Reg. office: 37, Bruton Street, London, W.1.

MAIDEN HOLDING CO. LTD.—Cap., £100. Manufacturers, vendors or purchasers of wireless, telephone and television apparatus. electricians, suppliers of electricity, etc. Solicitors: S. G. Wood, 13, Bedford Row, London, W.C.1.

FROMRAY PARENT CO., LTD.—Cap., £120. To acquire from V. C. Fromray the benefit of certain existing inventions and discoveries relating to the use of electricity, etc. Solicitors: Boyce Evans and Sheppard, 14, Stratford Place, London, W.1.

GEE JAY SUPPLIES (WHOLESALE), LTD.—Cap., £1 000. Electrical wireless and general engineers, manufacturers of and dealers in radio and telephone apparatus and supplies, wireless service agents, etc. Solicitor: C. Jones, Vron Chambers, Holywell.

WELSH MINERALS CORPORATION, LTD.—Cap., £5 000. Mine and quarry owners, reducers and precipitators by hydro-metallurgical, metallurgical, hydro-electric or other processes of metals or metallic substances, etc. Reg. office: 36, Park Place, Cardiff.

NYE AND MENZIES, LTD.—Cap., £1 000. Engineers, agents for, dealers in and manufacturers of railway and general engineering equipment, tramways, signalling apparatus, electrical and wireless apparatus, etc. Reg. office: 62, New Broad Street, London, E.C.2.

LINLEY ENGINEERING CO., LTD.—Cap., £50 000. To adopt agreement with G. C. Griffiths, B. J. W. Barry and R. T. Firminger, and to carry on business of metallurgists, electrical supply engineers, etc. Reg. office: Nechells Park Works, Eliot Street, Birmingham. (Public co.)

HARMONY, LTD.—Cap., £500. Manufacturers of and dealers in wireless receivers and instruments, drawn wire electric cabling, electric lamps, articles and things used in connection with electrical, telegraphic, telephonic and wireless appliances, etc. Reg. office: 66, Newman Street, London, W.1.

HAYNES AND FORD (STAMPERS), LTD.—Cap., £4 000. To acquire business of E. F. Haynes, Ltd., of 47, 48 and 49, Northampton Street, Birmingham, and to carry on business of makers of motor parts and fittings, wireless parts, etc. Reg. office: 47, 48 and 49, Northampton Street, Birmingham.

ROGERS-JENKINS AND CO. (PTY.), LTD.—Cap., £100 000. Incorporated in South Africa, to acquire business of a mechanical, electrical and contracting engineer carried on by A. Rogers-Jenkins as Rogers-Jenkins and Co., Durban. British address: 21, Chiswell Street, London, E.C.1, where H. F. Adams is authorised to accept service of process and notices on behalf of the company.

SIMPSON, BAKER AND CO., LTD.—Cap., £20 000. To acquire business of electrical suppliers, factors and agents carried on by C.M. Simpson and A. C. Baker, at 2–5, Nelson Street, Bristol, and at 32, Newman Street Marylebone, London, as "Simpson, Baker and Co." also to carry on business of manufacturers of and dealers in telegraphic, telephonic and wireless apparatus, etc.

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COMMERCIAL INFORMATION.

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debt. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

AVON ELECTRIC CO., 313, Aigburth Road, Liverpool, electricians. £16 1s. 6d. January 7th.

BURKHILL, Harold Benjamin, 11, Edleston Road, Crewe, electrical engineer. £24 1s. 3d. January 13th.

CARTER, Mr. N. E. W. (trading as CHELTENHAM ACCUMULATOR CO.), 8A, Pitville Street, Cheltenham, radio and electrical engineer. £22 5s. 10d. December 14th.

COLE, Mrs. A., 46, Barking Road, Canning Town, wireless trader. £11 17s. 8d. January 17th.

ETHERIDGE, J. L. AND CO., 6, Woolcomber Street, Dover, electrical engineers. £12 15s. 6d. January 11th.

GAMBLE AND SONS, LTD., 283, Belgrave Gate, Leicester, electrical engineers. £17 13s. 4d. December 12th.

GREEN, G. R. AND CO., 68, High Street, Evesham, electrical merchants. £13 1s. 5d. August 15th.

JACOBS, Mr. A. (trading as SHEEN ELECTRICAL CO.), 37, Sheen Road, Richmond, electrician. £12 12s. 6d. December 12th.

KNIGHT, Walter H., 51, London Road, Bromley, wireless dealer. £13 2s. 10d. November 26th.

MILWARD, Mr. R., Ystradgynleis, electrical and wireless engineers. £13 7s. 10d. December 14th.

SANDS, Mr. C. W., High Street, Kings Langley, electrical contractor. 13 18s. 7d. January 11th.

SUTTON, Mr. A., Corner House, Chase Road, Epsom, electrical contractor. £19 5s. 11d. January 9th.

TASSELL, W., AND CO., Cheltenham Parade, Harrogate, electrical engineers. £26 19s. January 14th.

TEMPEST, Mr. C., 4, Mann's Court, Kirkgate, Bradford, engineer and electrical contractor. £41 1s. 10d. January 10th.

WADDLE, Leonard, 14, Woodhom Road, Newbiggin-by-the-Sea, electrical dealer. £18 8s. 8d. January 9th.

Receiverships.

G. E. AMBATIELO AND CO., LTD. (formerly G. E. AMBATIELOS AND CO., LTD.). B. L. Clarke-Lens, of 76, Newgate Street, E.C.1, was appointed receiver and manager on February 8th, 1929, under powers contained in debenture dated July 9th, 1927.

ELECTRICAL APPLIANCES (BLACKPOOL), LTD. W. B. Haworth, 5, Bloomfield Road, Blackpool, was appointed receiver and manager on February 19th, on behalf of the debenture holders.

Private Meetings, etc.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

MARPOLE AND FRISBY, LTD., electrical engineers, 161a Wardour Street, London, W. At the statutory meeting of the creditors in this voluntary winding-up, the liquidator, Mr. F. Stanley Wilks, submitted a statement of affairs which showed liabilities to unsecured creditors £548, £76 due to preferential creditors, and £250 to a debenture holder. The assets were estimated to realise £309. The liquidator stated that for the year to February, 1927, the returns were £4 800, and for the year to February, 1928, they were £2 313. In reply to a creditor, he said that the company had worked on a gross profit of about 10 per cent., which, of course, was altogether insufficient for a business of that kind. Profits had had to be cut, however, in order to meet competition.

London Gazette, etc.

Company Winding-up Voluntarily.

MALDON ELECTRIC WORKS, LTD.—A meeting of creditors at the offices of Davies, Gantner, Lovell and Co., Accountants, 5, Great Winchester Street, E.C.2, on March 4th, at 11 a.m. All creditors have been, or will be, paid in full.

Bankruptcy Information.

LEE, Edward Francis (trading as FRANCIS NEWTON), 340A, Kings Road, Chelsea, S.W.3, electrical engineer. First meeting, March 6th, 11.30 a.m., and public examination, April 12th, 11 a.m., Bankruptcy Buildings, Carey Street, London, W.C.2.

Notice of Dividend.

COLLIER, Thomas Frederick, 64, Union Street West, Oldham, Lancashire, electrician. First and final dividend, 9s. 1d. per £ payable March 6th, Official Receiver's Offices, Byrom Street, Manchester.

Notice of Intended Dividend.

WALLIS, Cyril Kenneth, 51, Mons Avenue, Bognor, Sussex, electrical engineer. Last day for receiving proofs, March 12th, Trustee, R. W. Cave, 12A, Marlborough Place, Brighton, Official Receiver.

Application for Discharge.

GREGORY, Albert Butterworth, 29, St. Albans Road, Seven Kings, Essex, wireless expert. Hearing, March 18th, 10.45 a.m., Shire Hall, Chelmsford.

Partnership Dissolved.

HYAMS, Philip, trading as THE RADIO MART, dealer in wireless and radio supplies, Bath Street, Glasgow. The business was transferred, as at February 18th, 1929, to Hector Russell and Co., Ltd., who will carry on the business at the same address.

Bankruptcy Proceedings.

LAWRENCE, Louis Haydn (trading as HENRY F. LAWRENCE), 43, Canterbury Road, Margate, electrical engineer. The debtor filed his petition on January 16th, and the statutory first meeting of his creditors was held on Friday of last week at Bankruptcy Buildings, Carey Street, W.C. His statement of affairs disclosed ranking liabilities £1 001, and net assets valued at £517. His failure was attributed to lack of working capital, heavy overhead charges, and trade depression occasioned by bad seasons. It appeared from the Official Receiver's observations that the debtor acquired knowledge of electrical engineering while serving in H.M. Army (Royal Engineers). Thereafter he was employed as an electrician at an average weekly wage of £5. In May, 1923, he commenced business on his own account as an electrical engineer at 14, Alexander Road, Margate, without capital. He commenced canvassing the district, and when he had worked up a connection he took business premises successively at Paragon Garage, Zion Place, Mill Lane, and Buenos Aires, Margate, and finally, in September, 1927, at 43, Canterbury Road, Margate. He estimated his turnover for the year immediately preceding the receiving order to have been about £1 600, but states that in consequence of heavy overhead charges there was a net loss of £200 during that period. The meeting passed a resolution for the appointment of Mr. C. S. Scarlett, I.A., 5, Cecil Square, Margate, as trustee of the estate, assisted by a committee of inspection.

METAL AND CHEMICAL PRICES.

TUESDAY, February 26th.

		Price.	Inc.	Dec.
Copper—				
Best Selected ..	per ton	£82 5 0	£1	—
Electro Wirebars	,,	£84 10 0	—	—
H.C. Wires, basis	per lb.	11¾d.	—	—
Sheet	,,	11¾d.	—	—
Phosphor Bronze—				
Wire (Telephone) basis	per lb.	1s. 2¾d.	—	—
Brass 60/40—				—
Rod, basis ..	per lb.	8¾d.	—	—
Sheet ,, ..	,,	10¾d.	—	—
Wire ,, ..	,,	10¾d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£3 9 6	—.	—
Galvanised Steel Wire, basis 8.S.W.G. ..	,,	£14 15 0	—	—
Lead Pig—				
English	per ton	£24 15 0	5s. od.	—
Foreign or Colonial	,,	£23 10 0	7s. 6d.	—
Tin—				
Ingot	per ton	£221 15 0	17s. 6d.	—
Wire, basis ..	per lb.	2s. 11d.	¼d.	—
Aluminium Ingots	per ton	£95 0 0	—	—
Spelter	,,	£26 5 0	2s. 6d.	—
Mercury	per bottle	£22 5 0	—	—

Sulphur—Flowers, Ton £12 0 0 *Sulphuric Acid*—
,, Roll ,, £10 10 0 (Pyrites, 168°) Ton £6 15 0
Copper Sulphate ,, £25 to £25 10 0 *Sodium Chlorate* per lb. 2¾d.
Boric Acid (Crystals),, £30 0 0 *Sodium Bichromate* ,, 3¼d.
Rubber—Para fine, 1s. 1d.; plantation, 1st latex, 1s. 0⅞d.

∴ The metal prices are supplied by British Insulated Cables Ltd., and the rubber prices by W. T. Henley's Telegraph Works Co., Ltd.

THE LEAD MARKET.

James Forster and Co. state that at the opening on Monday last week the firm tone seen at the end of the previous week was again in evidence, prices rising 3s. 9d. for February and 2s. 6d. for forward. On Tuesday the market was steady and prices well maintained, while on Wednesday, in sympathy with the higher price in U.S.A. at 6.95 cents, values rose a further 2s. 6d. per ton. On Thursday the market was again steady, but in the afternoon on a large order, presumably for continental account, prices firmed up again, and a further 7s. 6d. was added to all positions. The contango had once more disappeared on the Mexican lead being declared absorbed.

Closing prices on February 22nd were £23 15s. for February, £23 12s. 6d. for March, £23 13s. 9d. for April, and £23 15s. for May, 16s. 3d to 13s 9d. per ton higher on the week.

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PATENT RECORD.

The following information is prepared from the Illustrated Official Journal (Patents) by permission of the Controller of H.M. Stationery Office. Printed copies of full Patent Specifications, when accepted, may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at 1s. each.

Specifications Accepted.

304 551 Siemens and Halske Akt.-Ges. Telephone cables. (3/3/28.)
292 088 Soc. Anon. de Telephonie Priviee. Automatic telephone system. (11/6/27.)
292 506 Akt.-Ges Brown, Boveri et Cie. Mercury vapour rectifiers. (20/6/27.)
292 978 Siemens and Halske A.G. Electric control device for machines or apparatus for the sorting, evaluating, or calculating of statistical cards or paper strips provided with perforated symbols. (28/6/27.)
304 574 C. Spirig and Swiss Locomotive and Machine Works. Single stage electrically driven rotary compression or vacuum pumps for braking purposes on vehicles. (11/8/28.)
299 015 Siemens-Schuckertwerke A.G. Synchronising synchronous machines. (19/10/27.)
304 579 Siemens-Schuckertwerke Akt.-Ges and G. Scharowsky. Rectifying units for electric current. (14/11/27.)
304 580 S. G. S. Dicker (N.V. Philips' Gloeilampenfabrieken). Coating metallic or non metallic bodies with osmium. (31/10/27.)
276 376 M. Compare. System of telegraphy or radio-telegraphy in combination with a typewriting machine adapted to ensure secrecy of messages. (23/8/27.)
304 618 J. Neale. Means for closing a local circuit by variations in an applied electrical current. (14/10/27.)
279 452 Siemens and Halske A.G. Device for regulating the degree of transmission in thermionic valve circuits. (19/10/26.)
304 621 Marcel-Sesame, Ltd., and F. Kerka. Electrical switches, plugs, sockets, or the like. (20/10/27.)
304 631 W. S. Smith and N. W. McLachlan. Thermionic valve negative resistance devices and the like. (20/10/27.)
304 622 W. S. Smith and N. W. McLachlan. Variable coupling devices for electric inductance coils. (20/10/27.)
304 623 A. Carpmael (I.G. Farbenindustrie Akt.-Ges.). Manufacture of liquid or solid products by gaseous reaction under the influence of silent electrical discharge. (20/10/27.)
304 629 F. Punga. Driving of alternating current generators. (22/10/27.)
304 707 J. Lyons and Co., Ltd., A. Goddard, G. Douglass, Igranic Electric Co., Ltd., and S. R. Wright. Electric remote-control apparatus. (24/10/27.)
304 709 Graham Amplion, Ltd., W. J. Rickets and N. T. Carne. Telephonic sound reproducing instruments. (25/10/27.)
304 710 W. S. Smith and N. W. McLachlan. Audio-frequency thermionic amplifiers for use in submarine and the like cable systems. (25/10/27.)
304 813 Standard Telephones and Cables, Ltd. (G. Deakin, L. Polinkowsky and W. Hatton). Automatic or semi-automatic telephone systems. (26/10/27.)
296 719 Weston Electrical Instrument Corporation. Electrical indicating instruments. (6/9/27.)
304 816 P. Krout. Electric time switches. (26/10/27.)
304 818 P. H. Waller. Electric display systems. (26/10/27.)
304 820 Automatic Telephone Manufacturing Co., Ltd., W. O. Passmore and R. Taylor. Telephone systems. (26/10/27.)
304 821 S. G. S. Dicker (N.V. Philips' Gloeilampenfabrieken). Loud speakers. (26/10/27.)
304 824 H. G. C. Fairweather (Winchester Repeating Arms Co.). Combined ring-hanger and belt-hook for electric flashlights. (27/10/27.)
304 831 K. Wallach. Electric artificial rain making and weather regulating apparatus. (27/10/27.)
304 832 A. Reyrolle and Co., Ltd., and H. Lieben. Electric protective systems. (28/10/27.)
279 890 Westinghouse Electric and Manufacturing Co. Thermionic cathodes for vacuum electric tube devices. (28/10/26.)
279 891 Associated Telephone and Telegraph Co. Step-by-step switches, particularly for use in telephone systems. (28/10/26.)
304 843 Standard Telephones and Cables, Ltd., and L. C. Pocock. Telephone hand sets. (31/10/27.)
304 844 Standard Telephones and Cables, Ltd., E. P. G. Wright and D. H. Wain. Automatic or semi-automatic telephone systems. (31/10/27.)
279 904 C. W. Van Ranst. Electrically driven pumps. (29/10/26.)
304 849 W. E. Beatty (Bell Telephone Laboratories, Inc.). Method of and apparatus for producing strip material of metal. (31/10/27.)
304 850 W. E. Beatty (Bell Telephone Laboratories, Inc.). Synchronous telegraph systems. (31/10/27.)
281 250 British Thomson-Houston Co., Ltd. Induction type electric meters, relays, and the like. (29/11/26.)
304 858 D. W. Sayer and Electramonic Co., Ltd. Devices for converting mechanical vibrations into electrical impulses, and *vice versa*, particularly applicable to sound reproducing apparatus. (7/11/27.)
304 870 Electric Control, Ltd., and G. H. Dean. Electrical switches, particularly for high-tension systems. (21/11/27.)
281 669 British Thomson-Houston Co., Ltd. Electric switches for adjusting ratios of transformers. (30/11/26.)

Applications for Patents.

January 16th.

1 568 Siemens and Halske A.G. Measurement of heat quantities. (6/2/28, Germany.)
1 499 C. S. Smith. Electromagnetic clutches, etc.
1 527 Standard Telephones and Cables, Ltd. (F. de Fremery). Variable condensers.
1 531 D. E. Thomas. Burglar alarms.
1 595 A. L. Trickett. Plug and socket connectors.
1 507, 1 508 J. B. Tucker. Plug and socket connections.
1 564 L. Zwilling. Electric gas lighters. (12/9/28, Germany.)

January 17th.

1 672 H. F. Anns. Shades for electric lamps.
1 718 Automatic Telephone Manufacturing Co., Ltd., and T. R. Rayner. Tone-generating equipment for telephone systems, etc.
1 719 Automatic Telephone Manufacturing Co., Ltd., W. J. Brown and S. R. Smith. Impulse senders for telephone systems, etc.
1 720 Automatic Telephone Manufacturing Co., Ltd., and S. R. Smith. Impulse senders for telephone systems, etc.
1 647 W. Burd, and Engineering and Lighting Equipment Co., Ltd. Electric lighting fittings.
1 713 W. F. Boyd and London Electric Wire Co. and Smiths, Ltd. Inductances.
1 070 A. Ebner. Electric drive mechanism for gramophones.
1 680 Nordisk Elektricitets Selskab J. P. Jakobsen, O. Ekman. Lamp shades. (18/1/28, Denmark.)
1 684 Electrical Research Products, Inc. Acoustic devices. (28/4/28, U.S.)
1 674 C. H. L. George and E. L. Lee. Electric fans.
1 608 R. Greaves. Rotary magnetic separators.
1 635 F. H. Jenkins and Rowlands Electrical Accessories, Ltd. Electric lamp fitment.
1 645 F. A. Lindemann. Device for amplifying photoelectric, etc., weak currents.
1 705 O. Schieritz. Method of producing insulating materials.
1 681 Siemens-Schuckertwerke A.G. Automatic electric machine plant. (21/2/28, Germany.)
1 729 Standard Telephones and Cables, Ltd. (H. G. Busignies). Telephone systems.
1 622 R. Surtees. Housings for electric lamps, etc.

January 18th.

1 810 British Thomson-Houston Co., Ltd. Electric distribution systems. (19/1/28' U.S.)
1 746 S. O. Cowper-Coles. Electro-deposition of metals.
1 750 Credenda Conduits Co., Ltd., and P. W. Davis. Electric conductors.
1 772 W. Eschbach and F. Habbel. Watertight electric fuses. (24/4/28, Germany.)
1 820 T. B. Franklin. Location of underground conductive bodies.
1 808 International General Electric Co., Inc. Regulating transformers. (18/1/28, Germany.)
1 809 International General Electric Co., Inc. Manufacture of electric condensers. (20/1/28, Germany.)
1 835 M. Leff. Incandescent lamps.
1 791 C. Lorenz Akt. Ges. Eliminating disturbing, etc., waves in wireless circuits. (31/1/28, Germany.)
1 780 G. Mammoli and L. Marchi. Automatic telephone systems.
1 836 Siemens-Schuckertwerke A.G. Regulation of electric potential. (30/9/28, Germany.)
1 775 T. S. Skillman and Standard Telephones and Cables, Ltd. Telephone systems.
1 867 W. Smith. Primary cells for generating electric current.
1 864 P. K. Turner. Thermionic wave amplifiers.

January 19th.

1 876 P. Burns. Automatic electric control of shop window-blinds.
1 875 W. J. Edkins. Means of detachably coupling electric batteries.
1 882 L. Farmer and H. E. Sewell. Drums for cables, etc.
1 871 J. H. O. Harries. Television, etc.
1 950 Koch and Sterzel A.G. Alternating current rectifiers. (21/1/28, Germany.)
1 892 Maxlume Lighting and Heating Co., Ltd. Flicker producing devices for electric fires.
1 911 Metropolitan-Vickers Electrical Co., Ltd. Electric circuit interrupters (1/2/28, U.S.)
1 939 Radiologie A.G. Röntgen tubes.
1 907 Siemens-Schuckertwerke A.G. Switches with heat-operated release. (21/1/28, Germany.)
1 929 J. Sousedik. Induction regulators.
1 930 J. Sousedik. Alternating current machines.
1 910 Westinghouse Lamp Co. Electric relays. (7/2/28, U.S.)

COMING EVENTS.

Friday, March 1st.

Junior Institution of Engineers.—39, Victoria Street, Westminster. Informal meeting. "Notes on the Control of Electric Lifts." By Mr. L. S. Atkinson. 7.30 *p.m.*

Saturday, March 2nd.

Royal Institution of Great Britain.—21, Albemarle Street, London. Lecture by Sir Ernest Rutherford on "Molecular Motions in Rarefied Gases." 3 *p.m.*

Monday, March 4th.

Royal Institution of Great Britain.—21, Albemarle Street, London. General meeting, 5 *p.m.*

Institution of Electrical Engineers (South Midland Centre).—University, Edmund Street, Birmingham. General discussion on "The Anticipation of Demand and the Economic Selection, Provision and Layout of Plant," with introductory papers by Capt. J. M. Donaldson and Mr. J. G. Hines. 7 *p.m.*

Institution of Electrical Engineers.—Institution, Savoy Place, Victoria Embankment, London. Informal meeting. Discussion on "Variable-Speed Alternating-Current Motors." Opened by Mr. L. J. Hunt. 7 *p.m.*

Tuesday, March 5th.

Electrical Contractors' Association (Derby Branch).—Ordinary meeting.

University of London.—Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London. Lecture V (Course of five lectures) on "High Voltage Cables." By Mr. L. Emanueli. 5.30 *p.m.*

Institution of Electrical Engineers (North-Western Centre).—Engineers' Club, 17, Albert Square, Manchester. Paper by Messrs. E. B. Wedmore, W. B. Whitney, and C. E. R. Bruce on "An Introduction to Researches on Circuit Breaking." 7 *p.m.*

Association of Supervising Electrical Engineers.—Junior Institution of Engineers, 39, Victoria Street, London. Illustrated lecture on "Television," by Mr. H. A. Hankey. 7.15 *p.m.*

Wednesday, March 6th.

Electrical Contractors' Association (Bath Sub-Branch).—Ordinary meeting.

Electrical Contractors' Association (Cardiff Sub-Branch).—Ordinary meeting. 2.30 *p.m.*

Electrical Association for Women.—46, Kensington Court, London. Social Sub-Committee "At Home." 3 *p.m.*

Institution of Electrical Engineers (Wireless Section).—Savoy Place, Victoria Embankment, London. Paper by Capt. P. P. Eckersley and Mr. A. B. Howe on "Single Wave-Length Working." 6 *p.m.*

Thursday, March 7th.

Institution of Mechanical Engineers (Glasgow Branch).—Paper by Mr. J. G. Weir on "Modern Feed-Water Circuits."

Electrical Contractors' Association (Newcastle Branch).—Ordinary meeting. 11 *a.m.*

Electrical Contractors' Association (Bristol Branch).—Ordinary meeting. 3.15 *p.m.*

Institution of Electrical Engineers (Irish Centre).—Physical Laboratory, Trinity College, Dublin. Lecture by Mr. E. S. Ritter on "Picture Telegraphy." 7.45 *p.m.*

Friday, March 8th.

Birmingham Electric Club.—Grand Hotel. Annual Dinner.

Ex-British Westinghouse Association.—Hotel Cecil, Strand, London. Annual dinner and reunion.

Institution of Mechanical Engineers.—Storey's Gate, St. James's Park, Westminster. Informal meeting. Display of a collection of recent industrial cinematograph films of engineering subjects, including one on "Electro-Farming," by Mr. R. Borlase Matthews. 7 *p.m.*

Junior Institution of Engineers.—39, Victoria Street, Westminster. Chairman's address on "Road Transport." 7.30 *p.m.*

Saturday, March 9th.

Institution of Electrical Engineers (London Students' Section).—Visit to works of Marconi's Wireless Telegraph Co., Chelmsford. 2.15 *p.m.*

Royal Institution of Great Britain.—21, Albemarle Street, London. Lecture by Sir Ernest Rutherford on "Molecular Motions in Rarefied Gases." 3 *p.m.*

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THE ELECTRICIAN

Established 1861. The Oldest Weekly Illustrated Journal of

Electrical Engineering, Industry, Science and Finance.

Bouverie House, 154, Fleet Street, London, E.C.4. Telegrams: "Benbrotric, Fleet, London."
Telephone: City 0244 (Ten lines).

[Closed on Saturdays in accordance with the "Five-Day Week" plan adopted by Benn Brothers, Ltd., and its associated organisations.]

No. 2649. [No. 10. Vol. CII.] **Friday, March 8, 1929.** Annual Subscription, 25s. Overseas, 30s.

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Current Topics.

Transatlantic Broadcasting.

THE American expression "tell the world" was almost put into effect on Monday, when the ceremony of swearing in Mr. HERBERT HOOVER as President of the United States was relayed from 2LO with moderate success. To the best of our knowledge this was the second nearest approach to a daylight relay of an American transmission ever attempted by the B.B.C., and though at the time of the broadcast the daylight in this country had almost disappeared, the conditions prevailing over the greater part of the Atlantic were daylight proper. As far as we have been able to ascertain, the attempt was only partially successful, in that fading and atmospherics destroyed the continuity of the announcements and speeches, but, notwithstanding these admitted interruptions, we feel that the B.B.C. engineers are to be congratulated on their endeavours. When the first American relays were made, usually at an hour round about midnight, the public listened to a series of atmospheric disturbances accompanied by a few bars of music from a jazz band, and acclaimed the performances as wonderful. Since then, American relays have been made at earlier hours, and the programmes have been comparatively clear, with the result that the public has been taught to expect good reception whenever such relays are made. Monday's results were not up to expectation but were nevertheless commendable in view of the hour and subject. To broadcast by wireless an open-air public address is at all times difficult, but when that transmission is relayed by a station 3 000 odd miles away with even moderate success, it shows that the progress made in wireless telephony as a whole is deserving of some praise. The only regret is that the listener has become so used to hearing an unblemished and uninterrupted programme, that he is inclined to look upon unsuccessful experiments at relaying as altogether ridiculous and a discredit to the B.B.C. On the contrary, without such experiments, relaying a foreign station would not be possible. We have already heard Australian transmissions, most of the large Continental stations, and now the Canadian Royal Commission, which is considering the position of broadcasting in the Dominion, is hopeful that by the time a chain of powerful stations is built across Canada, it will be possible to arrange a regular weekly programme of British broadcasting for Canadian listeners and *vice versa*.

Dual Transmission by Radio.

IN connection with the views expressed above, we note with interest that MARCONI'S WIRELESS TELEGRAPH CO., LTD., claim to have evolved a system of wireless telephony which may be operated simultaneously with wireless telegraphy on the same wavelength without frequency interference or heterodyne. The first tests of the system were made over the Canadian "beam," speech being transmitted in both directions during the normal working of the telegraph service. If the expectations of this system are realised a direct wireless telephone service between this country and the Dominions will be possible by means of existing stations. The economical advantages of the system are obvious, and since negotiations are already proceeding between this country and the Dominions for the establishment of wireless telephone services, the development of this new system may possibly change the whole aspect of communication by this means. We understand that previous experiments carried out over a period of about twelve months had been confined to speaking from Montreal to England, but now the reverse direction has been tried, with complete success. If such services with the Dominions can be operated practically, the Empire chain of communication, to say nothing of broadcasting, is nearer completion than most of us realise. The radio branch of electrical engineering appears lately to have had more than its share of the limelight, for what with facsimile transmission, broadcast relays of American programmes and so on, the daily newspapers have had plenty of good "copy." Such publicity is not only deserved, but it encourages engineers on that side of electrical research to seek even further possibilities, and though perhaps more physical in its requirements, radio engineering attracts a large percentage of the students of our electrical engineering schools and colleges, thus tending to even lower the percentage of unemployed electricals.

A Debt-free Supply.

MUNICIPAL electrical engineers will learn with interest of the decision of the Hampstead (London) Borough Council to pay off all the outstanding loans on its electricity supply undertaking, to the extent of £32 310, out of accumulated surplus, thus leaving the undertaking free from debt as from March 31st. By this move the enterprise will, it is believed, place itself in a position which is unique in the electricity supply industry. We understand that the Rugby U.D.C. Electricity Department is also practically free from debt, but its position is somewhat different from

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that of Hampstead, as Rugby has never had any generating plant of its own. The Hampstead position is certainly an enviable one, and possibly some other undertakings will seek to equal its achievement. As a means of utilising surpluses it is certainly preferable to the illogical and unreasonable policy of rate relief. Lest it be thought that Hampstead is making too much money it may be stated that the tariff is one of the lowest in the country, at 3d. per kWh for lighting and 3d. for power, heating and cooking.

Back to the Cable?

As if in contrast to the developments of radio the AMERICAN TELEPHONE AND TELEGRAPH CO. announced in its annual report last week, that it would spend £400 000 000 in the next five years on the extension of plant, facilities, and perfection of a transatlantic telephone cable. While the company is developing radio telephone services on a large scale between the United States and the Argentine it claims to have already devised an effective telephone cable for transatlantic use, a necessity which, it is stated, has come about by the tremendous growth in continent-to-continent calls overloading the present radio facilities. This proposal brings to light the popularity of the radio telephone service now conducted, and though the laying of an efficient cable would relieve Rugby to some extent, the relief would not be permanent. The cable would, however, have the advantage, we imagine, of giving a full day service, whereas Rugby is restricted by the well-known day and night phenomena associated with radio. The British Post Office has already expressed a willingness to co-operate with the American Company in the event of a cable being laid, and though one may at first look to radio for a solution of the world's communication problems, it is by no means unreasonable to postulate that the solution may be found in a radio-cable service.

Best—Not Better.

WE so frequently have to refer to the species of inferiority complex with which some members of the electrical industry are infected that it is refreshing to be able to draw attention to others who maintain a more enthusiastic outlook, sometimes in spite of early disappointments. So many electrical people say in a very dogmatic way that electric cooking with energy at more than 1d. per kWh is out of the question. One morning this week we heard from an electrical enthusiast—not connected with the industry, and not particularly wealthy—that he finds that electric cooking, with the unit costing 2d., is, in every way, a most satisfactory proposition and would not go back to other methods if the cost of electricity were doubled! Prompted by the disseminators of a rival commodity we are too apt to confine our sales' arguments—and even our own private thoughts—to cost, to the exclusion of all the inestimable advantages of the electrical method, which if properly emphasised, would rapidly accelerate the progress of domestic electrification. In this connection the Coué ism, "Electricity is not better—it is best," printed on the letter heading of a London firm of electrical installation contractors, Messrs. MORTIMER AND GALL, is well worth memorising.

Training in Foremanship.

IT is acknowledged as good business to train lads carefully in the technique of their craft, but it is not always realised that training in the duties and responsibilities of a foreman is equally good. Those employers who have not yet recognised the importance of the matter will derive useful knowledge from a report, which has been issued by the Association for Education in Industry and Commerce, on the Education for Foremanship. This report emphasises three main avenues of approach. Thus, lectures may be given with special regard to the requirements of foremen of long standing; other lectures, on somewhat different lines, and possibly more specialised, should assist the newly appointed foreman; while a third course might suit more especially the charge hand or under-foreman, or the man qualifying for promotion. The courses would, however, be complementary rather than altogether distinct. The subjects treated would be grouped broadly under two main heads, the one general, without definite relationship to the vocational aspects of the question; the other directly bearing upon the career. Economics, industrial history, and psychology, etc., would figure among the former; the principles of scientific management, of planning, and of statistics; the relations between the laboratories and the engineering departments and the works; wage systems, costs and sales, factory layouts, education and training, health and fatigue, and the like, would come into the directly vocational curriculum. Wisely undertaken and directed, vocational training for foremen is essentially sane and practical politics. It should prove to be a profitable proposition for employers and employed alike.

British Engineer Honoured.

IT is with some pride that we record the announcement that the American Institute of Electrical Engineers has decided to make the first award of the Lamme Medal to an engineer of British birth and training. The recipient of this award is Mr. A. B. FIELD, who has been associated for some years past in the capacity of consulting engineer with the METROPOLITAN-VICKERS ELECTRICAL CO., and though the work for which the distinction is conferred—"the mathematical and experimental investigation of eddy current losses in large slot wound conductors"—is well known to designers of large electrical machinery, it is probably not so familiar to engineers in other sections of the industry. It may, therefore, be of interest to recall that the investigation, the results of which were embodied in a paper presented to the A.I.E.E. in 1905, constituted the first thorough analysis of the subject, and provided for the first time a system by means of which the eddy current losses for any given design of large machine could be predetermined. The importance and completeness of the work are indicated by the fact that the system, to which little seems to have been added by later investigators, still remains the acknowledged basis for the calculation of eddy current losses in turbo-alternators and other machines, notwithstanding the ever increasing capacities of the units now being built.

Television Progress.

THE Television Society is to be congratulated upon the comprehensiveness of its first exhibition, which was held at the Engineers' Club, London, on Tuesday. The exhibits covered practically every phase of the science, and indicated in a very practical way the progress which has been made. Though perhaps most of us are inclined to look upon television as being a comparatively recent invention, it was a surprise to some to find among the exhibits apparatus developed some 47 years ago, which gave much the same results as are at present obtained, without the modern improvements brought about by valve amplifiers, etc. A still greater surprise, perhaps, was to be found in the fact that the designer of this early television equipment was no less a personage than Mr. LL. B. ATKINSON who, standing beside his exhibits, gave an altogether delightful explanation of the purpose of his apparatus, and demonstrated its use. The holding of a television exhibition this week is particularly appropriate, for the Post Office last week witnessed a demonstration of a commercial system, the results of which are now under consideration. Among those seen at the exhibition was Mr. J. L. BAIRD, whose system, now operated by a limited company, is claimed to have progressed so favourably that images and scenes transmitted and received have attained a degree of perfection which is truly remarkable, whether transmitted over a metallic circuit or by wireless. Whether or not we could agree with this conclusion we cannot say, for we have never yet been permitted to witness a satisfactory demonstration. We can say, however, that the exhibition was most interesting and the claims of the exhibitors reasonable, while every facility for investigation was offered.

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PERMANENT MAGNET MOVING COIL AMMETERS AND VOLTMETERS.

Synopsis of a Detailed Report of an Investigation undertaken by the B.S.I.R.A. on "Critical Examination of Characteristics of British and Foreign Permanent Magnet Moving Coil Instruments of Switchboard Pattern."

(*Concluded from page 159.*)

IN all the instruments, both British and foreign, phosphor-bronze springs were used. The alloy used for the springs in the ammeters consisted usually of copper containing about 0·7% of tin and a trace of phosphorus. For the voltmeter springs the proportion of tin was considerably higher, usually between 4% and 6%, with an accompanying increase of the amount of phosphorus present. In one ammeter the springs were made from phosphor-bronze which contained about 1·3% of tin, while in another ammeter the phosphor-bronze used was of the type generally used for the voltmeter springs.

All the instruments were tested to see if the zero changed temporarily or permanently after the coil had been kept deflected to about 90% of the maximum deflection possible, for periods up to 72 hours. In only two instruments was the zero unchanged after this period, though in practically every instance the change of zero was only temporary, the pointer coming back to its original zero after a period ranging from a few minutes to about 24 hours.

Duplicate instruments similar to those which had shown no zero change were tested in a similar manner in order to find out whether the springs used by the manufacturers of these particular instruments were commonly free from tendency to take up a sub-permanent set. The second instruments, however, showed an appreciable sub-permanent set after the test, so that the perfection of the first instruments, as regards permanence of zero, would appear to have been accidental. The examination of the instruments for zero change would appear to indicate that the problem of making springs free from the defect in question has not yet been solved by any of the manufacturers, British or foreign, whose instruments were examined.

The springs fitted in the different instruments differed greatly in the thickness, width and length, and also in the torque exerted for an increase in curvature equivalent to a movement of one radian between the ends of the spring. The variation in the stiffness of the control springs fitted in the different instruments was not related in any regular manner to the variation in the weight of the moving system. As a result, the "torque/weight" quotient varied very considerably, ranging between 0·044 and 0·46.

Magnetic System.

The degree of care taken by different manufacturers in the fit and finish of the components of the magnetic circuit varies very considerably; the air gaps in the different instruments also differ considerably in length. In most of the instruments the pole-pieces were mounted on a casting, or frame, which fixed them in their appropriate positions relative to each other. Usually the magnets fitted the pole-pieces fairly tightly, but in several instances the fit was so loose that the magnet had to be strained inwards in order to bring its two sides into contact with the backs of the pole-pieces. In one pair of instruments the magnet was not only too wide to fit the pole-pieces without considerable strain, but in addition the pole-pieces were badly surfaced on their back faces: it may be merely a coincidence that this instrument read 9·25% low. In certain other instruments in which the magnet fitted the pole-pieces somewhat loosely, thin strips of soft iron were packed between the pole-pieces and the magnets. In one pair of instruments the practice followed appeared to be to make the gap between the ends of the magnet an almost perfect fit on the backs of the pole-pieces, the fit being so perfect that the use of bolts or of any clamping device to fix the magnet on to the pole-pieces could be dispensed with. It is not suggested that the absence of bolts or other clamping device is to be recommended, but the closeness of fit which allows of dispensing with such devices is certainly desirable as compared with the type of fit found in many of the instruments. The magnets used differed largely in weight, in cross section and in length, though the variations in length were not very pronounced: the magnet steels also differed considerably in their "coercive force."

In assessing the relative merits of the magnetic systems of the different instruments, regard must be had to all the characteristics of the magnetic circuit and of the materials constituting that circuit, to the relation between the total reluctance of the circuit and the total magneto-motive force in the circuit and so on. The weight of the magnet steel used, in relation to the total flux in the air gap, should also be considered, as it affords, other things being equal, a measure of the "magnetic efficiency" of the magnetic system. In this connection it may be mentioned that, of the instruments of normal design, those with the longest and shortest air gaps respectively had gap fields which differed by less than 10% *despite the fact that the magnet in the instruments with the long air gap weighed only half as much as the magnet in the other instrument*: the heavier magnet was 20% longer than the lighter magnet.

Examination of the magnetic systems used in these instruments showed how this could be explained, the coercive force of the steel which was used in the instrument having the large air gap being some 30% higher than that of the magnet in the instrument which had the short air gap and, in addition, the design of the system was such as to minimise the magnetic leakage round and over the gap.

It will be seen, therefore, that an instrument cannot be adversely criticised merely because it has a somewhat large air gap. An instrument with a large air gap is not inferior on that account to an instrument with a smaller gap, provided the proper relation is held between the magneto-motive force of the magnet and the reluctance of the magnetic circuit, and provided that the construction of the magnetic system is such as to avoid unnecessary magnetic leakage. The larger gap has distinct advantages in some respects, not the least important of which is that it greatly reduces the danger of the coil "sticking" if a particle of magnetic dust happens to get into the gap.

Pole-Pieces.

The pole-pieces used in most of the instruments were of soft iron, though in a small number they were made of cast iron. Provided the cast iron is uniform and is free from blowholes, there would appear to be no great objection to the use of this material, though lack of uniformity might possibly cause variations in the intensity of the field in the air gap, which would be objectionable.

Some of the instruments were open to serious criticism as regards the way in which the pole-pieces were supported. Whether the movement is mounted in bridge-pieces fixed to the two pole-pieces, or is mounted in a separate self-contained frame or casting, the pole-pieces should be mounted in such a way that no strain can be imposed on the movement by the means provided for fixing the pole-pieces in position.

Such strain is not likely to arise if the movement is carried by a frame or casting which can be removed from the instrument without dismantling and without disturbing the pole-pieces.

If the movement is carried by bridge-pieces mounted on the pole-pieces, the strain will be slight if the various components fit each other accurately, but in some of the instruments the fitting of the components was so bad that the strain thrown on the movement during assembly must have been quite considerable.

The movements of most of the British instruments and also of the foreign instruments were mounted in separate frames or castings so as to be independent of the mode of fixing the pole-pieces.

Magnetic Shielding.

The instruments were not tested in any way to determine the extent to which their indications were affected by external magnetic fields. Inspection of the instruments indicated, however, that the degree of protection afforded by the instrument cases, against disturbances due to external fields, would vary considerably as between the different instruments.

About half of the instruments were fitted with cast iron cases, which, except for the opening over the scale, surrounded the instrument completely. All the instruments included in this group were of British or American origin. In general, these cast iron cases were sufficiently thick to provide reason-

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able magnetic shielding, though some of the openings provided for reading the scale were unnecessarily wide.

Pressed iron cases which totally enclosed the instrument except for the scale opening, were used in one set of instruments, while in another set the cylindrical part of the case was of pressed iron with a thin cast iron disc front; both these sets were made by British manufacturers. The case made of pressed iron throughout was of stout iron, and in all probability afforded a magnetic shielding quite as effective as that provided by the more usual cast iron cases. In the other set of instruments the cylindrical part of the case was very thin and light, and gave the impression that it would afford a less effective shielding than that given by the cast iron cases.

The Continental instruments examined were not so completely shielded as the British and American instruments. All except one set were fitted with thin pressed iron cases with full glass fronts, and, where metal plates were provided behind the glass, these plates were of non-magnetic material.

The cases fitted to one of the sets of Continental instruments were made of brass, with full glass fronts, no attempt having been made to protect the instrument against disturbances due to external fields.

External Appearance.

Opinions as to the type of case and type of finish most suitable for a switchboard instrument must necessarily vary very widely. It will perhaps be generally agreed that these instruments should be finished in such a way that the position of an instrument can readily be "picked up" on a switchboard, and that when this has been done there should be little or nothing to attract the eye on the instrument itself except the scale and the pointer.

Experience gained during the examination of the instruments has led definitely to a conclusion which favours a type of finish almost severely plain, the only relief being such as that which would be afforded by a thin raised rim, either nickel-plated or black, the rest of the body having either a plain or unobtrusive matt ground, finished dead black or semi-dead black.

The majority, though not all, of the British instruments examined were finished in styles corresponding to that for which preference has just been expressed, and while certain foreign instruments were finished in a similar manner, there were several which had full white dials and some which had bright lacquered brass cases as well.

Scales.

When the instruments were first put into use no definite preference could be expressed for any particular type of scale, though certain scales were selected at once as being graduated in a manner which was considered to be objectionable. As the examination of the instruments proceeded, however, it was found possible to select certain of the scales as being easier to read and less fatiguing than some of the others. This was traced down to there being in these scales a certain balance between the thickness of the graduations and their height, in relation to their spacing. If the graduations are too thick or too long in proportion to their spacing, the resulting "palisade" effect can be very trying to the eyes.

The types of scales which were considered to be the most satisfactory were fitted in certain of the British instruments; the makers of these instruments had evidently taken great pains to select a type of scale and a style and size of figure which would give clear and ready readings. In two pairs of foreign instruments the scales were fairly satisfactory, though the figures in most of the foreign instruments were much less readily recognised than those in the British instruments just mentioned.

Pointers.

The pointer-heads varied in shape from that of a narrow spearhead to a pear-shape, some of the heads having circular holes punched in the middle. In some instances the end of the pointer projected too far, so that its fine point was almost beyond the top of the scale divisions, and the head was so broad at a little distance back from the extreme point that the scale division over which it happened to lie was entirely hidden. In some instruments also the figures of the scale were printed below the divisions, so that if the reading of the instrument was in the neighbourhood of a figure, the figure was completely covered by the pointer head. The best type of pointer for accuracy of reading was one of a modified diamond shape, all four sides of the diamond being concave with the "reading" end of the pointer head very long and finely tapering, the extreme end being about the same width as the graduations of the scale.

The type of pointer selected as the most satisfactory was still preferred when the different pointers were used with different scales; the diamond-headed pointer just mentioned was fitted in one of the foreign instruments.

Construction and Finish of Dials.

The dials were all graduated in black lines on a white background. In one or two instances the white background was provided by painting the surface of a metal plate with a flat white paint, the graduations being ruled on this painted surface. In most of the instruments, however, the background consisted of a sheet of thick white paper or card supported on a metal back. The painted scales had a slightly grey appearance when compared with the whitest of the paper or card scales, though many of the card scales were distinctly yellow and compared unfavourably with the painted scales.

Provided that the paint adheres properly to the metal plate and does not become discoloured or detached when the instrument is in service, the use of a painted dial would appear to be preferable to the fitting of a paper dial cemented to a metal back, though the whiter colour which can be obtained on a first quality card is a point in favour of the use of card instead of painted metal.

The best finished dials were found in the instruments made by certain British manufacturers, and there is certainly no evidence of inferiority of the British instruments in this respect.

General Statement.

There are many difficulties in the way of preparing any statement as to the general superiority of one electrical instrument over another. From the point of view of the user an instrument should be reasonably accurate and should give satisfactory service over a long period, and, while such features as sensitivity and appearance are desirable, they are comparatively unimportant. An electrical engineer with a good knowledge of the principles of design will, however, consider many other properties of an instrument in endeavouring to appraise such instruments properly, and according to the "weight" given to certain characteristics of the instrument, so different engineers would express preferences for different instruments. It might be that one engineer would consider it important to have an instrument with a high "torque/weight" quotient, another would express preference for an instrument of the highest sensitivity obtainable, while a third might consider robustness of the moving parts, with provision against damage due to vibration, as being of the highest importance, and so on.

The degree to which any particular characteristic should be developed in the design of an instrument is a matter on which opinions differ, and any attempt to draw up a specification giving limits between which the characteristics should lie would lead to much argument. For example, it is held by some designers that a high "torque/weight" quotient is of great importance, as it tends, among other things, to minimise friction errors. Against this there is the evidence of tests, carried out by Drysdale and Jolly, on a number of different makes of instruments of the type under consideration, in which the percentage friction errors of the instruments tested showed no relation to the weights of the movements or to the values of the "torque/weight" quotients. See "Electrical Measuring Instruments," pp. 256-257, Drysdale and Jolly.

The most that can be said here, on this matter, is that a proper balance should be held throughout the design, so that if particular attention is paid to any one characteristic the development of this characteristic should not be pursued to such an extent as will cause other characteristics of the instrument to be in defect. Conversely, also, if any characteristic is allowed to be in defect as compared with other instruments used for similar purposes, this must be compensated either by excellence of workmanship or in some other way, so that it does not impair the performance of the instrument as a whole.

It would be possible, for example, to obtain a high "torque/weight" quotient in many ways, some of which might, if carried too far, involve reducing the sensitivity to an extent which would be undesirable, while others might result in an undesirable flimsiness of the movement. On the other hand, if the movement is made fairly heavy and the instrument has a comparatively low "torque/weight" quotient, particular

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attention must be paid to other details, such as the pivots and jewels, to ensure that the friction error is kept down to an appropriately low value.

The results of the examination can be summed up fairly completely as follows :—

(*a*) The best of the instruments examined, both British and foreign, are generally well suited to the purposes they are intended to serve, and none among them shows an outstanding superiority over all the others in every particular.

Two pairs of instruments of British manufacture were open to criticism in respect of certain details of construction, while two pairs of instruments of foreign origin were distinctly inferior, both in design and construction, to any of the other instruments examined.

(*b*) If the instruments are placed in order of merit as assessed on some particular criterion of excellence (e.g. efficiency of design, legibility, probable durability as judged by stiffness of construction, freedom from liability to damage due to mechanical vibration or shock, immunity from disturbance due to variation of temperature, degree of magnetic shielding provided, external appearance, etc.), the instrument placed first would in many instances be a British one ; certain of the British instruments examined would occupy high positions whatever criterion were chosen.

(*c*) The consistently high positions occupied by certain British instruments, when the instruments are judged in the manner described, has led us to the definite conclusion that the best-known British instruments of the kind dealt with are quite equal to the best-known corresponding products of foreign origin, in the suitability of their design for the purpose to be served, in the consistency of their indications, and in the general lines and details of their construction.

BOOK REVIEWS.

Every Inventor His Own Patent Agent. By W. H. Barraclough. (London : Effingham Wilson). Pp. 418. 20s. net.

This book, written by an experienced patent agent, shows in a very clear and simple manner how an ordinary inventor, unversed in the procedure, may procure his own patents without professional assistance, and at the cost of the Government fee alone. It covers, in addition to British patents, the question of foreign and Dominions patents. Infringements are thoroughly dealt with, and, besides stating what protection a British patent gives, it tells what may be patented and what may not be patented.

A particularly valuable feature of the work is the very complete classification and indexing of each subject. As a handy book of reference for the ordinary inventor desirous of securing his own patent without unnecessary waste of time and money the book should prove invaluable.

C. L. A.

Science for You. By J. G. Crowther. (London : George Routledge and Sons). Pp. 241. 5s. net.

The formerly almost impassable gulf between the scientific man and the ordinary member of the public is rapidly being bridged now that science is denuding itself of the snobbery which regarded lay interest in its doings as an impertinence. Under the guidance of such gifted interpreters as Sir Oliver Lodge and Prof. Andrade, the layman is getting a rudimentary knowledge of science which it is realised can only be to the good of teacher and pupil. Of books dealing with scientific subjects in a popular way, there are all too few. One is, therefore, inclined to welcome Mr. Crowther's attempt in the present volume to deal in a series of essays with such things as thunderstorms, stars, electric lamps, ultra-violet rays, atmospherics, and other subjects in which there have been recent advances and discoveries. But, as many capable scientists have discovered, popular exposition is a most difficult art ; and it is one in which Mr. Crowther cannot be said to excel. His chapter headings lead one to expect something unusual ; "Supers and Ultras" deals with super-magnetic fields, ultra-violet radiation, etc. ; "Plain and Spotted" is the title of a section dealing with colloids ; and a discourse on thin films is alluringly titled "Diaphaneity." Apart from quite a number of mis-statements, such as "with artificial lighting the illumination is never more than a few foot-candles" and clichés of which "mining is the most industrial of industries" is a fair sample, the phraseology is hardly calculated to convey much to the ordinary layman. A few examples will show how *not* to write "popular" science : "It is a generator of a single-phase type in which the field rotates and the coils are at rest....Since the current generated is alternating, its strength must be at zero at the moment when it changes its direction" ; "the magnetic field inside the atom is about 7 000 000 gauss." The book, nevertheless, represents an attempt to provide something of which there is a real need, and if it inspires a qualified reader to the writing of science for the masses, it will not have been written in vain.

H. G.

Underground Cable Systems. By G. Stubbings. (London : Chapman and Hall.) Pp. 215. 15s. net.

This book, while not pretending to be so comprehensive as those of Beaver or Dick and Fernie (it only includes 215 pages) will be useful to mains engineers and others who desire to have in brief form a fairly up-to-date general survey of the subject.

The number of papers, descriptive of research work and inventive developments, which has been presented on the subject of underground cable systems, before technical societies, is very large, and any work which seeks to collect together and summarise these researches and descriptions is to be welcomed. On this ground, Chapters XI and XII, the former dealing with "cables for extra high pressures" and the latter dealing with "automatic protective systems," are to be considered as distinctly useful—particularly the former—in which the author has shown considerable capacity in interpreting and condensing present-day knowledge.

This Chapter (XI) as well as Chapter XII, might well have been doubled in size—in fact Chapter XII is too sketchy.

Chapter X, on the localisation of faults, might also with advantage have been greatly amplified.

The author apologises, in the preface, for the shortness of Chapter VI, dealing with cable networks, and we must leave it at that. His section on the treatment of network impedances is quite good, and should be amplified.

It is unfortunate that on page 67, which contains an otherwise quite useful analysis of the relative merits of single-phase, two-phase and three-phase systems, treated in a more practical way than the average text book arrangement, there occurs a slip which may turn away engineers who refer to it, as giving obviously incorrect information. We understand, however, that the author is reconsidering this matter, and will no doubt straighten out the difficulty to purchasers of the book by the issue of an errata slip.

Both in connection with Chapter VI and Chapter XII, a lot of valuable work would have been done if the author had described the transitions through which both England and the United States have gone, and the reasons for the different lines taken up by them.

The chapter on the physical constants of cables, is quite sound as far as it goes ; but is, again, all too brief.

Still, as remarked at the beginning of this review, the book will fill a want, because, although all too brief on certain points, it attempts to give a general resumé on most of the topics covered by the title, and in one or two cases the detailed treatment is very good.

A. M. Taylor.

Alternating Current Power Measurement. By G. F. Tagg. (London : Sir Isaac Pitman and Sons.) Pp. viii+65. 3s. 6d. net.

Generally speaking, the measurement of power in alternating current circuits is a complicated problem. The author, has, however, shown in a very simple manner, how these measurements can be made by means of watt meters. The various methods of connection and the reasons for them have been carefully dealt with. Firstly an explanation is given of the meaning of both power and power factors, this being followed by a brief outline of the power in single, two and three-phase systems. A general theory of watt meters, given in the third chapter will be found both useful and interesting. Chapters 4 to 8 inclusive, deal successively with the measurement of power in single and two-phase ; three-phase balanced load ; three-phase, three-wire unbalanced load ; three-phase four wire unbalanced load circuits, and the summation of power in two or more circuits fed from the same supply. Power factor meters and the theory of instrument transformers are briefly described in the two final chapters.

Apart from one or two slight errors, the book is well written, and should prove a useful addition to the library, not only of the student, but also of the test room assistant.

C. W.

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METALS FOR E.H.T. LINE CONDUCTORS.

The Conductor Materials Compared—The New Cellular Copper Cable—Influence of Climate on Choice of Metals—Corrosion Problems with Galvanised Conductors.

By WILLIAM T. TAYLOR, M.Inst.C.E., M.I.E.E.

FOR a 220 000 V transmission line it is customary to consider a conductor of 1·0 in. overall diameter. In this country we have already settled on a diameter of a little over 0·75 in. overall, for the 132 000 V national "grid."

Of the different commercial metals to use for these types of overhead electric power lines we may select several that can at the present time be classed as the best conductor materials.

These are: (1) all copper; (2) all cadmium copper; (3) copper or cadmium copper for the conducting part of the strand and aluminium-bronze for reinforcing where additional strength is required; (4) all aluminium; (5) aluminium for the conducting part of the strand and galvanised steel for reinforcing where additional strength is required; (6) copper-weld copper; and (7) aluminium-bronze.

The last named composite metal is considered because of its resistance to corrosion, its high tensile strength, and its resistance to fatigue, all of which are excellent advantages. In its manufacture, it can be drawn to a tensile strength of 60 tons per sq. in.; it is more expensive than galvanised steel, but it is a better and safer metal than steel.

With reference to cadmium copper, this is based on a standard alloy giving 90 % of the conductivity of pure copper; the tensile strength is about 40 tons per sq. in., hence we have a high strength conductor with but a few per cent. less conductivity than commercial copper.

In the practice of to-day we have copper-weld wires and copper-coated steel wires. And, in recent times, we have had in use two distinct types of steel-core conductors, namely, the steel-cored aluminium and the steel-cored copper. The latter is made up of a steel core (copper-coated or copper-weld where desirable) with two layers of copper wires, the layers of copper wires being reversed over each other in such a manner as to give the best electrical properties. For many years the copper-weld copper conductor has been in successful use in overhead construction.

There are also two *hollow* type copper conductors. One of these is made up of a copper "I" beam section twisted around its longitudinal axis with a pitch of about 4 in., thus giving adjacent bearing points 2 in. apart along the axis of the cable, and about 1⅛ in. apart along any strand of the inner layer. Two layers of copper are wound over the "I" beam, each layer being wound in opposite directions.

Just recently we have had another type of all-copper or composite copper conductor put on the market. This is called the *cellular* conductor. It is made up of solid copper wires and hollow aluminium-bronze wires or tubes, and can be set up into many different forms varying from all hollow wires to any combination and arrangement of solid and hollow wires of one or the other metal. At the moment it is considered a little early to give relative physical and other characteristics of this new line-conductor. It has been patented and is being manufactured by a well known firm of smelters, refiners, and manufacturers of copper wires and cables (Thomas Bolton and Sons, Ltd., of Froghall and elsewhere). It is hoped that, at a later date, the relative characteristics of this composite copper conductor will be published in such manner as to present a useful comparison with the accompanying tables which, as will be seen, are so arranged in order of importance showing the greatest ultimate strength and the least a.c. resistance, starting with copper-weld copper and ending with steel-cored aluminium.

The four types of *cellular* conductor shown in Table I represent but a few of the many possible arrangements and combinations. The conductor construction, and the combination of metals used in the make up, will be self explanatory from Table I.

In this country our climatic conditions are such that we have a relatively greater humidity, heavier fogs, extended periods of moisture content in the air, and a relatively more extensive sea frontage than other countries operating overhead lines at voltages of 132 kV and over. In view of these natural adverse conditions, we should take great care in our choice of the conductor metals, their construction, and their composite make up.

Our best type of conductor for this country is unquestionably that form of construction offering a concentric stranded cable. In India and Africa, and similarly dry climates, the lock-wire cable would be the better type of conductor to use. As regards the metal to use on such important main lines, the writer believes that the two most questionable metals are steel and aluminium. Our climatic conditions are in various ways adverse to steel in the form used with aluminium for the most vital main transmission lines of the country, and our extensive coast-belt and other factors present disadvantages and/or dangers to ageing and to durable factor-of-safety, etc., in the use of steel, and to aluminium that is often in itself subjected to equivalently greater stresses and to greater and more bending and relatively greater movement due to temperature, and winds, etc.

Although local corona losses, and resistance to corrosion of the stronger metal (steel), are dependent upon the amount of moisture in the air, they are also dependent on the actual water adhering to the metal which sooner or later passes through in minute quantity to the steel core and thus endangers the real strength of galvanised-coated steel as well as on the surface-form and on the actual diameter of the conductor in its stressed condition as also the different ageing of the two metals and the chemico-physical conditions set up; all of which must be carefully considered.

TABLE I.

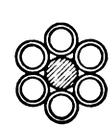
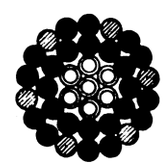
TYPES SUITABLE FOR E.H.T. OVERHEAD TRANSMISSION LINES.					
Overall Diameter		0·381 in.	0·396 in.	0·595 in.	0·7 in.
Construction	Solid Copper	4			
	Solid Cad. Copper			12	12 + 12
	Solid Al. Bronze		1		6
	Hollow Copper		6		
	Hollow Al. Bronze	3		7	7
Equivalent Copper Section, nominal		0·050 sq.in.	0·050 sq.in.	0·125 sq.in.	0·175 sq.in.
Weight per Mile		1356 lb.	1308 lb.	3567 lb.	5322 lb.
Breaking Stress		2·1 tons	1·9 tons	7·81 tons	12·68 tons

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TABLE II.—Copper-weld Copper Cable (American).

Outside Diameter (inch)	Dimensions.		Weight in lb. per 1 000 ft.				Resistance.		Internal Inductance.
	Equivalent C.M. of Copper	Area in C.M.	Total (lb.)	Copper (lb.)	Copper-weld (lb.)	Ultimate Strength (lb.)	Ohms per 1 000 ft. at 20° C. D.C.	Ohms per 1 000 ft. at 20° C. 60 Cycles	Micro-henries per 1 000 ft. at 60 Cycles
1·008	486 600	765 500	2 249	930	1 319	48 300	0·0218	0·0236	4·5
1·008	531 500	765 500	2 267	1 162	1 105	46 100	0·0199	0·0213	3·0
1·008	577 000	765 500	2 286	1 395	891	43 900	0·0183	0·0194	2·5
1·008	622 300	765 500	2 305	1 627	678	41 700	0·017	0·0179	2·0

TABLE IIa.—Steel-Cored Copper Cable (American).

Outside Diameter (inch)	Dimensions		Weight in lb. per 1 000 ft.				Resistance		Internal Inductance.
	C.M. of Copper	Diameter of Reinforcement or Core	Total (lb.)	Copper Strands (lb.)	Reinforcement (lb.)	Ultimate Strength (lb.)	Ohms per 1 000 ft. at 20° C. D.C.	Ohms per 1 000 ft. at 20° C. 60 Cycles	Micro-henries per 1 000 ft. at 60 Cycles
1·00	450 846	0·594	2208·9	1481·0	727·9	39 640† / 17 700*	0·0238	0·0264‡	21·2‡
1·04	499 059	0·602	2377·2	1636·5	740·7	40 370† / 19 600*	0·0205	0·0233	7·0

† Copper at 50 000 lb./sq. in. * Core at 200 000 lb/sq. in. ‡ For 500 amperes.

TABLE IIb.—Hollow Copper Cable (American).

Outside Diameter (inch)	Dimensions.		Weight in lb. per 1 000 ft.				Resistance.		Internal Inductance.
	Equivalent C.M. of Copper 97%	Diameter of Core (inch)	Total (lb.)	Copper Strands (lb.)	Core (lb.)	Ultimate Strength (lb.)	Ohms per 1 000 ft. at 20° C. D.C.	Ohms per 1 000 ft. at 20° C. 60 Cycles	Micro-henries per 1 000 ft. at 60 Cycles
1·10	500 000	0·790	1 560	1 372	188	20 900	0·02181	0·02183	5·66
1·10	550 000	0·727	1 713	1 582	131	24 600	0·01983	0·01988	6·74
1·10	600 000	0·685	1 864	1 719	145	26 500	0·01818	0·01824	7·52
1·10	650 000	0·612	2 036	1 936	100	28 000	0·01677	0·01689	8·76

TABLE IIc.—Steel-Cored Aluminium Cable (American).

Outside Diameter (inch)	Dimensions.		Weight in lb. per 1 000 ft.				Resistance.		Internal Inductance.
	C.M. of Aluminium	Diameter of steel-reinforcement (inch)	Total (lb.)	Aluminium Strand (lb.)	Reinforcement (lb.)	Ultimate Strength (lb.)	Ohms per 1 000 ft. at 20° C. D.C.	Ohms per 1 000 ft. at 20° C. 60 Cycles	Micro-henries per 1 000 ft. at 60 Cycles
0·912	556 500	0·3270	746	522	224	20 900	0·0312	0·0312	4·3
0·953	605 000	0·3177	779	568	211	21 270	0·0286	0·0286	4·3
1·000	666 600	0·3333	858	626	232	23 430	0·0258	0·0261	4·3
1·093	795 000	0·3642	1 024	747	277	27 950	0·0218	0·0221	4·3

For such like main lines, the high first cost of conductors is by no means the most important factor deciding against the most necessary factor of *permanent* durability and factor of safety, etc., in favour of reinforced *copper*.

It must be remembered that a fraction of an inch in length subjected to corrosion is all that is necessary to down a line; yet there are millions of these, or millions of chances, in a rust-forming country like this for corrosion to set in wherever a minute part of the steel (the galvanising of which forms only a thin skin over the steel and is likely to crack, form hair-lines, peel off, be imperfect, etc.) receives moisture from the air or a minute quantity of water from the outer conductor; one of the worst parts will be at or close to each insulator, on the line side.

The available figures for one make-up of the "cellular" conductor, to which reference is made earlier in this article, are given as follows:

Overall diameter of conductor (taken as the equivalent of 7d. for 37 wires of 0·105 in. diameter, each wire)	0·735 in.
Equivalent copper section	0·196 sq. in.
Total weight per 1000 ft.	910 lb.
Weight of copper per 1 000 ft.	640 lb.
Weight of aluminium-bronze per 1 000 ft.	270 lb.
Aggregate strength of single copper wires	1 854 lb.
Aggregate strength of single aluminium-bronze wires	9 666 lb.
Total strength	20 520 lb.
Estimated breaking strain of the conductor (Based on percentage of the aggregate)	17 800 lb.

OXY-CRYSTALLINE FINISHES.

Experiments to Obtain Characteristic Effect Without Flame.

THE oxy-crystalline style of finish, which has recently been largely adopted by manufacturers of scientific apparatus, including radio sets and accessories, has an appearance somewhat resembling the effect produced by frost on windows, except, of course, that it is black.

Most readers will be familiar with the appearance of the finish, and it is thought that a brief explanation of the method by which it is produced and particulars of some experiments carried out in this connection at the laboratories of Philips Lamps, Ltd., will be of interest.

The apparatus to be treated is first covered with lacquer containing raw Chinese wood-oil, and then brought into contact with the fumes of a gas or paraffin oil flame, at a temperature of about 100 deg. F, causing a pattern of ripples or crystals having the appearance of frost crystals to be formed. This peculiar effect is caused by the fumes, but it has not yet been ascertained by what component.

Carbon dioxide, carbon monoxide, and water vapour singly and mixed, have been experimented with; and coal gas and sulphur dioxide have also been tried, but to no effect.

As very small amounts of hydrogen peroxide can be produced in the combustion process, experiments were also carried out in a box containing a quartz mercury arc lamp. The ultra-violet radiation of this lamp produced ozone and peroxide of hydrogen. When air at 100 deg. F. was passed into the box, the crystalline surface began to appear in about 20 minutes, without the aid of a flame.

The experiment does not provide definite proof that peroxide of hydrogen is the active agent present in the fumes of the flames, but in any case it is an interesting fact that oxy-crystalline surfaces can be produced without any flame.

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THE ROTOR BEARINGS OF ELECTRICITY METERS.*

Manufacturing Problems Enumerated—Comparative Advantages of Jewels—Troubles with Bottom Bearings.

By W. LAWSON, M.I.E.E.

IN a paper† read before the South Midland Centre of the Institution, the author enumerated the principal defects to which meters are liable and described a method of recording the condition of meters removed from circuit, as ascertained on examination in the repair shop. Such statistics are useful as a means for obtaining data for any particular line of research in meter maintenance, and this paper is based on experiments and observations made in the study of the most prominent defect to which all meters of the motor type are liable, namely, the wearing of the rotor bearings.

In directing attention to this problem the author does not claim to have found a general solution, but he hopes that an account of his work and observations in this connection will not only be of interest to meter engineers, but may lead to a definite advance towards a solution.

For the purpose of this paper, it is sufficient to limit consideration to the bearings of single-phase and polyphase a.c. and mercury motor ampere-hour d.c. meters, as these constitute the majority of motor meters in use in this country.

The bearing arrangement consists essentially of a pivot working in a holed bearing at the top end of the rotor spindle, and the combination of a cupped jewel and pivot, tapered to a point, at the bottom of the spindle. Whilst there is a variety of designs, they all conform to this arrangement.

Various stones which rank high in the scale of hardness are utilised for the footstep bearing. The most favoured are rubies and sapphires. Garnets have been used in this connection, but are now generally discarded. Rubies and sapphires can be produced artificially, and it is claimed for them that they are more uniform in quality, and slightly harder, than the natural stones. Artificial rubies and sapphires rank the same in hardness, they differ only in colour.

The hardest known natural substance, the diamond, is used, but only to a limited extent, owing to its high cost. The bearing surface is cupped as with other stones, and its manufacture in this form is a highly specialised art.

Mercury Motor Meters.

The combination of a diamond having a flat bearing surface, surmounted by a holed sapphire to keep the pivot in place, has been suggested as offering less difficulty of manufacture, but with what success the author is unable to ascertain.

Steel is the material almost universally employed for pivots. The degree of hardness, molecular structure, and composition of pivot steel are questions which users are not as a rule in a position to investigate, although they are undoubtedly of importance.

So far as the author is aware, no attempt has been made to introduce oil-immersed bearings in mercury motor meters. A point of interest in connection with the bottom bearings of mercury motor meters may be noted. It has been found experimentally that in order to ensure the best possible starting, it is necessary to ascertain the correct depth of setting of the jewel in the bearing screw. The selection of a jewel set at the right depth to replace one which is too deep-seated can have the effect of reducing the starting current from 1/100th to 1/200th of full load, other conditions being favourable. The explanation may be found in the retarding effect of surface tension of the mercury acting on the pivot.

Both top and bottom bearings of motor meters are subject to defects which are liable to affect the performance of the meters more or less injuriously, but the bottom bearing is by far the greater sufferer.

It is true that top-bearing defects can be sufficiently serious, as in the rare case in which the top pivot dropped off its spindle through the action of rust. Usually, however, the defect takes the form of a certain slight stickiness, due to the collection of dust or rust or the presence of oil, but the errors thus introduced are not extensive.

Turning now to the bottom bearings, the outstanding weakness is in the bearing jewel. It is not too much to say that the frequency of jewel failures is the chief stumbling block in the way of achieving an ideal standard of reliability of meters in service.

The working area of the jewel is of almost microscopic dimensions, but the importance of keeping it in proper working condition cannot be exaggerated, as the occurrence of any fault almost invariably results in deficient registration, which means a dead loss to the undertaking. The extent of this deficiency is governed partly by the torque of the meter, but mainly by the weight of the rotor and the nature of the jewel defect.

Diamond Cupped Bearings.

In mercury motor meters, notwithstanding the extremely light downward pressure exerted by the rotor, cavities of appreciable depth have been bored by the action of the pivot. More frequently the wear is exhibited as rough patches on the surface, and in one case there was a broad scar extending from the centre to near the edge of the cup. The markings sometimes take the form of circles which are considerably larger in diameter than the diameter of the pivot, and it is probable that these are caused by out-of-balance of the rotor. The phenomenon of worn jewels in d.c. meters is even more difficult of explanation than that of a.c. meters, but it provides evidence in support of the conclusion that the weight of the rotor is not a determining factor.

It is probable that the advantages to be gained by the use of diamonds for the footstep bearings of meters were first recognised in America, where they have been produced and used extensively for the last 25 to 30 years. The superiority of diamonds over other stones in this connection has been pointed out by Mr. C. H. W. Gerhardi,* who was the first to use them in this country.

The successful results obtained in the early experiments with diamond cupped bearings carried out by the author led to their adoption in the Birmingham undertaking for use in generating ring-main and traction meters. Having proved their worth in this connection, their use was extended (gradually, because of the frequent difficulty of obtaining them) to h.t. consumers' meters.

In the hope of finding a cheaper and equally reliable substitute for the diamond bearing, the author took an opportunity afforded him in 1922 to carry out a series of tests with agate pivots working in sapphire cups. The conclusion arrived at was that neither the agate nor the sapphire pivot is suitable for use in polyphase meters, owing to the heavy rotors and large working forces employed.

Where the cost of a diamond bearing represents a small item in the total cost of the metering equipment it offers a complete solution of the bearing problem. With low-priced meters its use from a financial point of view is debatable, but might be justified in the long run. Users of meters should seriously consider the question of adopting diamond jewels in all meters of, say, 50 kW and over, and manufacturers should assist in this by placing themselves in a position to supply them.

In a.c. meters, vibration contributes to the wearing of the jewel, and becomes more destructive with increased working forces in the meter (compare tests of agate pivots in polyphase and single-phase meters). Care should be taken not to overload meters heavily, even if they are designed for accurate performance under such conditions.

Oil-immersion extends the life of the jewel and reduces the effect of wear on the accuracy, but is subject to physical changes and cannot be trusted for sufficiently long periods.

The agate pivot provides a possible means of solving bearing troubles in mercury motor meters which would be subject to very light action and free from the possibility of damage in transit.

Given bearings of the durability of the diamond, reasonably protected against dust accumulation, the pivots of all moving parts being made of rustless material and no oil being used, there is no reason why with modern a.c. meters the period of exchange should not be extended to 10 years or even longer.

* Extracts from a paper read before the I.E.E. on March 1st.

† "Defects in Electricity Meters," "Journal I.E.E.," 1920, vol. 58, p. 747.

* "Electricity Meters, their Construction and Management."

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STRUCTURAL STEEL FOR GENERATORS.

Manufacturers' Experiences with New Constructional Materials—Electric Welding Improvements—Possibility of Using Steel Plate End Flanges for Large Units.

DURING the last few years, due largely to revolutionary advances in the art of steel welding and cutting by flame and arc, great possibilities have been opened up for developments in the mechanical construction of electric generators. For this reason the following extracts from a special report of the Electrical Apparatus Committee of the National Electric Light Association, New York, are of particular interest. The report is presented in the form of statements by four large manufacturers. Work along similar lines is, of course, now going on in this country.

With regard to the use of structural steel and welding, one firm states that during the past year it has built a number of generators and motors having parts such as stator yokes, bases, rotor spiders, and bearing pedestals for roller bearings constructed of electrically welded steel parts. Experience so far with welded frames and bases has been quite satisfactory, there being a considerable saving in pattern work and pattern storage, and it is expected that the use of this type of construction will undoubtedly become very general. Although the frames made from structural shape and steel plate have ample strength, there is danger, if care is not taken in the design, that sufficient stiffness and rigidity will not be obtained. In fact, cast iron has definite advantages from the point of view of rigidity, but there is no reason why welded frames cannot be so designed and braced that they will be equally good in this respect.

Another firm estimates that 90% of its salient-pole synchronous machines as now designed are of structural steel.

There are, it is stated, several reasons for the recent tremendous increase in the use of structural steel and welding as a substitute for the use of castings. The cost of constructing patterns and the expense of storing them, the loss occasioned by defects in the castings, and the likelihood of failure in service as a result of internal strains, blowholes and the like, are some of the disadvantages of the old method.

With the development of flame cutting of steel plate, the designers have become convinced that steel plate will not only eliminate casting defects but will also produce better mechanical structures. In fact, factory tests have demonstrated that the new method of construction eliminates the disadvantages of castings, and produces a structure superior in strength and reliability.

In the welded-plate stator construction, as applied to horizontal units, the side plates consist of segments cut from heavy rolled-steel plate, which are welded together by means of the hydrogen-enveloped arc. The use of this arc-welding process eliminates the necessity of scarfing the joints between segments, and at the same time insures a ductile weld. The supporting feet of the units are cut out as part of the side plates, and a heavy foot plate is welded to these feet. The back plates are flame-cut, are rolled to the proper shape and are then welded to the side plates by an automatic arc-welding machine, which produces a practically perfect weld. The ribs for supporting the casting on which the stator laminations are stacked, are also welded to the side plates.

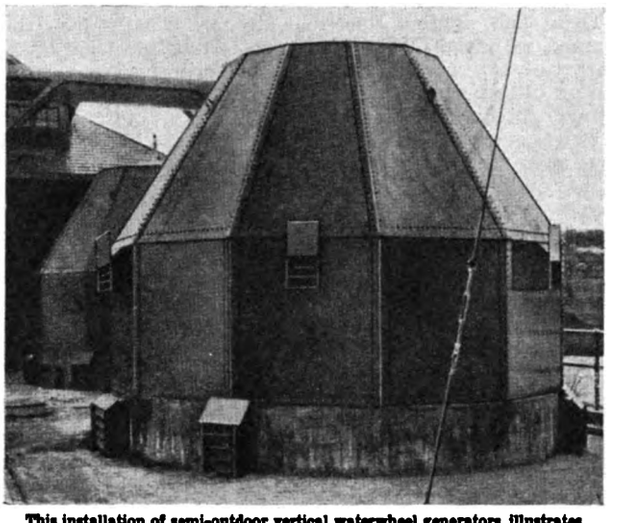
Practically the only cast frames which are used at the present time are for high-speed synchronous motors.

The disadvantages of castings are of even greater importance when rotating elements are considered, especially those rotors which are subjected to high stresses from overspeed. Structural-steel spiders of several types have been developed.

Spiders for small rotors have been built in considerable number of welded steel plates. The hub is flame-cut from thick steel plate or from shaft stock, and is welded to a centre web also flame-cut from heavy plate or stock. The outside rim is of steel plate, rolled to the proper diameter and welded to the centre web. This rim may be either of a single plate with arc-welded butt joint, or of two plates completely welded together around the outer edges. Since the rim is welded to both sides of the web plate around the complete periphery, the welded joint of the rim is not required to withstand the entire centrifugal force occasioned by rotation of the poles.

Another design of rotor spider which eliminates the use of castings is the so-called laminated punched type, which can now be used in sizes up to 10 ft. in diameter. The ventilating openings and dove-rail slots for the fastening of pole pieces are all punched in advance by a press.

An entirely new development is represented by the rotor spider of the third general type. This spider has a free rim, made of segmental punched laminations mounted on a centering spider, which may be of either structural or cast construction. The laminated rim is not anchored to the centering spider, and therefore must carry all the centrifugal force occasioned by the rotating of the poles. Since the centre has only to support the weight of the rim and of the poles, and to transmit the torque from the shaft, it is permissible to use cast material in this part of the structure. However, fabricated centres have been used in a number of machines.



This installation of semi-outdoor vertical waterwheel generators illustrates the simplified construction permitted by the newer structural methods and materials.

Almost all of this company's large turbo-generator frames are built of structural steel and are constructed from flame-cut boiler plate. A rib support is welded to the inside of the supporting plate, in order to secure sufficient surface for the bolting of the ribs. The ribs themselves are cut from steel plate and have machined surfaces, with a keyway left for supporting the punchings. On the outside of the circular supporting plates, which make up the sections of the units, there are welded ribs of steel plate.

It is still the practice to cast out of non-magnetic steel the end flanges for large units. However, in the case of auxiliary generators, and even in the case of some of the smaller main generators, the flanges have been made of steel plate. They have given very satisfactory service, and there is the possibility that plate flanges will be used on larger units.

The outer shell for the large unit is also made of boiler plate and is rolled to fit the supporting plates of the unit. The partitions are welded to the shell, an air-tight cover resulting.

The mechanical structure of direct-current generators, motors and synchronous converters has been changed considerably in the last year or two. All the magnet frames for these units are now made of rolled steel, in two parts. Each of these parts is rolled into the form of a semi-circle, and then bolted together to form the magnet frame. Feet for supporting the unit are welded on to this frame. Rolled frames have been made in diameters as large as 160 in., with a thickness of 9¾ in. and a width of 26 in. In fact, in the case of a steel-mill motor, the frames were of such size that it became necessary to weld together two rolled frames to secure the proper width.

The rolled construction for magnet frames was adopted as a means of securing better commutation of direct-current machines, since there was felt to be less likelihood of flaws than in castings. In addition, the placing of the rolled frame on a so-called production basis has given rise to a less expensive unit.

During the past year, fabricated construction has been adopted for the standard lines of moderate-size low-speed horizontal and vertical synchronous motors and generators, general-purpose synchronous motors and the corresponding sizes of generators, direct-current generators, and motors, and 3 600 r.p.m. steam-driven turbo-generators.

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ELECTRICAL SALESMANSHIP.*

Selling the Service rather than the Product—Possibilities of "Electricity Halls"—An Electrical Information Bureau—Newspaper Propaganda.

By "SALES MANAGER."

THE first problem that faces the ordinary sales manager is the existence or otherwise of a market for his goods. If a market exists, how much of it can he reasonably hope to secure? How much is his selling to cost on turnover? How many depots will he require?

These and kindred questions do not usually face those charged with the pleasant task of selling electricity. The market already in existence is but the criterion by which the market of to-morrow may be judged. Every single person is a buyer directly or indirectly of electricity, and therefore of electrical equipment. The only measure of the capacity to buy is the size of the purse; and on this point I shall have something to say later on. When the "prospects"—the potential buyers—of electricity are considered, you have the really remarkable situation of every prospect being anxious to buy. Electricity comes with a thousand new virtues—above all other illuminants in power and cleanliness, above all other heating agents in its freedom from work and worry. Interesting in a hundred different manifestations in every sphere of human endeavour; no wonder, then, that the man who talks electricity is sure of a ready audience.

Luxury or Necessity.

But it seems to an outsider that the vision of the majority of those engaged in "putting electricity across" is limited to rather old-fashioned notions. The idea seems to persist that electricity is a luxury, whereas it is a necessity. With few exceptions, restaurants specialising in the service of meals cooked by electricity, do not offer a popular priced meal The appeal to comparative wealth is usually much too insistent.

That is one angle of selling electricity which is capable of immense expansion. There should be in each centre a permanent exhibition of a general interest nature, where accommodation for all sorts of functions could be provided. In short, the electricity centre should be a centre of local activities, wherever it happens to be located—the most cheerful and convenient business place in the whole town. Wherever you go in the provinces you find a lack of such a social centre. The hotels in some degree cater for banquets, dances and other "events," but the hotel management are concerned first, last, and all the time with selling food and drink. There is no deeper motive such as there would be in our electricity halls—standing exhibitions all day and social centres in the evenings. You can think of half a hundred organisations that would be glad to pay a reasonable fee for the use of a charming series of rooms with a good dance floor for their social requirements—local societies, civic events, firms' social evenings, sports society dinners, and so on.

Every gathering in every "electricity hall" would be a first-class advertisement for electricity. It would provide an opportunity for modern lighting methods to be demonstrated: for new decorative fittings to be shown under ideal conditions; for the capacity of electrical heating to be proved; for the possibility of a cool temperature to be secured if the weather is hot.

The organisation of such electricity halls is not beyond the limits of immediate possibilities. The development of the domestic market means the establishment of an increasing number of "show-rooms" and there is no reason why, with good will and sound organisation, resources should not be pooled and a really useful and worthily impressive hall be erected in most of the important centres.

The point to be realised is the need for national selling of electricity, instead of the localised effort by small or great undertakings. These local efforts may be good within their limits or they may be as bad as the efforts of the local electricity company within my own area.

Every successful demonstration of the merits of electricity has repercussions on the business of every electricity undertaking, and the united efforts of a group must produce more important effects than the isolated propaganda of a series of companies and municipalities.

Propaganda on a really national scale would also include an information bureau with first rate personnel. There are so many points that the general public are interested in if only they knew where up-to-date and reliable information were available.

The time will come when odds and ends of information must be collated and indexed, and the sooner a bureau of information is available, the less work will be involved in making it effective. Think of the huge advantage the Selfridge Information Bureau has been to that store. All sorts of questions are asked and answered, and a sense of friendliness for the store which this service gives is helping in no small way in building up its business. That the information bureau of Selfridge's is up-to-date is proved by a letter the Secretary of the Race Course Betting Control Board mentioned recently. Selfridge's Information Bureau wanted full data of the manufacturers of totalisators—and they got it.

The Electricity Information Bureau would be advertised extensively, and all its inquiries would be indexed. The electricity undertakings supporting the bureau would be kept *au fait* with the general trend of inquiries, and specific requests for information would be sent to the undertaking operating in the inquirer's home area if the inquiry were of a nature calculated to interest the local undertaking.

I believe that the number of inquiries would surprise many of the heads of electricity undertakings, and I have no doubt that the Bureau would more than justify its existence.

Propaganda in the newspaper has been brought to a fine art, but I do not see electricity receiving its fairly deserved consistent publicity. Quite apart from space that is paid for in the shape of advertisements, the general Press is able to give quite a lot of space to news matter that has a general interest—if such news matter is prepared in a form suitable for publication. We need to remember that this is the age of persons and not of things—so far as the general Press is concerned, and the modern daily paper editor wants the human touch in every paragraph of his paper. What agency is there entrusted with the creation of public interest in the new force that has come into existence? How many people are able to work by electricity who would otherwise have to knock off at 3.30 in the winter afternoons? What has electricity done for the villages? What did electricity do during the great freeze? What new hopes, new ideas, new devices are there coming along? All these and a vast number of other points are good news value if only they are written in the right way, and it should be somebody's job to do for electricity what is being done for many other industries. But with this important difference. There is an interest in all things appertaining to electricity that is lacking in many other instances, and so the work of the propagandist for electricity should not be difficult—if only the thought of the human touch is kept ever present.

Service Before the Sale.

In the foregoing I have outlined three methods of selling which are not of the direct kind. They represent the new method of giving the public a service before sales are effected. This is real "sales promotion," and its manifold possibilities remain to be explored and then exploited by the men who are given the jobs to do. I have indicated some of the more obvious lines along which an economic staff for electricity might direct its efforts, and of necessity I have touched upon outstanding points only. It may be objected that some of these activities are well within the scope of the E.D.A. If they are, why is no more vigorous action taken? Lack of adequate contributions from the industry is often advanced as a reason why this, that, and the other scheme should not go forward, but, though I yield to none in admiration of the pioneer work that organisation has performed in the past, it is not altogether unreasonable to suggest that a development organisation which cannot find sufficient support to develop itself needs to do some constructive thinking along newer lines.

In the next of this series of articles I intend to put myself in the place of the sales manager of an electricity undertaking, who is anxious to extend his sales of electricity and of electricity consuming equipment.

[* This is the second article in an important series from the pen of a widely experienced sales manager who has enjoyed outstanding success in his own field.—ED.]

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CORRESPONDENCE.

The Editor welcomes the free expression in these columns of genuine opinion on matters of public interest, although he disclaims responsibility alike for the opinions themselves and the manner of their expression.

"Ideal Homes."

[To the Editor.]

Sir,—Your plea in "Current Topics" for a more representative use of electrical equipment in the village of "ideal" houses at the Ideal Home Exhibition is one which will receive the sympathy of all who are anxious to develop the domestic uses of electricity. Although E.D.A. was unable, for some reason, to arrange for the suitable display of electrical appliances in these houses, organisations in the gas industry managed to secure two out of the seven houses in which to demonstrate that "gas, suitably applied, is unrivalled from all points of view for supplying light and all the heat required in a house." One of the houses had a complete gas and coke service for lighting, heating, cooking, water heating, and refrigeration. Effects obtained by electrical means were closely imitated, as in the series of gas lighting fittings in which the burners are screened by tinted glass panels, and among other gas equipment seen in the villas were irons, clothes-drying cabinets, curling iron heaters, towel-rail heaters, coppers, "smoker's companion," pilot lights, and night lights. In one of these "gas" houses a feature is made of distant-controlled lighting. In the hall the light is controlled from the foot of the stairs, as well as from the door, so that the light may be switched on before entering the hall.

I must apologise for this gratuitous advertising of gas, but if it leads somebody in the electrical industry to arrange even one electrically equipped house next year it will provide its own excuse.—I am, etc.,

J. H. C.

Slough,
March 4th.

Factor of Safety of Concrete Poles.

[To the Editor.]

Sir,—In the paper referred to by Mr. Gauvain the formula given by Mr. Climie only applies to stresses in the steel and concrete.

It would seem that the figures are primarily based on a rectangular shaped reinforced-concrete beam having six longitudinal steel square-shaped bars that are wrapped on their outer ends with hoop wire; the reinforced concrete pole being of solid construction. The "Stobie" pole, coming from the same country, appears to resemble this type with the steel outside, in one piece, on each transverse side, to replace the three longitudinal steel rods on said sides.

The stress in the tensile steel is given as—

$$2\,\eta\,f'\,(1-k)/k$$

and the breaking stress of the concrete as—

$$kf/2\,\eta\,(1-k)$$

where—

f = stress in tensile steel. (Shown as varying from 32 000 to 50 000).

f' = breaking stress of concrete. (Shown varying between values of 760 and 2020 for different values of p and f).

η = E_s/E_c = modular ratio.

p = ratio of tensile steel to effective concrete area. (Shown as varying from 0·01 to 0·05.)

$$k = \sqrt{3\,P\,\eta + (2\tfrac{1}{8}\,P\,\eta)^2} - 2\tfrac{1}{8}\,P\,\eta.$$

Equating the total tension to the total compression, we have—

$$0{\cdot}666bkd + 3{\cdot}5\,\eta\,Ak - 2\,\eta\,A = 0$$

where—

A = area of the steel.

b = breadth of pole.

d = effective depth of pole from compression face to steel.

kd = distance of neutral axis from compression face.

$200A/bd$ = taken as total steel reinforcement as percentage of concrete.

And, a condition is assumed where the resultant of the compressive stresses in the concrete almost coincides with the compressive steel, in which case the bending moment will produce a tensile stress in the steel equal to the bending moment divided by the product of Ah, where h is the distance between tensile and compression steel, centre to centre.

The formulæ given are helpful, but it is hoped that we shall get down to the bending moment formula similar to that used for wood poles.—I am, etc.,

William T. Taylor.

London, N.2.

Memorial to the Late Sir Alexander Kennedy.

[To the Editor.]

Sir,—That there should be a permanent and lasting memorial of affection and esteem for the late Sir Alexander Kennedy is a feeling common to all who knew him or his work.

He was a pioneer in engineering education, for, during his tenure of the Chair of Mechanical and Civil Engineering (1874-1889) at University College, London, he was largely responsible for the lines and methods which higher education in engineering has adopted. As an engineer in practice, his wide knowledge of mechanical and electrical engineering was always available for the service of the country.

In connection with the Centenary Celebrations of University College, a movement was inaugurated to endow the Department over which he long presided with such distinction; and some time ago he had consented to the Chair in the Department being called by his name. Towards the sum of £30 000 required for this endowment, a sum of £18 035 has already been subscribed, leaving the amount of £11 965 still to be raised.

We are in hearty sympathy with this project, and feel that no more suitable Memorial of Kennedy's great work could be established. We invite all those who knew Kennedy to associate themselves with this memorial.

Subscriptions should be sent to the Right Hon. Lord Meston, the Chairman of the Centenary Fund, at University College, London.—We are, etc.,

E. Rutherford,
President, Royal Society.
Brodie Henderson,
President, Institution of Civil Engineers.
R. W. Allen,
President, Institution of Mechanical Engineers.
K. Edgcumbe,
President, Institution of Electrical Engineers.
Gregory Foster,
Provost, University College, London.

University College, London.
March 1st.

"Electricity Supply and the Consumer."

[To the Editor.]

Sir,—Mr. J. Rutherford Blaikie has taken Dr. Lulofs's discussion of domestic tariffs as a challenge or occasion. Dr. Lulofs can doubtless take care of himself if he sees fit.

Mr. Blaikie makes some statements which are too sweeping. For example: "All our load factor enthusiasts, disregarding the extent of the consumption, and reckoning only on the load factor, maintain that it is right to charge the individual consumer in accordance with a load factor analysis." I do not know where there are to be found any who advocate charging the individual consumer on a load factor basis only, much less where such a basis of charge is applied to all consumers. That load factor must be taken into account in any rational or equitable tariff is held by every one who has studied the question, including, I think, Mr. Blaikie himself. Mr. Blaikie, however, advocates a tariff which entirely ignores the load factor of any consumer, or class of consumers, making each consumer's rate depend exclusively upon the extent of the consumption of each. That this will work out with enormous discrepancies in the ratios of costs of supply, and the charges made for it, as between individual consumers, or between classes of similar consumers, he has before now admitted, but considers that immaterial.

From the point of view of the seller who has produced and sold a certain quantity at some total cost, including fixed charges, it is immaterial whether the income covering these costs with a satisfactory margin of profit has been obtained through the agency of a tariff which distributes the costs fairly, or one which operates unfairly, as between different consumers.

But from the point of view of a seller who wishes to increase the utility of his investment, and who also recognises a duty to afford the maximum of amenity to the population within his area of supply, it is important to establish a tariff which is approximately equitable, i.e., approximately charges each consumer in proportion to what it costs to supply each.

That this cannot be carried out exactly is obvious and admitted. But to charge solely on the basis of consumption

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is a serious departure from equity and sound commercial principles. For it means undercharging some and overcharging others. Its effect must be to keep away consumers who might be had on remunerative terms, and to attract consumers of a less remunerative character.

I do not agree that the ordinary man's demand for " equal quantities of the same article at the same price " exists in the sense suggested by Mr. Blaikie. The ordinary man has no use for electrical energy *per se*. He wants his house lit, his food cooked, his bath water heated. A kilowatt-hour used in lighting, in cooking a meal, and boiling a kettle, is not to him " the same article."

Mr. Blaikie's inverse quantity tariff must include a rate near the maximum for the business of cooking, heating, etc., in small houses—say, for consumptions of about 2 000 units annually, or, alternatively, it will attract nothing beyond the lighting consumption in such houses, say, 400 to 500 units annually ; probably not much of that.

Such a tariff attracting the small house total business will grossly undercharge large consumers for lighting only. It is doubtful whether a flat rate with discounts for quantity, or stepped down for quantity, can at the same time attract the small domestic consumer and prove reasonably remunerative. But I admit that a good deal depends upon the character of the area.

The real difficulty in bringing the average cost to the consumer much closer to the cost of generation is, admittedly, low load factor. In other words, the capital assets employed have a low coefficient of utilisation. The coefficient of utilisation is usually lower for distributing than for generating plant.

Few of those in control of supply undertakings seem to bother about their distributing load factor, even to the extent of knowing what it is for different sections and areas. The diversity factor between different areas improves the station (supply centre) load factor, but a good distribution load factor in one area does nothing to offset the effects of a poor load factor in another area. It is the increasing domestic uses which offer the best field for improving the sectional distributing load factors, and the resultant supply centre load factor. Also, such uses, encouraged by a suitable tariff, will improve the number of consumers per unit length of mains, which Mr. Blaikie rightly deplores.

Mr. Blaikie points out that many small consumers do no more, some less, than pay the fixed charges. The remedy is to turn them into larger consumers, and I do not think that any tariff but one which is approximately equitable will work that change.

The capital costs of connecting individual consumers do not vary directly with either the maximum demands or the consumption. For domestic consumers up to, say, 5 kW of maximum demand they are pretty uniform. This is an item which should be considered and covered in assessing the fixed charges element in any tariff.

For practical purposes it will probably serve all ends to take into account the load factor of separate classes of consumers, which involves the diversity factors within each class ; and the diverstiy factor among the classes which enters into the station load factor.

It is, confessedly, somewhat difficult to solve the problem of an equitable tariff of practicable simplicity, which does not bewilder or raise the suspicions of would-be consumers. It is in the way of solution by several plans. So far as these plans move in the right direction they reduce the difficulties, and one may say that the problem tends to solve itself, because the incidence of standing charges lessens as the collective load factor improves. If and when the average load factor is 50% instead of the present average of about 25% it will seem a simpler matter than it is at present.—I am, etc.,

HENRY M. SAYERS.

London, S.W.16.
March 3rd.

The B.I.F. Arrangements.

[TO THE EDITOR.]

SIR,—As an exhibitor in the Electrical Section of the British Industries Fair at Castle Bromwich I was glad to read your outspoken comments last week on several matters which undoubtedly detract from the efficiency of the Fair as at present conducted.

Exhibitors at this Fair can hardly be blamed for expecting not only that overseas buyers will be invited, but also that on arrival in this country their journey to the Fair should be made as easy as possible, and that their comfort should be the first consideration of all concerned during their presence at the Fair.

Actually, as your remarks seem to me to infer, the overseas visitor is entirely overlooked, while special steps are taken to interest and entertain people in our own industry, who are, on such an occasion, of little interest to exhibitors.

The arrangement of luncheons and conferences to discuss electrical matters, which could be more conveniently dealt with in other surroundings, serves only to clog the normal machinery, and does not assist export trade in any way. The admission of the general public is another bar to efficient working, and I am at a loss to imagine why such people are admitted, unless it is done to give the impression that the Fair is really a busy place.

Like many others, my firm went into the Fair with a view to developing our export trade. We can secure our home business by means other than the B.I.F.—I am, etc.,

" EXHIBITOR."

March 4th.

[TO THE EDITOR.]

SIR,—It seems to me, as a member of one of the stand staffs at the Birmingham Fair, that the visits of electrical associations and the admission of the general public are both expedients devised to cover up the poor attendance of foreign buyers. If this assumption is correct, one may further assume that the contention—of which I believe you, Sir, are a strong advocate—that the Fair is now being held at the wrong time of the year, is sufficiently proved.

Whenever this question has been raised in the past we have been told that the majority of the exhibitors were against a change in date. The only way to establish this is for the Fair Committee to take a ballot among the electrical exhibitors and then publish the result, giving the figures voting for and against retention of the present date. I venture to suggest that such a ballot would provide a good majority in favour of a change to May or June.—I am, etc.,

W. C. T.

March 5th.

Qualification for Wireless Trade Membership.

[TO THE EDITOR.]

SIR,—The letter by the secretaries of the Wireless Retailers' Association in your last issue refers to the points raised by your correspondent " Amused " (see THE ELECTRICIAN, February 15th, 1929, p. 196), but evades the real question.

If radio trade associations tacitly admit that the chief requirements for the granting of trade terms to a retailer is the display in a window of radio components, the suggestion that they " regard technical ability as a highly desirable attribute " would seem to be little more than a pious platitude.

The W.R.A. complains of the activities of the mechanics and engineering employees now " dabbling " in the wireless trade, but has it ever considered that many of these people are being directly encouraged by radio trade associations which have little interest in the technical qualifications of their members. It is by no means difficult to imagine that some of the " dabblers " have far more technical knowledge than some of the established radio retailers. The radio trade in general is at fault in not encouraging the development of its retail sales through electrical engineers.—I am, etc.,

" QUIZZICAL."

Manchester.
March 1st.

POINTS OF VIEW.

With every invention there comes the time when it has to be applied to industry.—*Lord Melchett.*

* * *

We cannot stem the tide of invention, nor is it desirable that we should, even if we were able.—*Mr. C. T. Cramp.*

* * *

The coroner would often be saved a job if a better lighting system were more universal.—*Mr. W. A. Shaw (Stockport).*

* * *

If the public wants a cheap supply of electricity it must put up with a plentiful use of overhead lines.—*Mr. T. P. Wilmshurst.*

* * *

The closer the co-operation of British labour with British capital, the greater will be the resulting prosperity ; and if one has any right to protection, so equally has the other.—*Mr. J. A. Rosetti.*

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NEWS IN BRIEF.

Hull and Foreign Telephone Cables—New Electricity Showrooms—The Electrical Position in Poland—Leyton and Electricity Meters—Batti Wallahs' Annual Dinner.

A REGULAR telephone service between Vienna, Berlin and Buenos Ayres was begun on March 1st.

Preesall Council has approved a scheme for electrical installation work on the hire-purchase system.

Bath Electricity Department announces daily cooking demonstrations at the showroom in Dorchester Street.

The Metropolitan Asylums Board is to renew the fire alarm system at High Wood Children's Hospital, at an estimated cost of £475.

The British Columbia Government has approved the West Kootenay Power and Light Co.'s undertaking on the Pend Oreille river.

It has been decided by the Roumanian Council of Ministers that the use of code telegrams by private firms and persons is again allowed both for inland communications and for abroad.

Ilford Electricity Committee has had under consideration the question of the erection of new offices and central show and store rooms, and suggests a site at the junction of High Road and Clark Road.

The Polish Ministry of Public Works has published data relating to Poland's electric power stations at the end of 1925. The total production of electricity was 1 667 435 000 kWh. Out of 631 towns in Poland only 278 possess electrical plants, of which 143 are municipal and 135 private.

Several tenders for cable were considered by Hull Telephones Committee last week, and in each case the lowest tender (whether British or foreign) was accepted. Where the difference was only £2 or £3 a motion to accept a British tender was defeated, and a German tender accepted.

Leyton U.D.C. has decided not to accept a tender for electricity meters, but that the Electrical Engineer purchase meters as and when required and, if unable to obtain them from British firms at prices reasonably near those quoted by foreign firms, suitable meters be purchased from foreign firms.

Benn Brothers' Dramatic Society, which gave successful performances of the mystery play, "The Creaking Chair," at King George's Hall, London, on February 22nd, and at the John Benn Boys' Hostel, London, on March 1st, will give a third performance of the play at the Scala Theatre, London, on March 18th.

Christchurch (N.Z.) Corporation's electric vehicle garage supplies charging and garage facilities for all sizes of electric vehicles. Rates are offered covering charging, and general care of batteries, and the garage staff carry out repairs on request from the owners. The number of vehicles at present in the garage is 37.

The Commercial Cable Co. has inaugurated new services of night and week-end cable letters to the United States, Canada and Newfoundland. These telegrams may be handed in at the company's offices or any Post Office in Great Britain and Ireland. The charge per word to New York is 2d. for the night service and 1½d. for the week-end cable.

Brighton Tramways Committee has approved a design for an illuminated sign to be displayed at the Aquarium shelter during next summer.

Good progress is being made with the construction of the Island Falls power plant at Churchill river, the most northerly power development in Canada.

Chesterfield Gas and Electricity Sub-Committee recommends that the proposed amalgamation of the gas and electricity showrooms be not proceeded with.

It is stated that works in connection with the provision of 15 new automatic telephone exchanges in Scotland will be authorised by the Post Office during the next few weeks.

Immediate steps are to be taken by Douglas Electricity Committee to have electricity showrooms prepared in Ridgeway Street, Douglas, at a cost of £1 000, plus £500 for appliances.

New offices and showrooms of Eastbourne electricity department were opened last week, in the presence of the Mayor and Town Council and others, by Sir Andrew Duncan.

A resolution that new showrooms, storerooms, and offices be erected at the corner of Smith Street and Samuel Street, was passed by Rochdale Electricity Committee at its last meeting.

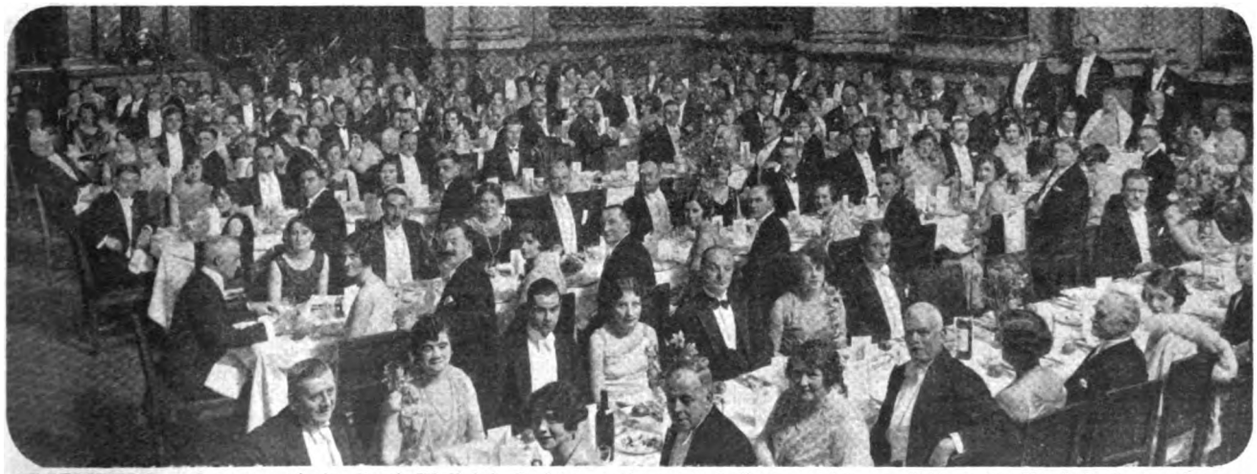
Preston Housing Committee has decided to rescind the resolution giving permission to the Preston Gas Co. to lay their service pipes in the 42 "all electric" houses being erected at Holme Slack.

Preparations for the installation of electrical plant for washing the exterior of passenger carriages on the L. and N.E. Railway at Cowlairs (Edinburgh) carriage sidings and also at Bridgeton Cross terminus have begun.

At a recent meeting of officials of the Marine Collieries, Cwm, Mr. R. Tedstone, the chief electrician, read a paper on underground telephones and signalling bells. He said bare telephone wires in mines, although permitted, were a potential danger. There was no danger in using bare wire in the signalling apparatus, as there was a safety device on the bell itself.

The Ministry of Transport has received an offer from a company to instal illuminated road "white lines," as an experiment, and the Ministry has asked Paddington (London) Borough Council to grant facilities for the experiment. The Council is recommended to agree to the provision of an illuminated white line 25 to 30 ft. in length, at the junction of Bayswater Road and Edgware Road.

The Leicester Isolation Hospital takes a supply of electricity from the Corporation electrical mains, and the cost during the past year was over £1 000. The Health Committee intends to instal two 75 kW generating sets, with the necessary switchgear, etc., the cost being estimated as follows:—Two 75 kW generating sets, £1 358; foundations, £44; pipe work and valves, £100; switchboard and cable, £180; alterations to existing engine room, £120. The committee is advised that the necessary supply can be generated by the proposed new plant for 0·366d. per kWh.



MEMBERS and guests of the Batti Wallahs' Society at the annual dinner which was held at the Hotel Cecil, London, on Friday, March 1st. Another photograph appears on our picture page.

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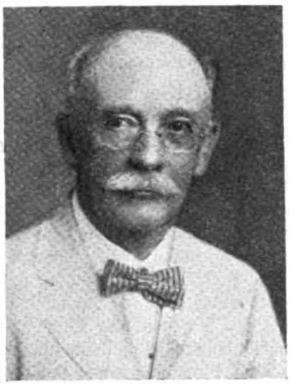
PERSONAL.

SIR James Donald has joined the board of the Calcutta Electric Supply Corporation, in the place of Mr. P. V. Luke, deceased.

The late Sir Henry Trueman Wood, who was for many years secretary of the Royal Society of Arts, left £47 210, with net personalty £46 943.



Dr. E. Weston, who has established a Fellowship with the American Electro-Chemical Society.

Dr. Edward Weston has established the Edward Weston Fellowship with the American Electro-Chemical Society. The candidate will be selected by the Society and selection will be based on marked capacity in carrying out research in electro-chemistry or its applications. The award will be made without distinction on account of sex, citizenship, race or residence, and the successful candidate may carry out his research at any university or institute approved by the Society. Dr. Weston was born in England in 1850, and went to the United States in 1870, when he devoted his time to the invention of new types of low voltage generators, and established in Newark, in 1875, the first factory in America devoted exclusively to that class of machine. In 1881 his plant was consolidated with the United States Electric Lighting Co., of which he was electrical engineer till 1888. At that time he formed the Weston Electrical Instrument Co., of which he has been president for many years.

Mr. V. Bingham has resigned his appointment as publicity manager to Crompton Parkinson, Ltd., and is taking up a similar position in the North of England.

Estate of the gross value of £4 412, with net personalty £4 069, was left by the late Mr. John Ferguson, general manager of the Perak River Hydro-Electric Power Co., Ltd.

Mr. Gordon Robbins, deputy chairman of Benn Bros., Ltd., publishers of THE ELECTRICIAN, has been elected chairman of the Council of the Newspaper Press Fund for the ensuing year.

Alderley Edge and Wilmslow Urban Councils, which have taken over the undertaking of the Alderley and Wilmslow Electric Supply, Ltd., have appointed Mr. E. Hesketh as manager.

Nelson Corporation has approved the Electricity Committee's recommendation that Mr. G. F. Nayler, borough electrical engineer, be permitted to act as consulting engineer to Barnoldswick U.D.C.

Col. the Hon. Francis V. Willey, a member of the Central Electricity Board and a past president of the Federation of British Industries, by the death of his father, Lord Barnby, assumes the peerage.

Mr. W. P. Hicks, who has for nearly 16 years held a responsible position in the technical sales department of Crompton Parkinson, Ltd., has left to join the Haviland Engineering Co., of Alloa. His colleagues presented him with a silver cigarette case.

Mr. H. C. Spence, assistant maintenance engineer with the Yorkshire Electric Power Co., has been appointed electrical engineer by the Holmfirth Urban Council in succession to Mr. J. W. Fawcett. There were 66 applicants for the post. He joined the Yorkshire Electric Power Co. in 1926.

Mr. G. A. Halmshaw, of Dewsbury, late inspector of telephones, who has retired after 40 years' service, has been presented by the staff of the engineering department with a divan easy chair and a mahogany clock. Mr. Halmshaw commenced his career with the National Telephone Co.

Mr. Robert Roper, the power station engineer of the South Wales Electrical Power Distribution Co., and a member of the Pontypridd U.D.C., and chairman of the Electricity and Tramways Committee of that Council, has just been appointed to the Bench of Magistrates for the County of Glamorgan.

Mr. T. Parker, of Ribble power station, has accepted an appointment at Calcutta Electricity Works and sails for India to-morrow (Saturday). On March 1st he was presented with a gold wristlet watch, a travelling trunk and a case of electrical instruments by Mr. S. Wood, superintendent of the station, who referred to the valuable services of Mr. Parker. Mr. R. Dickinson (deputy superintendent) and Mr. Lucas (Blackpool transmission cable superintendent) added their tributes.

The Lamme Medal Committee of the American Institute of Electrical Engineers has awarded the first (1928) Lamme Medal to Mr. Allan Bertram Field " for the mathematical and experimental investigation of eddy current losses in large slot wound conductors in electrical machinery." The Lamme Medal was founded as a result of a bequest in the will of the late Mr. Benjamin G. Lamme, chief engineer of the Westinghouse Electric and Manufacturing Co., who died on July 8th, 1924. Mr. Allan Bertram Field, consulting engineer of the Metropolitan Vickers Electrical Co., Ltd., was born at New Barnet, Herts, in 1875. After receiving his early education in London, he attended the Finsbury Technical College (1890-1893) and was awarded diplomas in both electrical and mechanical engineering. Following studies at St. Johns College, Cambridge, from 1896 to 1899 and the passing of the Mathematical Tripos examination, he was awarded the Honours B.A. degree. He was later awarded the M.A. degree in the regular course. He took the Honours Science examination of the University of London, and received the Honours B.Sc. degree in 1900. Previous to his education at St. Johns College, Mr. Field had been employed in shop work and drafting in and near London for about two years. From 1899 to 1902, he was engaged in engineering work in traction, power, and lighting projects with the British Thomson-Houston Co. in London. In order to become more familiar with American practice, he joined the General Electric Co. of America in 1902 and spent more than a year in the Testing Department in Schenectady, afterward being engaged in transformer design. From January, 1905, to October, 1908, he was employed in the Bullock Electric Manufacturing Co. and the Allis-Chalmers Co. in the design of a.c. generators and motors. He joined the engineering forces of the Westinghouse Electric and Manufacturing Co. in 1909 and was engaged in the design of salient pole alternators. In 1911 he was appointed engineer-in-charge of turbine-generator design. During the next two years he was responsible for the development and commercial introduction of the built-up rotor design, which has ever since been followed by that company, and solved, in collaboration with Mr. Lamme, many problems of turbine-generator design. He was consulting engineer and professor of mechanical engineering at Manchester University from 1914-1917, and during the next three years was with Vickers, Ltd., in London. Since 1920 he has been consulting engineer with the Metropolitan-Vickers Electrical Co., Ltd., Manchester, England. Mr. Field is the author of a number of important papers on electrical machinery which appeared in the Transactions of the Institute and other engineering publications. He joined the Institute in 1903 and became a Fellow in 1913. He is a member of the American Society of Mechanical Engineers, the Institution of Electrical Engineers and the Institution of Mechanical Engineers.

Obituary.

MR. W. R. SPAVEN, on March 1st. He was for twenty-four years manager of Portsmouth Corporation Tramways. He retired two years ago.

MR. C. E. CROCKER, on March 4th, as the result of a motor accident. He was general manager of Perth (W.A.) City Council Electricity and Gas Department.

MR. JOHN DUGDILL, aged 66 years. He was one of the oldest electrical installation contractors in the country, but, some years ago, devoted himself almost exclusively to the design and manufacture of " Dugdill's Patent "—lighting arms and fixtures of every conceivable shape and size to meet any special individual lighting problem that might arise.

MR. M. H. BOLLINGER, aged 45 years. He was born at Wellington, N.Z., and in 1905 came to this country as test bed assistant with the Phoenix Dynamo Co., later taking a position as draughtsman with Siemens Bros. Dynamo Works, Ltd., on d.c. motor and a.c. generator design until 1908. He then returned to New Zealand, subsequently becoming, in 1920, general manager of the electrical department of A. S. Paterson and Co., Wellington, the position he held at the time of his death.

DR. CHARLES S. DU RICHE PRELLER, at his home in Edinburgh, on Sunday, aged 84 years. Dr. Preller was an eminent civil and electrical engineer and also found opportunity for much literary work. He had been engaged in earlier years in railway and electrical undertakings in Saxony, Italy, and Switzerland, and was formerly chairman and chief engineer of the Dimmat Valley Electric Railway. He was the author of a number of papers on engineering, and was awarded prizes by the Institution of Civil Engineers.

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LEGAL INTELLIGENCE.

Application for Extention of Patent by British Thomson-Houston Co., Ltd.

IN the matter of letters patent bearing date May 8th, 1913, numbered 10 918/1913, and granted to the British Thomson-Houston Co., Ltd., for "Improvements in Incandescent Electric Lamps," an originating summons issued on behalf of the company and asking that the terms of the patent may be extended for five years will come before Mr. Justice Luxmoore on April 9th for directions as to the hearing, and any notices of objection must be lodged at least seven days before that date.

Lamp Patents Infringed.

In the Chancery Division, on February 20th, Mr. Justice Clauson, on a motion for judgment in default of appearance and defence, granted an injunction to the British Thomson-Houston Co., Ltd., restraining J. Isow, of Alvington Street, Hackney, and Alfred L. Finegold, of Blakesby Street, Commercial Road, E., from infringing two incandescent electric lamp patents, and passing off.

His Lordship also made an order for the delivery up of infringing lamps.

Mr. Tookey, for the plaintiffs, said the particulars of sale referred to 44 cases of infringing lamps.

In the Chancery Division before Mr. Justice Eve on February 22nd, Mr. Trevor Watson again mentioned the case of the British Thomson-Houston Co., Ltd., against the City Incandescent Light Co., in which his lordship on the previous Friday granted ex parte an injunction restraining infringement of plaintiffs' letters patent with respect to gasfilled lamps. His Lordship granted a perpetual injunction.

NEW YEAR HONOURS LIST.

Electrical Names in the List of Awards.

THE official list of New Year Honours issued on February 28th, the publication having been delayed two months by the illness of the King, contained the following:—KNIGHTS: Prof. J. A. Fleming, F.R.S., Emeritus Professor of Electrical Engineering, University College, London; Lt.-Col. C. B. Levita, chairman of London County Council; Col. T. F. Purves, engineer-in-chief, Post Office. ORDER OF ST. MICHAEL AND ST. GEORGE: Mr. M. F. Headlam, chairman, Pacific Cable Board. KNIGHTS BATCHELOR: Mr. G. A. Julius, chairman of the Council for Scientific and Industrial Research, Commonwealth of Australia. ORDER OF THE BRITISH EMPIRE (G.B.E. Civil Division): Sir W. S. McCormick, F.R.S., chairman of the Advisory Council of the Department of Scientific and Industrial Research; (O.B.E. Civil Division) Major J. A. Sadd, Mr. P. A. Theis, assistant secretary, Pacific Cable Board; (M.B.E. Civil Division) Mr. J. A. B. Jones, assistant electrical engineer, Sudan Government Railways and Steamers; ORDER OF THE INDIAN EMPIRE (C.I.E.): Mr. E. E. Gunter, director, Persian Gulf Telegraphs, Indo-European Telegraph Department (retired). See page 307.

LAMP MANUFACTURE.

Large Increase in Efficiency of British Standard Electric Lamps.

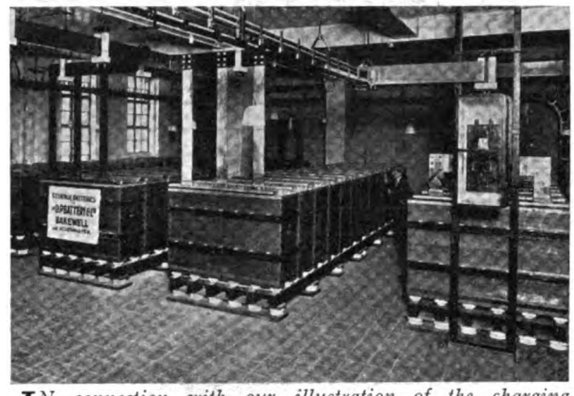
A recent reference to the issue of the British Standard Specification for electric lamps called attention to some of the improvements which have been established in lamp manufacture. It is interesting to note that the Specification reflects the results of the large amount of research work carried out in recent years by the British manufacturers, in that the efficiencies of gasfilled electric lamps have been substantially increased, whilst still retaining the average life of 1 000 hours. The improvements in manufacture have also made it possible to keep the light centre length constant within less than half the variation found necessary in 1925 when this specification was last revised.

A contract has been let for the construction of the dam in connection with the British Columbia Power Co.'s hydro-electric works on the Stave river. The new plant will have an initial capacity of 43 000 H.P. and provision is made for the addition of a further unit of similar capacity when necessary. The total cost is estimated at $7 250 000.

I.E.E. STUDENTS.

Big Attendance of Members and Guests at London Section's Annual Dinner.

THERE was an attendance of nearly 140 members and guests of the London Students' Section of the Institution of Electrical Engineers at the 22nd annual dinner at Les Gobelin's Restaurant on Tuesday. Mr. S. H. Hart was in the chair and the guests included Mr. P. V. Hunter, Mr. H. T. Young, and Mr. P. F. Rowell. Lieut.-Col. K. Edgcumbe was prevented by illness from attending.



IN connection with our illustration of the charging plant at the Metropolitan Telephone Exchange, Wood Street, London, in the February 22nd issue, the D.P. Battery Co., Ltd., has sent us the above picture showing two batteries at the exchange, each consisting of 25 cells, "D.H. 69-plate" D.P. type of 9 987 Ah capacity.

Mr. L. S. CRUTCH, in proposing the toast of the Institution, drew attention to the fact that about 25% of the Institution's membership of 13 000 was furnished by students. He deplored the small attendances at the students' meetings, and hoped that in future more students would go to the meetings. The Institution played a great part in electrical affairs and it was up to the students to do their share.

Mr. P. V. HUNTER, in reply, said that following many years of association with the Institution, he believed that it was, and would continue to be, of great benefit to the electrical industry. The fact that all sorts of sectional associations were growing up was no weakness of the Institution. On the contrary, it showed that electrical engineers were virile and keen on their work. He looked to the young people in the Institution to play a larger part in conducting its affairs.

Mr. MOFFAT, in proposing "Our Guests," revealed the fact that the Students' Section now had several lady members in its ranks, and Mr. H. G. COUSINS, who replied, remarked that the Students' Section of the Institution of Civil Engineers had been similarly favoured. He expressed regret that the I.C.E. Students had not recently found a suitable opportunity for a joint meeting with the I.E.E. Students, but it was hoped that further meetings of this kind would be arranged in the future.

Mr. H. T. YOUNG proposed "The Students' Section." He thought that the London Section, with its 1 290 members, should get a better muster at its meetings. There was a great future for trained electrical engineers. Referring to the distinction conferred upon two well-known members of the I.E.E., Prof. J. A. Fleming and Col. T. F. Purves, Mr. Young said that the field open for young electrical engineers to-day was still wide enough to make it possible for many of the students present to rise to similar heights of achievement.

Mr. S. H. HART, in a brief reply, mentioned that the attendance at the dinner was the largest they had had for six years. Although attendance at discussions and meetings could not be called satisfactory, it was improving gradually. The Committee had authorised him to invite suggestions for means to increase the numbers of students attending meetings.

An enjoyable entertainment was provided by Messrs. Morland Hay and Jay Greene, and Mr. F. Corthesy was again prevailed upon to give some of his dramatic recitations.

A photograph taken during the evening is reproduced on page 303.

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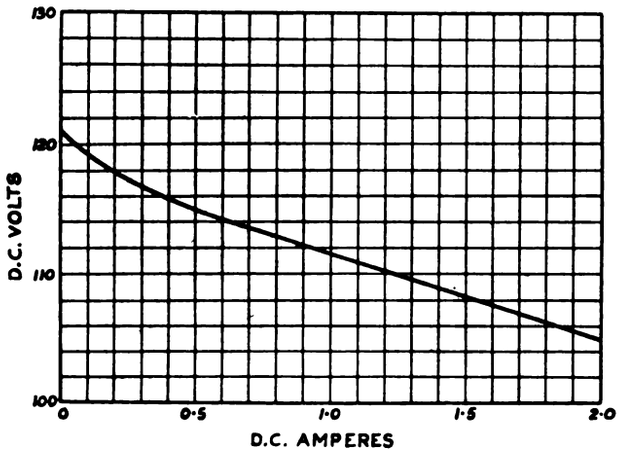
BATTERY CHARGING.

WE have received from the WESTINGHOUSE BRAKE AND SAXBY SIGNALLING CO., LTD., of 82, York Road, King's Cross, London, N.1, particulars of the Westinghouse metal rectifier style R.P.20, for charging large batteries. In these



The voltage regulation curve of the Westinghouse R.P. 20 rectifier.

sets the adjustable reactive transformer, as used in the R.T.10 and R.P.10 models, is replaced by a transformer and tapped reactance housed in the rectifier casing, the connections from the reactor taps being taken to a six-way switch, each of the six studs giving a different charging rate. This R.P.20 rectifier is made in six types for an a.c. input up to 600 V, with outputs in d.c. volts of 110–114, 110–114, 55–57, 200, 6, and 22–26, the amperage being in each case as written, 0·3–2·0, 0·4–3·0, 0·5–6·0, 0·2–1·5, 1·5–2·0, 1·0–10. In larger sizes, three-phase sets can be built, although for battery charging this introduces some complication in respect of economical regulation of the output.

The construction is much the same as for the other Westinghouse models, while the efficiency curve gives a high reading even to a 1/10th of the full load. It is claimed that in the event of the a.c. supply failing when the rectifier is charging, the value of the reverse current from the battery is negligible, while charging will restart immediately the supply is again available. Uses for the rectifier other than charging include the operation of solenoids, relays and contactors to avoid noise and chatter, magnetic chucks, faceplates, clutches, separators and small speed motors, alternator excitation, synchronous motor excitation, alarm and signalling systems, and electro-medical apparatus. The makers point out that in cases where it is desired to avoid using a transformer, it may be worth while designing the d.c. apparatus for working at such a voltage that it can be used on the rectifier direct-coupled to the supply. When this is done, it should, however, be borne in mind that the rectifier still forms a direct link with the supply system and must therefore be insulated accordingly.

It will be appreciated that the d.c. output voltage for any given a.c. voltage is not easily defined as being the a.c. voltage less a certain resistance drop, but depends on the form factor of the workin; conditions. In most cases it may be taken that the ratio of a.c. to d.c. voltage is on open circuit 1·2 to 1, and on full load 1·4 to 1, giving approximately 20% drop in volts from no-load to full-load, as shown by the voltage regulation curve above.

CHECKING ALTERNATOR FREQUENCY.

We are informed that in the United States successful efforts are being made to keep the average frequency of alternators at a constant speed. For this purpose, the Warren Company supply a Graham dead-beat clock with seconds pendulum as a master in each generating station, and provide a seconds hand concentric with a Telechron seconds hand so that any lag or advance is at once revealed.

The linking up of our own generating stations under the Central Electricity Board demands something better and it is interesting to learn from the Synchronome Co., Ltd., of 32/34, Clerkenwell Road, London, E.C.1, that the London Power Company, Ltd., is combining the use of Telechron synchronous motors with the Synchronome system of electric clocks.

IN PARLIAMENT.

Replies to Questions of Electricial Interest in the House of Commons.

IT is proposed to instal 23 police telephone boxes in the Metropolitan Police Richmond sub-division, and 20 in the Wood Green sub-division.

There are now 237 centres approved by the Ministry of Health or the Board of Education for artificial light treatment. It is understood that steady progress is being made with the provision of these facilities.

The B.B.C. and Income Tax.

Assessments to Income Tax have been made on the British Broadcasting Corporation in respect of its profits, including any profits derived from publishing newspapers, etc., but the Corporation disputes liability.

There is at present no known system of wireless communication capable of being worked at a cost which would justify its installation for communication between the small outlying islands round the coast of Scotland.

Certain fatal accidents have been due to faulty insulation of electricity in bathrooms. The wiring arrangements in private houses are not under the control of the Ministry of Transport or the Electricity Commissioners.

Replying to a question whether he would interchange electricity and the merchant marine which are at present under the Ministry of Transport and the Board of Trade, respectively, the Prime Minister states that he has noted the suggestion but does not think it practicable.

For the period from April 1st to December 31st last the gross receipts of the Post Office from the Imperial beam wireless services are estimated at about £380 000. The credit balance in respect of the same period (before charging depreciation or interest on capital) is estimated at about £152 000.

The Communications Co. in connection with the cables and wireless merger scheme has not yet been formed, and no agreements or contracts have yet been concluded. The Government intends to lay before the House of Commons any agreements or contracts for which the Government is responsible.

The Minister of Transport does not think there is at present any prospect of the introduction of complete uniformity in the charges for electricity in London, but the Joint Electricity Authority is reviewing the existing tariffs, and proposes to consider how far a greater uniformity in the methods of charge could be recommended.

There is no Post Office wireless station at Stornoway. The existing wireless station at Lochboisdale, with which Stornoway is connected by wire, is brought into use as quickly as possible when the cable between Stornoway and the mainland breaks down. It is not considered that the expense of re-opening of the Stornoway wireless station would be warranted.

The President of the Board of Trade understands from the chairman of the Baird Television Development Co. that the annual meeting was deferred in view of negotiations with the General Post Office and British Broadcasting Corporation (which were in progress in the latter part of the year) for the provision of facilities for an experimental broadcast of television, that arrangements have only just reached a stage at which progress can be reported to the shareholders, and that a general meeting has now been held.

With regard to a question as to the proposed disconnection of Stockport telephone subscribers resident in the Heaviley and Cale Green wards from the Stockport automatic telephone exchange and their connection with a new manual exchange to be known as Hazel Grove, the Assistant Postmaster-General says the Stockport automatic exchange is one of the older type of automatic exchanges, and the manual exchange is the most economical method of arranging for the telephone extension in this area.

The Postmaster-General informed both the British Broadcasting Corporation and the Baird Television Development Co. a few months ago that he would be prepared to agree to the use, subject to suitable conditions, of one of the corporation's stations for experiments with television apparatus. The corporation decided, after their officers had witnessed a demonstration of the Baird system, that it did not then fulfil the conditions which would justify a trial through one of their stations, although they expressed their readiness to review this decision if and when development justified it. A further demonstration was given last week and the question of using a broadcasting station for television is to be reconsidered.

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IMPERIAL CHEMICAL HOUSE.

A Brief Description of the Electrical Effects in New London Offices.

THE fullest possible use of electricity is made in Imperial Chemical House, Millbank, the new head offices of Imperial Chemical Industries, which were opened publicly on February 22nd. Among the unique features of the building is the installation of panel cooling, the system being driven by an electric motor of 130 H.P. There are nine passenger and two goods electric lifts, each being provided with a micro-levelling device which automatically brings the car within a quarter inch of floor level on stopping. The power supply is taken from the mains of the Westminster Electric Supply Corporation and practically all motors in the building are three-phase in type; the collective loads are light, 400 kW; heating, 168 kW; cooking, 285 kW; and power, 779 H.P. Artificial daylight is used throughout, and in the offices lamps are concealed in glazed recesses in the ceiling. Staircase halls are lighted through special "laylights," the lamps behind being fitted with specially designed reflectors having matt white surfaces. No natural lighting is provided in the corridors, the illumination being carried out by means of rectangular ceiling panels, reaching a maximum of 6 ft. candles under panels. Octagonal diffusing ceiling fittings are used in the conference rooms and elsewhere.

The directors' rooms are illuminated by electro-mechanical ceiling lights, consisting of reflectors fitted with daylight lamps, and a mechanism incorporating a solenoid which raises and lowers the ceiling by way of controlling the amount of light. The device is actuated by means of a push button, either at the desks or the doorway, which completes a low voltage circuit, for energising a series of relays; these latter then simultaneously bring the solenoid into operation. This results in the movable portion of the ceiling being raised, and the light gradually coming into effect with a dimmer in circuit. A second pressing of the push button completes a circuit which causes the intensity of the lighting to be reduced by 50 per cent. without affecting the raising and lowering device, while a third pressing of the button causes a complete reversal of the operation—i.e., the lights gradually fading out, and the movable portion of the ceiling being lowered into position.

Cornice lighting is employed in the refectory and special fittings also project light from outside through lunette windows. The colonnades are lighted by means of Allom reflectors behind the columns causing the latter to stand out in bold relief. The main interior courts are floodlighted, while in the basement area daylight lamps are used in diffusing pendant globes. In lavatories, combined door locks and switches are fitted, operating small local lights. These are run at low voltage from small local transformers. Desk lamps in the form of globes are provided in the more important offices. On each globe the map of the world is reproduced in relief.

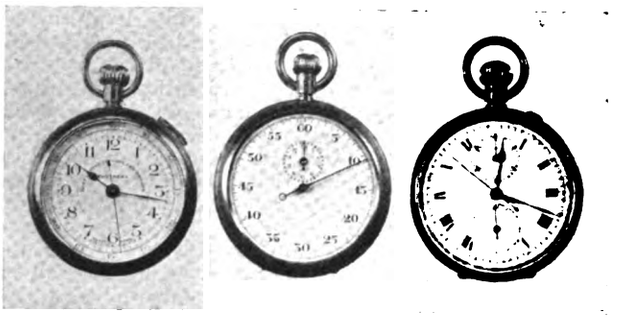
Other Details.

Among other interesting electrical features of the building are the operation of the main doors on the Millbank front by means of a push button actuating electric motors. There are electric bells with indicators of a specially designed luminous type and electric clocks are installed on the Synchronome system, one master clock controlling approximately 540 dials throughout the building.

The whole of the wiring for the electric lighting, power, bells, etc., was carried out by T. Clarke and Co., Ltd., electrical contractors, of 129, Sloane Street, London, S.W.1. The magnitude of the work can be estimated when it is mentioned that the number of points installed runs into several thousands and the amount of wires and cables installed is well over 70 miles, also the steel conduits exceed ½ million feet. To control the installation, a switchboard has been installed which is made up in three panels, which cover a length of 41 ft.; the power panel is equipped with one 1 000 A t.p. main breaker and seven 200 A t.p. outgoing control breakers; the heating panel is equipped with twelve 500 A s.p. breakers and three 1 000 A s.p. breakers and the lighting panel is equipped with three 500 A s.p. main breakers and nine 250 A s.p. sub-breakers. The board was made by the Astral Engineering Co. to T. Clarke and Co.'s specification. Other firms connected with the installation are Lighting Trades, Ltd., Newbury and Thomas, Waygood and Otis, Ltd., the Reliance Telephone Co., Ltd., the Synchronome Co., Ltd., Neon Lights (1928), Ltd., Metro-Vick Supplies, Ltd., W. T. Glover and Co., Ltd., the Steel Tubes and Conduit Co., and the Walsall Hardware Manufacturing Co., Ltd.

ENGINEERS' STOP WATCHES.

A RANGE of stop watches suitable to the needs of electrical and other engineers has been placed on the market by A. ARNOLD AND Co., of 17, Elmcroft Avenue, Golders Green, London, N.W.11. The "Fortress" pattern shown in the



The range of stop watches offered by A. Arnold & Co.

left-hand picture serve the purpose of both an ordinary watch and a stop-watch, giving accuracy to within a fifth of a second. It is a 30-hour lever movement instrument, guaranteed for 12 months. In addition to the usual minute and hour hands a centre seconds hand is fitted, one complete revolution being made per min. over a scale graduated in fifths of a second. The stopping and starting movement is given by a small projection on the outer rim of the case. The centre illustration shows the Arnold "Racing Recorder," fitted with lever movement, and minute and second hands only. It has starting and stopping and fly-back actions, re-setting both hands to a zero reading. Still another product is the fly-back "Chronograph," illustrated on the right. This is a 15-jewelled lever with independent centre seconds hand.

ELECTRICAL WOMEN.

Activities of the Electrical Association for Women during February.

ON February 7th, a large party of members of the Electrical Association for Women visited the Soho School of Cookery when Miss Mabel Collins, the principal, gave a lecture-demonstration on a "Five Course Dinner." During the afternoon Miss Collins gave some useful cooking hints which were very much appreciated.

The second evening lecture of the association was given on February 12th at the E.L.M.A. Lighting Service Bureau, by Mr. A. de H. Donisthorpe, of the General Electric Co., Ltd. Mr. Donisthorpe dealt with the history of wireless and the development of television and radio pictures; lantern slides and films and practical experiments added to the interest of the evening.

On February 19th many members availed themselves of the invitation to visit the showrooms of the Singer Sewing Machine Co. Talks were given on the history of the sewing machine, and members were both interested and amused at the contrast between the model of the first Singer machine made and the latest electric model.

The Birmingham and Midlands Branch of the association held another "Outlet Campaign" meeting on February 12th, with Lady Brooks (president) in the chair. Mrs. L. A. Wilson spoke on "House Problems from the Woman's Point of View."

Mr. T. R. Martin spoke on the "Red Seal" Campaign in Canada, and how well the movement was progressing.

Mr. Forrest, in a very clear and lucid manner, dealt with off-peak loads.

At the last meeting of the North Wales branch of the association, Mr. Price F. White, borough electrical engineer, Bangor, gave an address on domestic electrical appliances and his views were reinforced by Mrs. White's experiences. Among the apparatus demonstrated were electric cookers, heaters, radiators, ultra-violet rays, artificial sunlight, and washers.

The British Thomson-Houston Co., Ltd., has tendered an invitation to members to visit the Ideal Home Exhibition on March 13th, and the Hotpoint Electric Appliance Co. is inviting the party to luncheon and tea. Parties of members from Birmingham, Cheltenham and Ashford will be attending and it is expected that well over 200 members will take part in this visit.

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BUSINESS OPENINGS.

Latest Particulars of Electrical Engineering and Wiring Installation Contracts for which Tenders are being Invited at Home and Abroad.

WE give below the latest particulars of contracts for which tenders are invited. The closing date is given, when available.

LIVERPOOL CORPORATION.—Electrically driven pumps for Aubrey Street pumping station. Specification, etc., from the Water Engineer, 55, Dale Street, Liverpool; deposit £2 2s.

PORTSMOUTH CORPORATION.—Supply and installation of four electrically driven vertical circulating pumps, each capable of pumping 10 000 gallons of water per minute. Specifications from Mr. B. Handley, Electricity Department, High Street, Portsmouth.

WALSALL AND WEST BROMWICH UNIONS JOINT COMMITTEE, March 8th.—Supply of electric fittings, etc. Forms of tender, etc., from the Clerk, 22, Lombard Street, West Bromwich.

LEEDS CORPORATION, March 9th.—Supply of single-phase (2 000 and 6 600 V), three-phase (6 600 V) and Scott-connected transformers, as required over a period of two years; and 11 000 V three-phase transformers (10 500 kVA), for early delivery. Specification from Mr. C. N. Hefford, Electricity Department, 1, Whitehall Road, Leeds; deposit £1 1s.

Supplies for Poor Law Institutions.

OLDHAM GUARDIANS, March 11th.—Supply of electric lamps and fittings. Forms of tender from Mr. F. W. Fletcher, Union Offices, Oldham.

PERTH CORPORATION, March 11th.—Electric lighting work, in connection with erection of 16 houses at Crieff Road, Hillyland, Perth, 44 houses at Darnhall Drive, and 36 houses at Rigg's Road. Schedule, etc., from the Burgh Surveyor; deposit £1 for each.

WARRINGTON CORPORATION, March 11th.—(1) Motors; and (2) transformers. Specifications from the Borough Electrical Engineer; deposit £1 1s. for each.

BELFAST GUARDIANS, March 12th.—Twelve months' supply of electrical fittings, etc. Forms of tender from Mr. R. H. Wilson, clerk to the Guardians.

MANCHESTER CORPORATION, March 12th.—Supply of trucks for electric tramcars. Specifications, etc., from the general manager, Corporation Tramways, 55, Piccadilly, Manchester.

NORTH BRITISH ALUMINIUM CO., LTD., March 12th.—Supply and installation of all material required for electric power and lighting distribution system, at the company's works, near Fort William, Inverness-shire. Specification, etc., from the Company's Offices, Adelaide House, King William Street, London, E.C.4.

BERMONDSEY (LONDON) GUARDIANS, March 13th.—Six months' supply of electric lamps (item 68). Form of tender from the Clerk, 283, Tooley Street, S.E.1. Stamped, addressed envelope to be sent.

DUNDEE CORPORATION, March 13th.—Supply of l.t., paper insulated, lead covered and double steel tape armoured cable, to B.E.S.A. specification for working pressure up to 660 V. Specifications, etc., from Mr. D. H. Bishop, Electricity Supply Department, Dudhope Crescent Road, Dundee.

LEEDS CORPORATION, March 13th.—Electric lighting installation at Gateforth Sanatorium, Hambledon, near Selby. Form of tender, etc., from the City Engineer.

ISLINGTON (LONDON) GUARDIANS, March 14th.—Six months' electrical supplies. Forms of tender from Mr. Albert King, Guardians' Offices, St. John's Road, Upper Holloway, N.19. Stamped, addressed envelope to be sent.

SHEFFIELD CORPORATION, March 14th.—Buildings, civil engineering works and constructional steel work (specification B.M. 64); transformers (B.M. 66); pipework and valves (B.M. 69); e.h.t. three-phase switchgear (B.M. 71); battery locomotive and accessories (B.M. 74). Specifications (deposit £3 3s. for each) from Mr. S. E. Fedden, general manager and engineer, Electric Supply Department, Commercial Street, Sheffield.

BELFAST EDUCATION COMMITTEE, March 15th.—Electric light installation in Riga Street and Montcollyer Elementary Schools. Specifications, etc., from the Education Architect, Victoria Street, Belfast; deposit £1 1s. for each.

EDINBURGH CORPORATION, March 15th.—One 1 500 kW motor-converter, for Dewar Place sub-station. Specification from Mr. E. Seddon, engineer and manager, Electricity Department; deposit 10s. 6d.

BRADFIELD RURAL DISTRICT COUNCIL, March 18th.—Electric motors (with switchgear) for driving air compressors, at Pangbourne sewage works. Specification from the engineer, Mr. C. H. Stafford, 209, King's Road, Reading; or the Clerk, Town Hall Chambers, Reading.

EDMONTON GUARDIANS, March 18th.—Six months' supply of electric lamps, and X-ray, light, massage, etc., requisites. Forms of tender from the Clerk, 77, Bridport Road, Edmonton, London, N.18. Stamped, addressed envelope to be sent.

LANCASTER CORPORATION, March 18th.—Two water-tube boilers, to evaporate 36 000 lb. of water per hour, with mechanical stokers, etc., at Caton Road generating station. Specification, etc., from the Borough Electrical Engineer; deposit £2.

MANCHESTER CORPORATION, March 18th.—Twelve months' supply of incandescent lamps. Forms of tender, etc., from Mr. H. C. Lamb, Electricity Department, Town Hall, Manchester.

NEWTON ABBOT URBAN DISTRICT COUNCIL, March 18th.—Supply of pumping and other equipment, with electric motors, control panels, etc., for sewer construction works. Specifications from Mr. F. W. S. Stanton, 5, Victoria Street, London, S.W.1.

CARDIFF CORPORATION, March 19th.—Supply of e.h.t. and l.t., paper insulated cables during 12 months, commencing April 1st (specification No. N 64), and supply and erection of natural draught cooling tower (specification N 65). Specifications, etc., from the City Electrical Engineer, The Hayes, Cardiff. Only members of the King's National Roll are invited to tender.

HOLBORN (LONDON) GUARDIANS, March 20th.—Supply of electrical fittings, for six months. Forms of tender from the Clerk, 53, Clerkenwell Road, E.C.1. Stamped, addressed envelope to be sent.

METROPOLITAN ASYLUMS BOARD, March 20th.—Automatic telephone system at North Western Fever Hospital Hampstead, N.W.3. Specification, etc., from the Board's Office, Victoria Embankment, E.C.4; deposit £1.

PADDINGTON (LONDON) GUARDIANS, March 20th.—Six months' supply of electricians' sundries, etc. Forms of tender from the Clerk, 313-319, Harrow Road, W.9. Stamped, addressed envelope to be sent.

HULL CORPORATION, March 21st.—One 2 000 000 gal. per hour, electrically driven circulating water pump, motor, motor starter, etc. Specification from Mr. J. N. Waite, Electricity Works, Sculcoates Lane, Hull; deposit £1 1s.

STOURBRIDGE GUARDIANS, March 21st.—Supplies of electric lamps for six months. Particulars from the clerk, Mr. G. F. James, 12, Hagley Road, Stourbridge.

HARROGATE CORPORATION, March 23rd.—Twelve months' supply of cables, joint boxes, joint box compound, service meters, service cut-outs, and transformers. Specifications, etc., from Mr. N. McLean, borough electrical engineer, 33, Swan Road, Harrogate.

Electric Lighting of Tenement Buildings.

BETHNAL GREEN (LONDON) BOROUGH COUNCIL, March 25th.—Electric lighting installation in seven blocks of tenement buildings. Specification, etc., from Mr. David J. Keep, town clerk, Town Hall, Cambridge Road, E.2; deposit £2 2s.

EDINBURGH CORPORATION, March 25th.—Supply of materials to the electricity department for 12 months, including cables, conduits, fuses and fuse boards, electrical material, electricity meters, meter boards, etc. Specification from the Engineer and Manager, Dewar Place, Edinburgh.

GLOUCESTER CORPORATION, March 25th.—Supply and erection of two 1 000 kW motor generators, for conversion of 11 000 V 50 cycle a.c. to 460/500 V d.c. Specification, etc., from the City Electrical Engineer, Commercial Road, Gloucester.

ILFORD CORPORATION, March 25th.—Supply of paper insulated cables. Specification, etc., from the Borough Electrical Engineer, Electricity Works, Ley Street, Ilford.

BROOK MOTORS, LTD., March 29th.—Electric lighting work, in connection with extensions to Empress Works, St. Thomas's Road, Huddersfield. Plans, etc., can be seen at the offices of Mr. J. Arnley, 55, New Street, Huddersfield.

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RHONDDA URBAN DISTRICT COUNCIL, March 30th.—Supply of house service, a.c., ordinary and prepayment meters, cable joint boxes, compound, cut-outs, etc., for one year. Specifications, etc., from the Electrical Engineer, Electricity Works, Porth, Glam.

CENTRAL ELECTRICITY BOARD, April 15th.—Supply and erection of 33 000 V overhead transmission lines, in connection with the North West England and North Wales Electricity Scheme. Specification (No. N.W.E.-S.L.2) from Sir J. R. Brooke, secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

Overseas.

UNLESS otherwise stated, particulars of overseas contracts are to be had from the Department of Overseas Trade (Room 52), 35, Old Queen Street, Westminster, London, S.W.1. *Note.—An asterisk denotes that local representation is, in practice, essential.*

MAYO COUNTY BOARD OF HEALTH, March 9th.—Electric lighting installation at Creagh House, near Ballinrobe. Specification from Mr. T. Flanagan, county surveyor, Castlebar; deposit £2 2s.

YUGO-SLAV MINISTRY OF COMMUNICATIONS, March 10th.—Supply of various materials, including electric welding apparatus, machine tools, Diesel engine with electric generator and switchboard, two electric motors (25 and 20 H.P.), various electric generators and other electrical materials, for the River Shipping Board; telegraph and telephone materials for the Construction Department; electric lighting sets for passenger coaches, for the Machinery Department, etc. (Reference C.X. 2 982.*)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, March 12th.—Supply of telephone relays (schedule C. 408). (Reference B.X. 5 078.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, March 12th.—Supply of switchboard cords (P. and T. 151/1 247). (Reference B.X. 5 017.)

BELGIAN MINISTRY OF RAILWAYS, MARINE, POSTS, ETC., March 13th.—Supply of bronze and copper wire. (Reference A.X. 7 604.)

BENGAL NAGPUR RAILWAY CO., LTD., March 15th.—Supply of five-ton overhead electric travelling crane. Specification, etc., (10s.), from the Company's Offices, 132, Gresham House, Old Broad Street, London, E.C.2.

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, March 26th.—Switchboard cords. (Reference B.X. 5 067.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, March 26th.—Supply of telephones and dials (schedule C. 401). (Reference B.X. 5 023.)

EGYPTIAN MINISTRY OF THE INTERIOR, March 27th.—Supply and installation of electric lighting system for the town of Fashn. (Reference B.X. 5 037.)

SOUTH AFRICAN POSTS AND TELEGRAPHS, March 28th.—Supply of telephone switchboard cords. (Tender No. 148), (Reference B.X. 5 048.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, April 2nd.—Supply of jumper rings and terminal strips (schedule C 405). (Reference B.X. 5 066.)

ARGENTINE MINISTRY OF PUBLIC WORKS, April 4th.—Supply of Diesel electric Titan crane. (Reference A.X. 7 583.)

VICTORIAN ELECTRICITY COMMISSION, April 8th.—Galvanised steel transmission line towers (specification 29/13). (Reference A.X. 7 401.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, April 9th.—Supply of induction voltage regulators, for Lake Coleridge scheme (section 215). (Reference B.X. 5 018.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, April 15th.—Conductor cords (No. P. and T., 151/1 319). (Reference B.X. 5 098.)

Tenders Accepted.

ADMIRALTY.—Edison Swan Electric Co., Ltd., lampholders and insulators.

LONDON COUNTY COUNCIL.—Edison Swan Electric Co., Ltd., insulating blocks.

TONBRIDGE URBAN DISTRICT COUNCIL.—English Electric Co., Ltd., switchgear for sub-station.

METROPOLITAN WATER BOARD.—W. T. Henley's Telegraph Works Co., Ltd., supply of copper wire, £170.

CHEADLE AND GATLEY URBAN DISTRICT COUNCIL.—Edison Swan Electric Co., Ltd., supply of gasfilled lamps.

RUGBY URBAN DISTRICT COUNCIL.—W. T. Henley's Telegraph Works Co., Ltd., cables for extensions, £331 16s.

WEYMOUTH CORPORATION.—English Electric Co., Ltd., supply of isolation panel for sub-station switchboards, £117 3s.

MAIDENHEAD GUARDIANS.—Maidenhead Radio Co., electric light installation at The Gables scattered home, £13 4s. 4d.

LONDON COUNTY COUNCIL.—Edison Swan Electric Co., Ltd., supply of push keys, punch case parts and electric lamps.

CAMBERWELL (LONDON) BOROUGH COUNCIL.—General Electric Co., Ltd., supply of electric lamps for 12 months. (Recommended.)

HALIFAX CORPORATION.—Gath Electrical Engineering Co., Ltd., electricians' work in connection with Moor End housing scheme (64 houses).

HORNSEY CORPORATION.—Synchronome Co., Ltd., installation of 27 electric clocks at town hall, £40, and rental of £16 6s. 6d. per annum.

SURREY COUNTY COUNCIL.—V. G. Middleton and Co., electric lighting work in connection with extensions at Brookwood Mental Hospital, £1 225.

LONDON COUNTY COUNCIL EDUCATION COMMITTEE.—Stegman and Co., electrical installation at Beaufoy Institute, Lambeth, £390. (Recommended.)

NEWBURY CORPORATION.—Hathorn Davey and Co., Ltd., electrically-driven pumping plant, to deal with storm water at sewage pumping station, £899 5s.

LANCASTER GUARDIANS.—E. W. Shepherdson, electric light installations at the institution, £645, the isolation hospital, £27, and the children's home, £99.

BRIDLINGTON.—S. Kilvington, electrical and other works in connection with alterations and additions to 83, 85 and 87, Hilderthorpe Road, for Mr. E. Wilson.

DONCASTER CORPORATION.—Callender's Cable and Construction Co., Ltd., extra high pressure cables, £106; Enfield Cable Works, Ltd., low pressure cables, £368.

CHELMSFORD CORPORATION.—Carter and Co., electric fire alarm system, £280; Post Office Engineering Department, wiring and maintenance of wiring for same.

GLOUCESTERSHIRE EDUCATION COMMITTEE.—Edwards and Armstrong, Ltd., electric light installation in meals room at Boys' Central School, Strand, Gloucester, £14 9s.

METROPOLITAN WATER BOARD.—Liverpool Patents Co., Ltd., electrically-driven "Trident" boiler scaling machine, with 1½ H.P. motor, etc., for Kempton Park Works, £65.

MEMBERS of the London Students' Section of the Institution of Electrical Engineers and their friends at the annual dinner at Les Gobelin's Restaurant, London, on Tuesday. The chair was taken by Mr. S. H. Hart, and in the absence, through illness, of Col. K. Edgcumbe, the guest of honour was Mr. P. V. Hunter. *A report of the speeches is given on page 299.*

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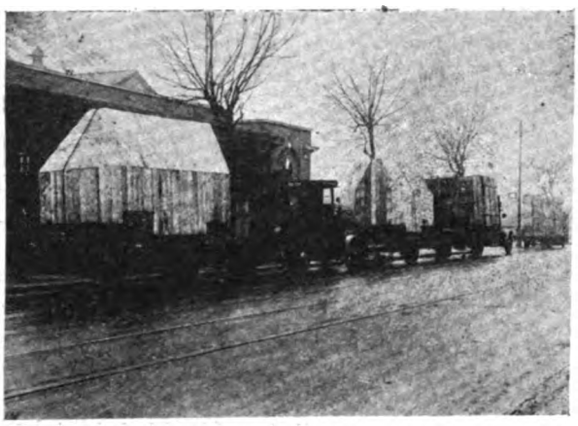
LEEDS GUARDIANS.—Crompton, Parkinson, Ltd., supply of nine electric motors, for the laundry at the Institution, including two 25 H.P., one 10 H.P., one 7 H.P., four 3 H.P., and one 6 H.P.

CHESTERFIELD CORPORATION.—Metropolitan-Vickers Electrical Co., Ltd., electric governing control gear, £168 6s.; English Electric Co., Ltd., spare armatures for turbo-condenser motors, £182.



WHAT are claimed to be the two largest searchlights in the world are here seen packed on Pickford's vans ready for shipment from the works of the London Electric Firm to a continental State, the total weight being 20 tons.

ILFORD CORPORATION.—A.F.A. Accumulators, Ltd., new cells for electric tower wagon battery, £147. British Insulated Cables Ltd., supply of trolley wire, 10½d. per lb. (Both recommended.)

ESSEX COUNTY COUNCIL.—Power Contracts, Ltd., electric wiring and installation of motors at Brentwood asylum, £9 674 5s.; Waygood-Otis, Ltd., two electric lifts at new county offices, Chelmsford, £1 379. (Both recommended.)

WESLEYAN CHAPEL, PWLLHELI.—Electrical Contracting Co,. electrical installatio., in connection with alterations and repairs, £30. Also tendered: B. W. Sprowell and Co., £25; West Wales Electric, Ltd., £29; National Electric Construction Co., Ltd., £35.

LONDON, MIDLAND AND SCOTTISH RAILWAY CO.—Siemens Electric Lamps and Supplies, Ltd., 12 months' supply of Siemens gasfilled and vacuum lamps; Metro-Vick Supplies, Ltd., 12 months' supply of Met-Vick carbon, metal filament, vacuum and gasfilled lamps.

BRENTFORD GUARDIANS.—Reliance Telephone Co., Ltd., intercommunication telephones, for Warkworth House, Toolands House, and West Middlesex Hospital, £1 115, plus £10 for two indoor and two outdoor extension bells; re-wiring wireless installation at the Hospital, £100, less 7½%.

BATTERSEA (LONDON) BOROUGH COUNCIL.—British Electric Transformer Co., Ltd., two 500 kVA transformers, £467; Bertram Thomas, supply of switchgear, £1,167 5s.; Metropolitan Vickers Electrical Co., Ltd., provision of earthing system at power station, £203 19s. 9d. (All recommended.)

STEPNEY (LONDON) BOROUGH COUNCIL.—Wm. White and Co., 12 months' supply of steel conduits, for wiring department, £567 8s. 8d. (recommended). Also tendered: Wholesale Fittings Co., Ltd., £572 6s. 3d., P. L. Dwyer and Co., £603 16s. 3d., General Electric Co., Ltd., £643 14s., Sloan Electrical Co., Ltd., £661 18s. 2d.

WIMBLEDON CORPORATION.—A. Reyrolle and Co., supply of e.h.t. switchgear, and extensions to existing switchboards, £2 921 10s. 6d.; English Electric Co., Ltd., supply of h.t. switchgear equipments, £1 258 12s. 6d.; George Ellison, supply of l.t. switchgear equipments, £2 064 17s. 6d.; Metropolitan-Vickers Electrical Co., Ltd., one 2 000 kVA 10 000/2 000 V transformer, £635.

SWINDON CORPORATION.—Griffin, Harding and Bryant, wiring installation at the new power station, Moredon, £2 018 16s. 1½d.; Carter and Co. (Nelson), Ltd., supply, erection, connecting, wiring, etc., on open circuit system, of a Carter-Micro street fire alarm system, £853 12s., plus additional cost of special leading in wiring, and a 2 H.P. syren for calling members of the fire brigade, £70.

CROYDON CORPORATION.—British Electric Transformer Co., Ltd., supply of the following transformers: 1 000 kVA Scott-connected, 6 300 to 2 100 V, £570; two 750 kVA Scott-connected, 6 300 to 460/230 V, £872; two 500 kVA Scott-connected, 6 300 to 2 100 V, £660; two 400 kVA Scott-connected, 6 300 to 460/230 V, or 400/200 V, £604. W. Lucy and Co., Ltd., 133 electric lamp standards, £1 097 5s.

BIRKENHEAD CORPORATION.—Switchgear: New Switchgear and Construction Co., Ltd., three h.t. sheet steel switchgear cubicles, £329 5s.; English Electric Co., Ltd., one 11 000 Volt truck-type cubicle, £156 2s. 3d.; Ferguson, Pailin, Ltd., one h.t. outgoing feeder switchgear cubicle, £100 4s. 6d. W. T. Glover and Co., Ltd., supply of cable, £1 952 10s.; English Electric Co., Ltd., two 100 kVA indoor type transformers, £163.

GLASGOW CORPORATION—R. J. M'Intyre, electrical installations at 318 houses on Hagill estate, £1 240 18s. 2d., and at 174 houses on Saracen estate, £715 12s.; A. Reyrolle and Co., Ltd., sub-station switchgear; Ferranti, Ltd., four 400 kVA transformers; Bruce Peebles and Co., Ltd., six 200 kVA transformers; Waygood-Otis, Ltd., passenger lift, £1 173; and A. and P. Steven, Ltd., goods lift, £411, at Glasgow Cross Buildings; British Insulated Cables, Ltd., copper bonds. (All recommended.)

STOKE-ON-TRENT CORPORATION.—Painter and Madew, electric light installation at Stoke police station, £95 13s.; Barnett and Soans, overhead wiring and services to 170 houses on Hanford estate, £476 19s. 9d.; Metropolitan-Vickers Electrical Co., Ltd., supply of sub-station switchgear for 12 months; Callender's Cable and Construction Co., Ltd., supply of cables and laying mains for 12 months. Supply of sub-station transformers for 12 months: British Thomson-Houston Co., Ptd., 200 kVA; Metropolitan-Vickers Electrical Co., Ltd., 800 kVA.

LONDON COUNTY COUNCIL.—Alex. Hawkins and Sons, electric lighting, cooking and heating installation in central (No. 1) block of dwellings on Ossulston Estate, St. Pancras, £1 739. Also tendered: C. Lindop and Son, Liverpool, £1 393 3s.; G. V. Francis, £1 794 3s.; Hall's Longitudinal Lighting Co., Ltd., £1 834 17s. 5d.; Electricity Services, Ltd., £1 960; A. V. Gifkins and Co., Ltd., £1 999; Alpha Manufacturing and Electrical Co., Ltd., £2 150; E. Dyne, £2 246 10s.; Eons Electrical Co., £2 347 19s.; Tredegars (1923)Ltd., £2 354 8s.; Harland and Wolff, Ltd., £2 357 13s. 6d.; W. Davey, £2 362; Engineering Works (Electrical and General) Ltd., £2 367; Joseph Vigor, £2 492 11s. 11d.; A. Higginbotham and Sons, £2 530; Aldwych Electrical, Ltd., £2 592 10s. 5d.; H. H. Bucklar, £2 701; E. Wight and Co., £2 857 17s. 2d.; Fred Hodgson and Co., Ltd., £2 879; J. Nicoll, £3 684 10s.; General Electrical Maintenance Co., £4 219. Chief engineer's estimate, £1 790.

THE NATIONAL REGISTER.

Nineteen Contractors Accepted for Registration at March Meeting.

AT a meeting of the Executive Committee of the National Register of Electrical Installation Contractors, held at the Institution of Electrical Engineers on March 1st, 33 applications by electrical installation contractors for admission to the Register were considered. It was decided that 19 of these applications be accepted, and that the remaining 14 be declined.

The names and addresses of the newly registered contractors are given below: Ainley, John R., 196A, Roundhay Road, Leeds; Aspin, James A., Keighley Road, Colne, Lancs; Brentwood District Electric Installations, Ltd., King's Road, Brentwood, Essex; Brown and Roberts, 2, Albert Street, Barnsley, Yorks; Chapman and Inman, Tennant Street, Stockton-on-Tees; Collins and Sharp, 123, Meanwood Road, Leeds; Engineering Works (Electrical and General), Ltd., 7 and 8, Great Winchester Street, London, E.C.2; Graham and Zebedee, 75, Donegal Street, Belfast; Gray, James, and Son (Ironmongers and Electricians), Ltd., 89, George Street, Edinburgh; Kay and Morris, 176, North Road, Preston; Leonard, Vincent, 36, Berry Street, Belfast; Lucas, A. W., and Co., St. Martin's Chambers, 12A, Bull Ring, Birmingham; Peat, Herbert, 4, Dodsworth Court, Briggate, Leeds; Pritchard, A., and Co., High Street, Lye, near Stourbridge; Ryan, Leo. R., 37, High Street, Marlow, Bucks; Smith, Harold C., 1, Banstead Terrace, Roundhay Road, Leeds; Taplin, H. C., and Sons, 27, South Front, Southampton; Yewdall, Harry, 573, Meanwood Road, Meanwood, Leeds; Young, N., Albany House, Amble, Northumberland.

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ELECTRICITY SUPPLY.

Extension of Electric Street Lighting in Battersea—Wallasey's Profitable Undertaking—Loan for Liverpool's New Station—Hampstead Pays Off All Loans—Additional Lines Between Blackpool and Preston.

CROYDON Electricity Committee is to extend mains at a cost of £1 042.

Barnstaple T.C. has decided to instal another 300 kW Diesel generating set in the spring of 1930.

Borrowing powers for £10 000 are being sought by Prestatyn U.D.C., for new meters and extensions to mains and services.

Lowestoft Works Committee recommends the expenditure of £648 per annum for the lighting of Normanston Drive by electricity.

The Derbyshire and Nottinghamshire Electric Power Co. is to erect overhead cable lines to supply electricity to Spondon and Hatton.

Winchester City Council has applied to the Ministry of Transport for consent to use overhead lines for the supply of electricity to Twyford and Compton.

Bromley (Kent) T.C. has entered into a new agreement for ten years with the West Kent Electric Co., Ltd., for a bulk supply. It is estimated that there will be an annual saving of from £1 700 to £2 000.

Wing R.D.C. has decided to approach Luton T.C. with the object of obtaining a supply of electricity for the Ivinghoe district from the h.t. line to be carried between Cheddington and Ivinghoe to Aylesbury.

West Ham T.C. has received sanction to a loan of £19 081, balance of an application for extensions, made up of buildings, £2 020; switchgear, £7 575; cooling towers, foundations, etc., £2 323; superstructures and pipework, £7 163.

Stepney (London) Electricity Committee recommends authorising the Borough Electrical Engineer to give effect to proposals for the wiring of the Calvert Buildings, Fulcher's Buildings, Allen House, and Plough Street Buildings.

Battersea (London) Electricity Committee has decided to substitute electric for gas lamps in further streets, at a cost of £1 468. Mains are to extend from Park Road, Battersea Bridge Road, to the premises of Hovis, Ltd., Anhalt Road.

Despite the fact that the assessment of Wallasey electricity undertaking has been increased from £3 000 to £10 000, it has been decided to place £10 000 to reserve, to allocate £5 000 to the relief of rates, and to reduce charges by ½d. per kWh.

Liverpool City Council is recommended to apply to the Electricity Commissioners for sanction to a loan of £1 767 644 for the acquisition of the Clarence Dock site and for the first stage of the erection and equipment of a capital generating station to contain two 50 000 kW alternators.

Hampstead (London) B.C. has decided to pay off all outstanding loans on the electricity supply undertaking, amounting to £32 310, out of accumulated surplus, thus leaving the undertaking free from debt as from March 31st. The prices charged for current are 3d. for lighting and ¾d. for power, heating and cooking.

During the frost, in the week ended February 17th, the electricity generated by Blackpool electricity department showed an increase of 36 per cent. compared with the average of the previous weeks. The maximum demand amounted to 13 290 kW, compared with 9 614 kW in the corresponding period of last year.

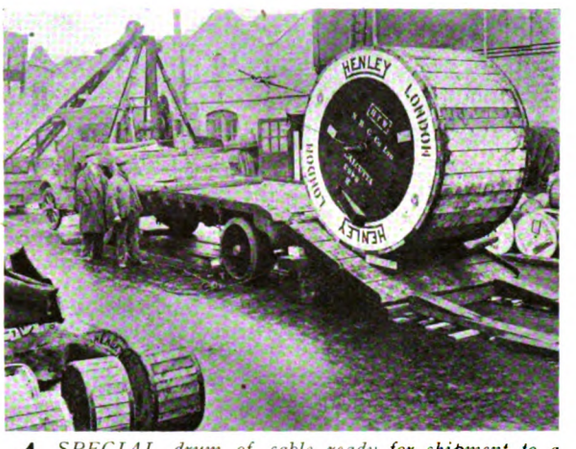
In the report on the Glasgow lighting department for the year ended May last it is stated that the total number of public lamps, gas and electric, had increased from 29 920 to 31 164. There was a reduction in the number of employees from 1 175 to 1 163, in consequence of the continued conversion of lighting from gas to electricity.

The estimate of cost of Hornsey Corporation's new sub-station in Oakfield Road amounts to £18 966. An amount is included for a balancer, and the borough electrical engineer (Mr. N. Staniland) is endeavouring to arrange with the Hewittic Electric Co. for a new type of single bulb rectifier, with change-over arrangements, to be made for the purpose.

Guildford Electricity Committee has decided to erect a transformer kiosk and lay cable at a cost of £2 082, to supply electricity to residents in the Shamley Green and Lords Hill districts.—The Central Electricity Board is in communication with the Electricity Committee regarding a bulk supply to the Hindhead and District Electric Co.—Mains are to be extended to supply residents in the Blackheath and Chilworth districts. The cost of the mains extension and a kiosk and transformer will be £2 872.

Barnsley Electricity Committee recommends that new distributing and public lighting mains be laid in the Pit Street West and Blenheim Road area, at an estimated cost of £432.—The Committee has received sanction to borrow £10 000 for hired wiring purposes.

Application is being made by the Preston Electricity Committee to the Electricity Commissioners for permission to borrow £23 000 for the erection of buildings, etc., in connection with the supply of electricity to Kirkham. Sanction has been given by the Commissioners to the borrowing of £42 000 for works in connection with the provision of additional main transmission lines between Blackpool and Preston.



A SPECIAL drum of cable ready for shipment to a colliery in India. As neither of the two winches at the colliery was suitable for this cable, W. T. Henley's Telegraph Works Co., Ltd., supplied an extra strong drum, fitted with boss plates and an accurately fitting spindle, so that the drum was actually used as a sinking drum. The cable was cleated at intervals of 20 to 25 ft. to the pump rising main, so that the actual vertical weight of cable supported by the drum at the surface was merely the weight of 20 to 25 ft. of cable.

Mr. C. H. Yeaman, city electrical engineer, has been authorised by Stoke-on-Trent Electricity Committee to negotiate for the purchase of a site for a static transformer sub-station, in connection with the change over of the supply in the Dresden area to three-phase a.c. An e.h.t. overhead line is to be erected from Greenbank Road sub-station to Fegg Hayes, for supply to the Fegg Hayes Mills, at a cost of £2 000.

The Central Electricity Board has informed Hastings T.C. of its intention to erect an overhead line from Stonestile Lane to Broomgrove power station, in connection with the South-Eastern scheme. There have been strong petitions from private residents against the proposal.—Electricity for power is to be supplied to Battle U.D.C. for three pumping stations, on an agreement for five years, with a guaranteed minimum of 40 000 kWh per annum, at 1d. per kWh, subject to an increase should it become necessary. The cable extensions will cost £1 160. The mains are also to be extended, at a cost of £1 045, to supply 28 houses at Batchelor's Bump.

The Electricity Commissioners have given formal sanction to the borrowing of £144 152 by Hull Corporation, without prejudice to the consideration of any application the Council may make for consent to change the system of supply to consumers, and on the understanding that any consents necessary to the appropriation of sub-station sites will be obtained.—The Tramways Committee has considered the question of the power station in Osborne Street, and agreement had been reached upon the technical and financial conditions of supply, but the terms quoted do not provide for the absorption by the electricity undertaking of any of the displaced staff of the tramway department. The Tramways Committee asks that the Electricity Committee definitely state its proposals relative to absorption, and that other Committees when making new appointments, consider the question of absorbing the displaced tramway staff.

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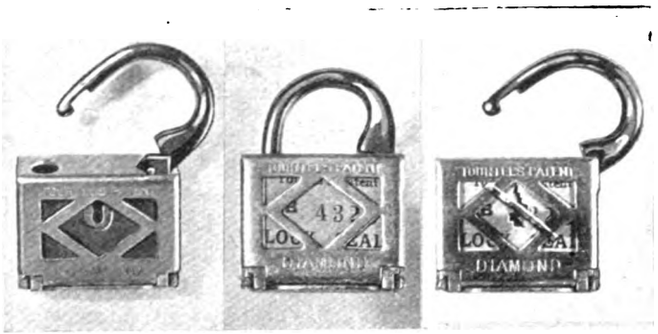
METER SEALING DEVICE.

WE have received from the TOURTEL MANUFACTURING CO., of 48, Uxbridge Road, Ealing, London, W.5, a sample of the "Diamond" type padlock for meter sealing. This lock is fitted with a hinged front which accommodates a numbered



Illustrating the meter sealing lock of the Tourtel Manufacturing Co., Ltd.

ticket covering the keyhole. Before the lock can be opened the key is required to pierce the paper ticket before it can be inserted for turning, thus indicating that the meter has been opened. Seals are available in five different colours, each seal of individual series carrying a different number. Our illustration of the unit shows on the left the lock ready for taking the seal, with the device locked and sealed in the centre; on the right the seal is broken with the key in position for opening the lock.

ELECTRIC TRACTION.

"Southern" Electrified Scheme over Sutton-Mitcham Line now Working.

ON Sunday, March 3rd, the last strip of the 875 miles of the Southern Railway system which have been undergoing conversion to electric traction was opened. Something like 14 000 additional seats have been provided by the introduction of new electric rolling stock; signalling systems have been improved; and stations have in many cases been extended. Further schemes for electrification are to be brought before the board very shortly.

London County Council Highways Committee has decided to take no further action in regard to heating the tramcars. Estimates have been prepared for an electrical system of heating, and this would involve a total initial expenditure of £56 000.

At a recent sitting of the Royal Commission on Transport, Mr. C. J. Spencer, chairman of the Tramways and Light Railways Association, said the road maintenance burden upon tramway owners had become very heavy since the advent of mechanically self-propelled road vehicles, and the road-bed, which was sufficient for rail-borne traffic, had proved inadequate to meet the added strain. In the five years, 1923 to 1927, privately owned tramway undertakings had spent over £2 000 000 on the repair and maintenance of permanent ways. In certain circumstances there was a great future for trackless trolley vehicles. It all depended on the character of the load. With a peak load they must have the largest capacity unit, and they could not have that without rails.

The conversion of one of the old-type escalators at Oxford Circus Underground station to a machine of the latest comb pattern was commenced last week. Its speed will be 100 ft. a minute compared with the present 90 ft. a minute. There are now five escalators at this station handling a daily traffic of 90 000 passengers. On the whole Underground system there are 83 escalators, of which 15 have been installed in the last twelve months.

Transport workers of the Underground companies started the New Year with an excellent batch of suggestions for improvements in the equipment and operation of the services. The number of suggestions received averages 500 a month. Those submitted in January were exceedingly good, and they included an improvement to facilitate the cleaning of steam pipes at the Chelsea power house (from a fitter), a magnetic locking device for oil pumps on the tube cars (from a fitter's mate), an electric clock to control automatically furnace doors at Chiswick overhaul works (from a fitter), improvement to omnibus driver's canopy and handle of destination sheet on single-decked vehicles (from a driver), and improvement to dash lights on trams (from a motorman).

WIRELESS NOTES.

National Radio Exhibition Poster Competition.

THE Radio Manufacturers' Association is again offering a prize of £50 for the best poster design advertising the National Radio Exhibition, 1929. In addition to the premier award, five other prizes are offered, viz., 2nd prize, £25; 3rd prize, £10; 4th, 5th and 6th prizes, £5 each.

The designs, which must be submitted by May 31st (finished rough, in colour), must be full size upright, double crown 30 in. by 20 in., and must be treated with a view to reproduction by lithography in not more than nine colours and reduction for use as poster stamps (2½ in. by 1½ in.). They should, of course, be applicable to radio, and should incorporate the following wording: "The National Radio Exhibition, Olympia (New Hall), September 23rd to October 3rd, 11 a.m. to 10 p.m. Admission 1s. 6d. daily (Tuesday, September 24th, up to 5 p.m. 2s. 6d.)." Sketches should be sent to the Secretary, The Radio Manufacturers' Association, Astor House, Aldwych, London, W.C.2.

Entries will be judged by a Committee appointed by the R.M.A. Prize winning and other selected sketches will be exhibited at the National Radio Exhibition.

It is officially reported that the Government of South Africa is withholding the licence to which the South African Wireless Telegraph Co. which works the "Beam" system in South Africa is entitled under the agreement of 1923, ratified by Parliament, provided the system is working at full efficiency. It appears that the Government proposes alterations which the company is unwilling to accept. No interruption of the service is anticipated.

It is reported that a company will shortly be formed under the name and style of the "Nederlandsch-Indische Radio-Omroep Mattschappij" (Netherlands Indian Broadcasting Company). The company will be established in Holland, and will be represented locally by two delegates. The capital required is f. 600 000, of which f. 300 000 have been promised by Messrs. Maintz and Co., Radio-Holland and the Philips group in equal shares. The main station will be built in the neighbourhood of Batavia; it is estimated that it will cost f. 400 000.

THE SOCIAL SIDE.

THE students of the Brush Electrical Engineering Co., Ltd., held their annual dance at the Town Hall, Loughborough, on February 22nd. About 120 guests attended, amongst whom were Mr. W. Johnstone, managing director, Mr. A. T. Brotherton, works director, and Mr. F. G. Healey, secretary. Mr. W. H. Cooke, chief electrical engineer, Luton Corporation, was also amongst those present. An enjoyable evening was spent, a feature being the attendance of a number of ex-students, who make this dance the occasion of an annual re-union.

The annual dinner and concert of Evershed's Social and Athletic Association was held on February 23rd, at the Clarendon Restaurant, Hammersmith. There was a good attendance under the chairmanship of Mr. Vines, president of the association. Following the dinner a very successful concert was enjoyed, with talent enlisted from the staff and works.

The committee of the Igranic Electric Company's Rugby Football Team is to be congratulated on a successful dance which was held on March 1st, at the Crofton Rooms, Bedford. Over 200 guests were present, and dancing continued until 2 a.m.

L. McMichael, Ltd., Slough, recently held their second annual dinner at the White Hart Hotel, Windsor. The seats of honour were occupied by Mr. and Mrs. L. McMichael. The dinner was followed by a dance.

The staff of the Rheostatic Co., Ltd., of Mackenzie Street, Slough, last month held a social evening, at which the managing director, Mr. L. Satchwell and Mrs. Satchwell, were present.

The staff of Messrs. James Scott and Co., electricians, Inglis Street, Dunfermline, held their annual staff dance last month.

The staff of J. H. Tucker and Co., Ltd., held a social evening on February 14th, when a dance was given at the Marshal Foch Hotel, Birmingham. The evening was thoroughly enjoyed by everyone, though it was regretted that the principals of the firm were unable to be in attendance due to indisposition in some cases and other engagements with others.

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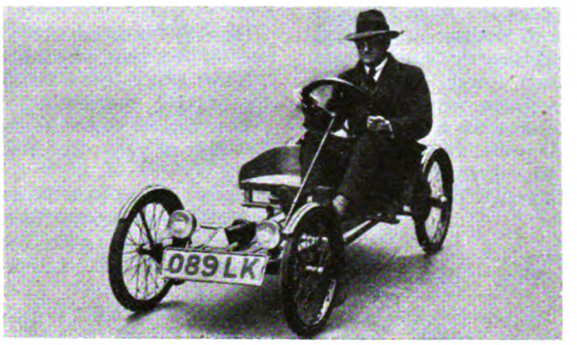
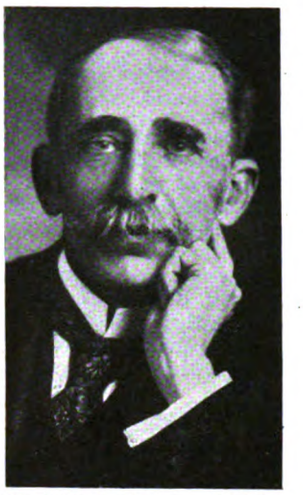
ELECTRICAL NEWS OF THE WEEK IN PICTURES.

Col. T. F. Purves, engineer-in-chief of the Post Office, whose name appears in the New Year Honours List on page 299.



Among the 'buses, cabs and other traffic of the London streets, there appeared last week this two-seater electric runabout. It is driven by a 16 V battery and is, we understand, capable of attaining a speed of 12 miles per hour.



Prof. J. A. Fleming, F.R.S., Emeritus Professor of Electrical Engineering, London, upon whom has been conferred a knighthood.

Members and guests of the Faraday House Old Students' Association and Faraday House Rugby Club, at the annual dance which was held at the Victoria Hall, London, on Tuesday.

Group taken on the occasion of the annual dinner of the Batti Wallahs' Society, at the Hotel Cecil, London, on March 1st, showing vice-presidents, together with those ladies present whose "millinery" won prizes for originality. "Admiral" H. L. Howard, the president-elect, is seen standing second from the left. Members of lower rank wore "flag" officers' caps, summer rig. Another photograph, showing the diners, is given on page 297.

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COMPANY NEWS.

Manufacturers' Shares Weaker—Enfield Cable, Proposed New Capital—Marconi International Co.'s Increased Receipts—Underground Railways Improved Position—Meeting of Electrical Distribution of Yorkshire, Ltd.

THE market for electrical shares has shown all round weakness since we last wrote. General Electrics have relapsed to the tune of 7s. 6d., and at the time of writing are quoted 57s. 6d. Callender's Cable, Siemens, and Electric Construction ordinary shares are each half a crown lower, and W. T. Henley's 1s. 3d. Ever Readies have given way a further shilling to 23s., and English Electric shares at a shade over 8s. are 7½d. down. Ferranti 7% 2nd prefs. have changed hands recently at a higher level of 21s. 3d. Eastern Telegraph Stock is a point or two weaker, and Marconi's Wireless shares have lost half a crown.

Last Annl. Divd.	Description.	This Week.	Last Week.	1926 to 1928. Highest	Lowest.
%	**Electricity Supply.**				
(*d*)	Brompton & Kensington Ord. ..	27/-	27/-	35/6	23/9
4	Central Elec. Sup. 4% Deb. ..	93	93	95½	88½
(*a*)	Charing Cross Elec. Ord. (£1) ..	26/6	26/6	51/-	24/3
4½	,, ,, ,, 4½% C.P. (£1)	17/6	17/6	18/3	16/6
(*e*)	Chelsea Elec. Sup. Ord.	27/-	27/-	45/3	24/-
10	City of Lond. Elec. L'ting Ord. ..	31/10½	31/10½	52/10½	26/-
6	,, ,, ,, ,, 6% C.P.	23/-	23/-	24/3	21/6
7½	County Lon. Elec. Sup. Ord. ..	52/-	52/-	68/6	25/9
6	,, ,, ,, ,, 6% C.P. ..	23/-	23/-	24/-	21/3
(*g*)	Kensington & K'bridge Ord. (£1)	27/-	27/-	27/6	23/9
(*b*)	Lon. Elec. Sup. Ord. (£1).. ..	27/6	27/6	37/6	23/-
9	Metro. Elec. Sup. Ord.	43/9	45/-	53/-	24/9
4½	,, ,, ,, 4½% C.P. ..	17/6	17/6	18/3	16/3
7½	N'castle & Dis. Elec. Ltg. Ord. ..	28/1½	28/1½	31/9	17/6
6	N'castle-upon-Tyne Elec.Sup.Ord.	26/3	26/3	30/3	19/3
6	N. Metro. Elec. 6% C.P.	23/-	23/-	23/9	20/10
6	Notting Hill 6% C.P. (£10) ..	10½	10½	11½	9½
(*c*)	St. James & P.M. Ord. (£1) ..	27/6	27/6	28/6	23/6
1/4½	Shrops.Worcs.&Staffs. Power B.Ord.	37/6	37/6	37/6	21/4
(*f*)	W'minster Elec. Sup.Ord. (£1) ..	27/-	27/-	52/9	24/-
4½	,, ,, ,, 4½% C.P. (£1)	17/6	17/6	17/10½	16/7½
8	Yorks. Elec. Power Ord.	36/-	36/-	38/9	24/6
6	,, ,, ,, 6% C.P. ..	24/-	24/-	26/9	20/7
	Railways and Tramways.				
8	Brit. Elec. Trac. Pfd.Ord. Stk ..	128	128	152	117
6	,, ,, ,, 6% Pf. Stk.	128½	128½	133	103½
4	Cent. Lon. Ry. Ord. Stk. (asstd.)	72	72	72	54
4	,, ,, ,, 4% Deb.	80	81	83	77½
4	City & S. Lon. 4% Perp. Deb. ..	79½	79½	81	76½
4	Lon. Elec. Rly. Cons. Ord. Stk. ..	75½	75½	75½	42½
4	,, ,, ,, ,, 4% Pf. Stk.	75	74	77	68
4	,, ,, ,, ,, 4% Deb. ..	80	80	83	70½
5	Lon. & Sub. Trac. A. Deb. ..	97½	97½	97½	74
4	Lon. Un. Trams, 1st Deb. ..	61	61	63	39
4½	Met. Elec. Trams,4½% Deb. ..	70	70	73½	62
5	,, ,, ,, 5% Deb. ..	69½	69½	70½	65½
3	Met. Rly. Cons. Ord. Stk. ..	63½	64½	81	54½
3½	,, ,, ,, 3½% Pf. Stk. ..	65	65	67	60½
3½	,, ,, ,, 3½% Deb. ..	71	71	73½	67½
4	Met. Dis. Rly. Ord. Stk.	80½	80½	77½	52½
4½	,, ,, ,, 4½% 1st Pref. ..	82½	82½	84	74½
6	,, ,, ,, 6% Perp. Deb. ..	116½	116½	118½	110
4	S. Met. Elec. Trams, 4% Deb. ..	70	70	70	64½
5	Underground Electric Rlys. Ord.	25/-	25/6	28/2	11/-
—	Yorks. (W.R.) Trams, Ord. ..	5/-	5/-	16/-	3/-
4½	,, ,, ,, 1st. Deb. ..	59	59	78	60
	Electrical Manufacturing.				
7	Brit. Elec. Transformer 7% C.P. ..	15/-	15/-	19/10	4/6
15	Brit. Insulated Cables Ord. ..	95/-	95/-	86/3	56/-
6	,, ,, ,, 6% C.P. ..	22/6	22/6	23/10	21/-
7	British Thomson-Houston Pref. ..	23/9	23/9	24/9	19/7
7	,, ,, ,, 7% Deb.	104½	104½	109½	102½
10	Brush Electrical Ord.	28/9	28/9	30/9	24/-
15	Callender's Cable Ord.	85/-	87/6	91/3	66/-
6½	,, ,, 6½% C.P. ..	25/-	25/-	25/9	22/-
7½	,, ,, 7½% B. Pref. ..	27/6	27/6	28/3	25/-
8	Crompton-Parkinson 8% Cum. Pf.	25/7½	25/7½	27/-	14/-
6	,, ,, 6% Cum. 2nd Pf.	19/-	19/-	19/6	9/7
7½	Edison Swan Elec. 1st Pref. ..	25/7½	25/7½	13/-	7/4½
5	,, ,, ,, 1st Deb. Stk.	86½	86½	92	81½
7½	Elec. Construction Ord.	21/3	23/9	32/6	23/6
7	,, ,, 7% C.P. ..	22/6	22/6	22/9	21/-
—	English Elec. Ord.	8/1½	8/9	15/9	5/-
6	,, ,, 6% C.P. ..	9/4½	9/4½	18/9	7/-
7	Ericsson Telephones 7% Pref. ..	18/9	18/9	22/7½	17/6
35	Ever Ready (Gt. Britain) Ord. ..	23/-	24/-	92/3	18/1
6	Ferranti 6% Pref.	18/-	19/-	19/4½	16/9
7	,, 7% 2nd Pref.	21/3	19/-	19/3	13/9
10	General Elec. Ord.	57/6	65/-	46/6	26/6
‡25	W. T. Henley's Ord.	120/-	121/3	120/-	69/3
12½	Johnson & Phillips Ord.	38/9	38/9	67/11	34/-
7½	Lon. Elec. Wire. & Smith's Pref ..	23/9	23/9	25/-	22/3
7½	Siemens Bros. & Co. Ord. ..	27/6	30/-	36/6	24/9
10	Telegraph Const. Ord. (£12) ..	25½	25½	30½	20
	Telegraph.				
3½	Anglo-Am. Tele. Ord. Stk. ..	61½	61½	63½	56½
10	Eastern Ord. Stk.	261½	265½	273	135
3½	,, 3½% Pref. Stk.	68½	68½	70½	59
4	,, 4% Deb.	79½	79½	81½	74
10	Eastern Extension Ord. (£10) ..	25½	26⅜	27½	14
22	Gt. Northern Telegraph (£10) ..	32½	33	43½	26
10	Indo-European (£25)	55½	55½	48½	30
20	Marconi's Wireless T. Ord. ..	78/9	81/3	84/4	12/-
12½	,, Int. Mar.	68/9	72/6	90/-	16/6
10	Western Tel. Ord. (£1)	25⅜	26⅜	27½	12½

(*a*) 1s. 7 $\frac{8}{11}$d. per share. (*b*) £8 8s. 6.66d. per cent. (*c*) 1s. 6.949d. per share.
(*d*) 1s. 8.706d. per share. (*e*) 1s. 9.3d. (*f*) 1s. 0.912d. (*g*) 1s. 7.223d.
‡ Including 1s. bonus.

CLAUD HAMILTON, LTD.—Div. for year 5%, less tax. Fwd. £6 441.

HURST, NELSON AND CO., LTD.—Intm. div. of 7½%, less tax, on ord. shs., payable on May 15.

NEWCASTLE-UPON-TYNE ELECTRIC SUPPLY CO., LTD.—Fin. div. of 3½%, making 6% for year, is proposed.

TELEGRAPH CONSTRUCTION AND MAINTENANCE CO., LTD.—Fin. div. of 7½%, tax free, for 1928, makg. 10% (same as last year).

ATLAS LIGHT AND POWER CO., LTD.—This co. has passed a resolutn. providg. for the sale of all its holdgs. in electric supply and tractn. cos. to the American Foreign Power Co., Inc.

INTERNATIONAL LIGHTING ASSOCIATION, LTD.—Pft. for 1928, £1 270, agst. £1 077. After paying pref. div. and directors' fees, blce. is £281, transferred to special res. for div. on pref. shs.

ENGLISH ELECTRIC CO., LTD.—Directors announce that financial results of past year did not admit of paymt. of div. on pref. shs.

TOTTENHAM AND DISTRICT GAS CO.—Net rev. for 1928, £122 014, includg. £16 254 from electricity. Divs. for half-year to Dec., 1928, at rates of 5½% p.a. and 5% p.a. on pref. stks. and £6 12s. 6d. p.a. on ord. stk.

LAUNCESTON AND DISTRICT ELECTRIC SUPPLY CO., LTD.—Rev. for 1928, £5 217, agst. £5 022; gross pft. £2 623; net pft. £1 326, plus £1 726 brt. in. To res. £600; depreciatn. £800; ord. div. for year 8%, tax free. Fwd. £1 141.

LONDON AND SUBURBAN TRACTION CO., LTD.—Divs. and int. on investmts. and loans and sundry pfts. for 1928, amt. to £55 381, increase £4 922, exes. £45 240, increase £1 007, leavg. £10 141, plus £25 996 brt. in, makg. £36 137, increase £10 141, which is carried fwd.

NORTHALLERTON ELECTRIC LIGHT AND POWER CO., LTD.—Pft. for 1928, £69 183, agst. £71 858, plus £3 209 income from investmts. To gen. res. £8 000, agst. £9 849; to benevolent fund £2 000, agst. £1 000. Fin. div. 5%, makg. 9% (same as last year); fwd. £9 690, agst. £9 910.

LIVERPOOL OVERHEAD RAILWAY CO.—Gross rev. for 1928, £97 493, workg. exes., includg. appropriatn. to res. funds. £79 610, surplus on year's workg., £17 883. Int. on deb. stk, £6 755, leaving blce. £11 127, plus £534 brt. in. Div. 5% on pref. shs. for year, payable March 14. Fwd. £3 730.

ENFIELD CABLE WORKS, LTD.—Pft. for 18 months ended Dec. 31, 1928, £142 000. Fin. div. 10%, makg. 30%. A mtg. will be held on March 20 to consider resolutns. authorisg. creatn. of 350 000 additional ord. shs. of £1 each. Directors will propose to issue 100 000 of these to existg. sh. holdrs. at 40s. per share in proportn. of two for every five held.

YORKTOWN (CAMBERLEY) AND DISTRICT GAS AND ELECTRICITY CO.—Gross pft. for 1928, £13 181. After providg. for deb. and other int., divs. on pref. shs. and stk. and intm. div. for half-year to June, 1928, blce. is £13 134. Divs. recommended at rate of 12½% p.a. on original shs., and 8¾% p.a. on additional shs., including intm. div. already paid, both less tax. Fwd. £10 421.

MARCONI INTERNATIONAL MARINE COMMUNICATION CO., LTD.—Gross rev. and receipts for 1928, £905 816, compared with £912 640. Net pft. £193 420, agst. £179 730. Investmts., £514 561, showed a decrease of £99 943, and this is mainly offset by an increase of shrs. in a foreign associated co. Intm. div. 7½% was paid on Oct. 17, 1928, and directors recommend fin. div. of 7½% for year 1928. Fwd. £36 689, increase £13 011.

UNDERGROUND ELECTRIC RAILWAYS CO. OF LONDON, LTD.—Rept. for 1928 shows increases of £160 170 in investmt. income and £28 782 in miscellaneous receipts, total rev. being £188 952 higher at £1 153 798. Expenditure was reduced by £11 724, to £68 277, net receipts £200 676 greater at £1 085 521. Int. on 4½% and 6% income bonds £303 496, agst. £427 279; int. on 5% deb. stk. £74 253, increase £74 253; and int. on 6% 1st cum. income deb. stk. £76 380. Fin. div. 4% on ord. shs. makg. 7% for year, compared with 5%. Fwd. £262 504, agst. £169 761.

KOLSTER-BRANDES, LTD.—This co., on Monday, invited subscriptns. for an issue of 350 000 ord. shs. at par. The co., which was incorporated on Feb. 26, 1929, to manufacture and sell apparatus and equipmt. used in connectn.

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with radio, gramophone and kindred industries, has acquired the exclusive right to exploit, in the British Isles, in all British colonies and possessions, except Canada, Australia and New Zealand, and in the whole of Europe, all inventions belonging to the Kolster Radio Corporation. The co. has also acquired the entire undertakg. of Brandes, Ltd., which was incorporated in England in 1924.

KENSINGTON AND KNIGHTSBRIDGE ELECTRIC LIGHTING CO., LTD.—Net pft. for 1928, £33 569, plus £15 513. Intm. divs. paid during year at rate of 3% on 1st pref. shs. in respect of 6 mths. to June 30, at rate of 3½% on 2nd pref. shs. in respect of 9 mths. to Sept. 30, and at rate of 9d. per sh. on ord. shs. Directors propose blce. div. on 1st pref. shs., in respect of 6 mths. to Dec. 31 at rate of 3%, accrued div. on 2nd pref. shs. in respect of 3 mths. to December 31 at rate of 1¾%, makg. 5% for year, and blce. div. on ord. shs. at rate of 10·181d. p. sh., makg. standard div. for year of 1s. 7·1811d. p. sh. To special res.-ord. shhldrs. benefit under sliding scale for 1926, 1927 and 1928, £7 544. Fwd. £10 664.

GENERAL ELECTRIC CO., LTD.—An extraordinary gen. mtg. will be held on March 13 to consider and if thought fit, to pass resolutions that the capital of the company be increased to £7 600 000 by the creatn. of 1 600 000 new shs. of £1 ea.; that the new shares be called "British ord. shs" and that they be issued only subject to the conditn. that they shall not be registered in the name of or transferable to or held on behalf of any foreigner, foreign corporation, or corporation under foreign control as defined by the articles of association of the co. for the time being but that in all other respects (including participatn. in profits and surplus assets of the co. and voting rights) they rank equally with the existing ord. shs.; and that the articles of associatn. be altered accordingly.

YORKSHIRE CO.'S MEETING.

Large Increase of Consumers—Effect of National Schemes upon Charges.

THE 25th ordinary general meeting of Electrical Distribution of Yorkshire, Ltd., was held in Leeds on Tuesday, March 5th. The chairman, Mr. R. W. Wickham, said: We have again increased our list of consumers by a large number. It is interesting to know that we have actually made 15 248 new connections in the last two years.

We recently made an application for powers to supply in part of the rural district of Worksop in the county of Nottingham. The Order has been made by the Electricity Commissioners, and when it has been confirmed by Parliament the company's area of supply will be increased to 1 197 square miles, with a population of 744 000.

Our extensions are being made partly by underground and partly by overhead mains, and I want to say a word about the latter. A lot of letters have been written and protests made about the use of overhead mains in rural districts, and demands have been put forward that, although it will cost more, mains should be laid underground wherever there is a likelihoood that overhead mains would interfere with the amenities of the district. In our own area there is an average population of less than one person to the acre, and the length of mains for each consumer is proportionately greater than in urban and more densely-populated areas. To justify development, financial considerations cannot be overlooked, and to provide supply in such sparsely-populated districts it is necessary to proceed by that method which entails the least capital expenditure. The problem is not so simple as it is assumed to be. It is frequently not a choice between underground and overhead mains, but between overhead mains and no mains at all.

The scheme of the Electricity Commissioners for Mid-East England has recently been issued by the Central Electricity Board. Much has appeared in the Press about the low costs of generation under the various schemes, and there is a tendency to assume that the costs of generation which have been quoted are the prices at which electricity can be sold to the consumer. Generation is not all: the costs of distribution also must be met, and when electricity is supplied in small quantities to users spread over a thinly-populated area it cannot be expected that great reductions for small users will result because of reductions in the cost of generation.

The directors' report and accounts were adopted, and the dividend at the rate of 9%, less tax (of which 4½% was paid in August last) was approved.

COMMERCIAL INFORMATION

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debt. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

ELECTRICAL INSTALLATION CO., 25, St. Mary's Road, Moseley, electrical engineers. £16 7s. December 19th.

GOWING, John Fowler, 209, Leeds Road, Huddersfield, radio contractor. £25 13s. 6d. January 17th.

MASTERMAN AND CO., LTD., R/O, Sykes Street, Castleford, electrical contractors. £13 16s. 6d. January 17th.

PARKER BROS., 135, School Road, Moseley, electricians. £22 13s. 5d. January 23rd.

ROBERTS, T., 125, Commercial Street, Batley, wireless dealer, £14 11s. 1d. January 17th.

THOMAS, H. C., Belle Vue, Tenby, radio engineer. £25 2s. 5d. December 14th.

YELDON, Gerald, 20, New Road, Portsmouth, wireless dealer. £11 14s. January 1st.

ZONE WIRELESS CO., LTD., 167, Oxford Street, W. £11 6s. 4d. January 21st.

Mortgages.

[NOTE.—*The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—allowed by the date of the Summary, but such total may have been reduced.*]

HAMBLING CLAPP AND CO., LTD., London, W.C., wireless manufacturers. Registered January 28th, £1,700 debenture, to W. H. Sayers, 14, Rectory Road, Beckenham; general charge. *Nil. August 12th, 1927.

LANCASHIRE TELEPHONE SYSTEMS, LTD., Manchester. Registered February 13th, series of £4,000 debentures, present issue £550; general charge. *—, January 4th, 1929.

LONDON POWER CO., LTD.—Registered February 8th, supplemental trust deed dated February 4th, 1929, securing £3 000 000; general charge. *£10 928 400. March 2nd, 1928.

PRECISION RADIO AND MANUFACTURING CO., LTD., Woking. Registered January 31st, £300 debenture, to W. C. Powers, 56, Fleet Street, E.C., paper merchant; *general charge.

REASON MANUFACTURING CO., LTD., electrical manufacturers.—Registered February 6th, mortgage to bank charged on property in Lewes Road, Brighton, etc. *£11 000. December 27th, 1927.

TRE-COIL WORKS, LTD., London, E.C., electrical engineers.—Registered February 7th, £400 debenture to Semi Freudenberger, 79, Chatsworth Road, Brondesbury; general charge.

Satisfactions.

FOOTS CRAY ELECTRICITY SUPPLY CO., LTD., London, E.C.—Satisfaction registered February 8th, £3 800 and 5% premium, registered October 20th, 1909, to January 6th, 1914.

KESWICK ELECTRIC LIGHT CO., LTD.—Satisfaction registered January 29th, £550, part of amount registered July 1st, 1901.

QUEENSWAY, LTD., London, W.C., electric light engineers,—Satisfaction registered February 8th, £300, registered May 15th, 1928.

RADIO SERVICE (LONDON), LTD.—Satisfaction registered February 13th, part of amount registered July 26th, 1927.

RANGOON ELECTRIC TRAMWAY AND SUPPLY CO., LTD., London, E.C.—Satisfaction registered February 12th, £11 042, part of amounts registered February 15th, 1906, December 31st, 1908, November 18th, 1913, and March 10th, 1924.

SOUTH LONDON ELECTRIC SUPPLY CORPORATION, LTD.—Satisfaction registered January 29th, £130,000, registered February 18th, 1909.

Private Meetings, etc.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

EPOCH ELECTRICAL SOCIETY, LTD., late Gracechurch Street and Cannon Street, London, E.C., and at Manchester.—The statutory meeting of the creditors in this voluntary winding up was held on February 28th, at the offices of Linett, Hughes and Co., accountants and auditors, 24/25, Ironmonger Lane, E.C. Mr. G. Hughes, the liquidator of the company, occupied the chair, and submitted a statement of affairs which showed ranking liabilities of £2 059. The assets consisted of cash in hand and at bank £73;

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book debts £267, estimated to realise £166; stock £450, valued at £150; furniture and fittings at cost £164, expected to produce £39; deposits £65, valued at £40; making a total of £470. After allowing £147 for preferential claims, the net assets were £323, or a deficiency of £1 736. The landlord had distrained prior to the liquidation and the stock had been seized. It had been offered for sale by public auction, and it was estimated that it would realise £150 to £170. The company was registered September, 1927, with a nominal capital of £1 000 and the whole of the shares were issued for cash. The company started an entirely new business, and between September 6th, 1927, and February 9th last, the turnover was £9 871, with a gross profit of £1 765. The expenses in the same period were £3 775, including salaries of £1 706, and there was a net loss of approximately £2 000. No directors' fees had ever been paid. Asked how the present position had arisen, the Chairman said he was given to understand that the company was forced to vacate its premises at an unfortunate moment, the Christmas trade being interfered with. A certain amount of price cutting had possibly taken place; when a man entered a shop to purchase a wireless set, he invariably asked for a discount, and, practically speaking, no purchaser paid the full amount. A resolution was passed confirming the voluntary liquidation of the company, with Mr. Hughes as liquidator, and an advisory committee was appointed, consisting of Messrs. C. Latham, of the Wireless and Radio Trades Guardian Association, A. Ball (Marconiphone Co., Ltd.), and R. A. Bishop (C. D. Dickeson and Sons, Ltd.). The following are creditors:—Marconiphone Co., Ltd., £142; Rolls-Caydon Sales, Ltd., £126; Phillips Lamps, Ltd., £111; Sun Electrical Co., Ltd., £105; Dickeson, C. D., and Sons, Ltd., £96; Harris and Russell, Ltd., £87.

GREENWOOD (A. I.), LTD., Guildford Street, Leeds, electrical engineers, etc. At the statutory meeting of the creditors in this voluntary winding up, the liquidator (Mr. B. Armitage) submitted a statement of affairs which showed assets estimated to realise £3 692, less £198 preferential claims, leaving a balance of £3 494 to meet debentures of £5 000, and nothing available for the unsecured creditors, whose claims aggregated £2 280. The company was registered in March, 1926, and took over the business as from the previous November. The widow of the late proprietor was allotted as purchase consideration the whole of the £6 000 shares and debentures for £5 000. During the period to September, 1926, the turnover was £3 595, with a net loss of £2 140, and in the following year there was a net loss of £2 063, on sales of £27 795. During the year to September 30th, the sales were £19 350, with a net loss of £2 433. Since September 30th last the sales had been £4 336, with a net loss of £1 176.

RUTHERFORD, Albert, electrician, Plowman's Yard, Finchley, N.W. A meeting of the creditors was held on February 27th, when a statement of affairs was presented by Hereward Scott and Co., C.A., 133, High Street, N.16, which disclosed liabilities of £735 (trade creditors £661), and net assets expected to realise £177, from which had to be deducted preferential claims of £169, or a deficiency of £566. The debtor's solicitor stated that the business was commenced just after the war, but he could not say what capital was put into it. The present position had been brought about by the debtor recently incurring a bad debt of £143. That item had been included in the list of sundry debtors and had been written off in the usual way. The accountant stated that it was impossible to prepare any proper trading accounts as the debtor's books had not been fully written up, and the time at his disposal had not enabled him to complete any investigations. An account prepared as at June 30th, 1928, showed that the stock at cost was £259, whilst there were debtors of £259. The liabilities to trade creditors at that time were £692. In reply to questions, the accountant reported that there was no offer to put before the meeting. It was decided that Mr. W. A. J. Osborne, of Corfield and Cripwell, should be appointed to investigate the matter and report to a further meeting of creditors.

London Gazette, etc.

Bankruptcy Information.

HALL, Sidney, trading as E. GREEN and CO., 13, Caledonian Road, Leeds, and 30, Leighton Lane, Leeds, electric lamp dealer. Receiving order, February 27th. Creditor's petition.

HORSFALL, Robinson, trading as HARRISON AND HORSFALL, Midland Street, Barnsley, electrical engineer. Receiving order, February 28th. Debtor's petition.

TRUSS, Thomas Frederick John, 28, Wincobank Avenue, Sheffield, electrical engineer. Receiving order, February 26th, creditor's petition.

WHEELER, Thomas Charles, 6, South Scarborough Street, West Hartlepool, Durham, electrician. Receiving order, February 25th, debtor's petition.

Bankruptcy Proceedings.

JACQUES, Roysentul, electrical engineer, 45, Woodbury Grove, Finsbury Park, London. When this debtor's name was called on the day appointed for his public examination in the London Bankruptcy Court, he failed to answer to his name, and no statement of affairs had been filed. The official receiver said that the receiving order was made on December 17 and the debtor had not surrendered to the proceedings. He had no knowledge of his whereabouts beyond the fact that he might possibly be abroad. Both the bankruptcy notice and the bankruptcy petition were served by substituted service and in these circumstances he applied for an adjournment of the public examination *sine die*, which was granted.

MULTIRAY WIRES AND ALLOYS, LTD. In this compulsory liquidation the statement of affairs shows liabilities £1 122, of which £1 103 are expected to rank, and assets £14 net, a total deficiency of £3 089 being disclosed with regard to the shareholders. The company was registered in March, 1927, with a nominal capital of £2 000 in £1 shares to take over from Thomas Brown his formula for the manufacture of nickel chrome alloy billets to be drawn into wire for use in the construction of electrical apparatus, as founders. According to the promoter, Eric Pickard, it was not the intention of the company to manufacture the wire, but to manufacture the billets and place out at contract the drawing of the billets into wire. To this end and in order to procure capital for the manufacture of the billets and the execution of other orders in foundry metal which the company might obtain, he negotiated with a Swiss metal company, but since the Multiray company was unable to demonstrate the drawing of the billets into wire such negotiations came to an end as did negotiations in other directions. As a result of an apparent misunderstanding between Pickard and Brown the company has from its inception carried on business with insufficient capital. During the negotiations with the Swiss company and afterwards the company carried on business in the manufacture and sale of castings, etc., in nickel chrome alloy and also experimented with a product in stainless iron. Some extremely good orders seem to have been obtained, but the company did not possess the capital to execute them profitably and to develop the business. An overdraft guaranteed by the directors was obtained from the bank and one of the directors advanced small sums from time to time to enable wages to be paid. A net loss of £1 019 is shown in the books of account in the carrying on of the business. Shortly before the presentation of the petition to wind up the company various judgment creditors levied execution on its effects, and on the seizure and sale the company's business came to a standstill. The failure and insolvency of the company are attributed by Pickard to the shortage of working capital occasioned by the failure of the expected arrangement with the Swiss company, the fulfilment of which was calculated to provide the company with ample capital and the source of considerable profit in the sale of the wire. In the opinion of the Official Receiver the failure is attributable to mismanagement on the part of the directors in that the working capital provided was totally inadequate, with the result that the company which was formed to acquire and place on the market a commodity manufactured from a patent formula had been handicapped throughout by a shortage of working capital.

METAL AND CHEMICAL PRICES.

TUESDAY, March 5th.

		Price.	Inc.	Dec.
Copper—				
Best Selected ..	per ton	£88 0 0	£5 15 0	—
Electro Wirebars	,,	£91 10 0	£7 0 0	—
H.C. Wires, basis	per lb.	1s. 0 7/16d.	1/16d.	—
Sheet	,,	1s. 0 1/4d.	1/8d.	—
Phosphor Bronze—				
Wire (Telephone) basis	per lb.	1s. 3 7/16d.	1/16d.	—
Brass 60/40—				
Rod, basis ..	per lb.	9d.	1/2d.	—
Sheet ,, ..	,,	11 1/4d.	1/4d.	—
Wire ,, ..	,,	11 3/8d.	1/4d.	—
Pig Iron—				
Cleveland Warrants	per ton	£3 9 6	—	—
Galvanised Steel Wire, basis 8.S.W.G. ..	,,	£14 15 0	—	—
Lead Pig—				
English	per ton	£25 0 0	5s. 0d.	—
Foreign or Colonial	,,	£23 12 6	2s. 6d.	—
Tin—				
Ingot	per ton	£219 17 6	—	£1 17 6
Wire, basis ..	per lb.	2s. 10 1/4d.	—	1/4d.
Aluminium Ingots	per ton	£95 0 0	—	—
Spelter	,,	£26 7 6	2s. 6d.	—
Mercury	per bottle	£22 5 0	—	—

Sulphur—Flowers, Ton £12 0 0 *Sulphuric Acid*—
,, Roll ,, £10 10 0 (Pyrites, 168°) Ton £6 15 0
Copper Sulphate ,, £25 to £25 10 0 *Sodium Chlorate* per lb. 2 1/4d.
Boric Acid (Crystals),, £30 0 0 *Sodium Bichromate* ,, 3 1/4d.
Rubber—Para fine, 1s. 1 1/4d.; plantation, 1st latex, 1s. 0 7/8d.

The metal prices are supplied by British Insulated Cables Ltd.

THE LEAD MARKET.

A more hesitating tone was noticeable in the market last week, and according to James Forster and Co., after opening 5s. lower on Monday prices slowly recovered 7s. 6d., when an easier tone was again in evidence. The raising of the American quotation 15 points to 7.10 cents on Wednesday gave a small fillip to prices in London the next day.

Closing prices on March 1st were £23 15s. for March and April, and £23 16s. 3d. for May and June, 2s. 6d. and 1s. 3d. higher on the week.

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EXPIRING PATENTS.

BELOW is a list of patents of interest to electrical engineers which, unless extended, will expire during 1929 :—

No.	Date (1913)	Name of Patentee.	Subject of Patent.
212	Jan. 3 ..	Turner	Casings for electrical switches.
818	Jan. 10 ..	Siemens Bros. & Co., and Pettigrew	Selecting devices for telephone circuits.
882	Jan. 11 ..	Lawson	Electricity meters.
1 182	Jan. 11 ..	British Thomson-Houston Co. (G.E. Co., U.S.)	Centrifugal air compressors.
1 600	Jan. 20 ..	British Thomson-Houston Co. and Young	Electric measuring instruments.
1 855	Jan. 22 ..	British Thomson-Houston Co. and Young	Electric measuring instruments.
1 902	Jan. 23 ..	Western Electric Co. (Western Electric Co., Belgium)	Telephone exchange systems.
1 915	Jan. 23 ..	British Thomson-Houston Co. (G.E. Co., U.S.)	Manufacture of tungsten.
2 901	Feb. 4 ..	British Thomson-Houston Co. (G.E. Co., U.S.)	Incandescent lamps.
3 271	Feb. 7 ..	British Thomson-Houston Co. (G.E. Co., U.S.)	Manufacture of material suitable for electrical insulation, etc.
3 566	Feb. 11 ..	British Thomson-Houston Co. (G.E. Co., U.S.)	Manufacture of a material suitable for electrical insulation.
4 091	Feb. 17 ..	Helm	Winding coils.
4 618	Feb. 24 ..	Western Electric Co., Ltd. (Western Electric Co. U.S.)	Selective signalling systems.
4 862	Feb. 26 ..	Gambrell	Resistance boxes, Wheatstone bridges, switches, contact makers, breakers, etc.
4 869	Feb. 26 ..	Cooper and Barlow ..	Controller for electric lifts and hoists.
5 295	March 3 ..	Marks (Landers, Frary and Clark, U.S.)	Electrically heated apparatus.
5 481	March 5 ..	Thomson (Ateliers de Constructions Electriques de Charleroi, Belgium)	Starting groups of electrical machines
6 285	March 13..	British Thomson-Houston Co. (Cie Francaise Thomson-Houston, France)	Regulation of electrical machines.
6 376	March 14..	British Thomson-Houston Co. (G.E. Co., U.S.)	Centrifugal compressors.
6 982	March 22..	Quilliam	Scaling means for boxes containing electric point controllers, switches, etc.
7 128	March 25..	Siemens Bros. and Co., and Pettigrew	Circuit arrangement for telephone exchanges with selecting devices.
7 311	March 27..	Smith and Garnett ..	Manufacture of electric cables.
7 994	April 5 ..	Chadburn's (Ship) Telegraph Co., and Howie	Speed indicating apparatus.
8 417	April 9 ..	British Thomson-Houston Co. (G.E. Co., U.S.)	Manufacture of a material suitable for electrical insulation.
8 746	April 14 ..	Irving, and British Pneumatic Railway Co.	Electro-pneumatic systems and apparatus for railway signalling.
8 821	April 15 ..	Thompson (Ges. für Drahtlose Telegraphie m.b.H., Germany)	Receiving arrangement for use in wireless telegraphy and telephony.
9 166	April 18 ..	Siemens Bros. and Co., and Christian	Observation circuits of telephone systems.
9 278	April 19 ..	Earl	Regulation of electrical installations.
10 841	May 8 ..	Railing and Garrard ..	Operating rotary converters and other a.c. machinery.
10 918	May 8 ..	British Thomson-Houston Co.	Improvements in incandescent electric lamps.
10 919	May 8 ..	British Thomson-Houston Co. and Taylor	Winding for electrical machines.
11 274	May 14 ..	Greville	Regulating electric currents passed through the human body or through electric lamps.
11 503	May 17 ..	Kelvin and James White, Field and Renfrew	Mariners' compasses.
11 623	May 19 ..	Irving and O'Donnell ..	Electrically-operated or controlled valve.
11 888	May 21 ..	Baron (Georg Hiemann, Germany)	Automatic or semi-automatic graded service telephone system.
12 162	May 24 ..	Automatic Telephone Manufacturing Co. (Automatic Electric Co., U.S.)	Telephone systems.
12 424	May 28 ..	Western Electric Co. (Franklin Tuthill Woodward, U.S.)	Machine telephone switching systems.
12 566	May 29 ..	Siemens Bros. and Co. (Siemens and Halske A.G. Germany)	Circuit arrangements for telephone systems.
13 315	June 9 ..	Otis Elevator Co. (Otis Elevator Ges. m.b.H., Germany)	Alternating current electromagnets.
13 636	June 12 ..	Marconi's Wireless Telegraph Co. and Franklin	Receivers for use in wireless telegraphy and telephony.
14 310	June 20 ..	Childs, and Reason Manufacturing Co.	Electrolytic meters.
14 423	June 21 ..	Helzelberger, and New British Ever Ready Co.	Electric lamps.
14 614	June 24 ..	Siemens Bros. and Co., and Petithory	Number dial for automatic and semi-automatic telephone.
14 796	June 26 ..	British Thomson-Houston Co. (G.E. Co., U.S.)	Motor control systems.
14 816	June 27 ..	Conner and Kahl	Electric switches.
14 892	June 27..	British Thomson-Houston Co. (G.E. Co., U.S.)	Vacuum tubes.
15 348	July 3 ..	Bey	Electrically illuminated letters.
15 579	July 5 ..	Reeves and Lundell ..	Automatic telephone exchanges.
15 636	July 7 ..	Ford	Magnetos.
15 875	July 9 ..	Ateliers de Constructions Electriques de Charleroi	Arrangements for starting groups of electrical machines.
16 040	July 11 ..	Berry	Electric heating.
16 048	July 11 ..	Faerber	Incandescent electric safety lamps.
16 208	July 14 ..	Mond (Maschinenfabrik Oerlikon, Switzerland)	Controllers for electrical apparatus.
16 428	July 17 ..	Campbell	Electro-motors for portable drilling machines.
16 753	July 21 ..	H. Aron Electricitatszahlerfabrik, g.m.b.H.	Electric meters.
17 899	Aug. 6 ..	Hirst and Brook	Switchgear.
18 018	Aug. 7 ..	Western Electric Co. (Franklin Tuthill Woodward, Belgium)	Telephone transmission systems.
18 765	Aug. 18 ..	Fessenden	Oscillatory electrodynamic apparatus for submarine signalling, etc.
18 841	Aug. 19 ..	Morcam	Applying coatings or deposits to surfaces.
19 109	Aug. 22 ..	Hancock and David ..	Plates for secondary batteries.
19 733	Sept. 1 ..	Moller	Electrically separating suspended bodies from electrically non-conducting fluids.
20 179	Sept. 6 ..	Western Electric Co. (Franklin Tuthill Woodward, Belgium)	Telephone transmission circuits.
20 195	Sept. 6 ..	W. T. Henley's Telegraph Works Co., and Bishop	Bonding clamp for metal-sheathed electric wires and cables.
20 853	Sept. 16 ..	Campbell	Electrically operated winch.
21 109	Sept. 18 ..	Hay and Sullivan	Electrical resistances.
21 646	Sept. 25 ..	Beaver and Claremont ..	Electric joint, and apparatus therefor.
21 689	Sept. 25 ..	British Thomson-Houston Co. (G.E. Co., U.S.)	Power systems.
22 198	Oct. 2 ..	St. Helens Cable and Rubber Co., and White	Connecting up cables, etc., and protection of exposed ends and terminals.
22 222	Oct. 2 ..	Lewis	Carbon electrodes for arc lamps.
22 405	Oct. 4 ..	Western Electric Co., Nash and Grace	Lamp annunciators for telephone switchboards.
23 035	Oct. 13 ..	Donovan	Replacement fuses or switches for electric circuits.
23 127	Oct. 13 ..	Norballe and Lawson ..	Motor starters.
23 449	Oct. 16 ..	Waters	Electric protective systems.
23 720	Oct. 20 ..	Jackson (Horace N. Packard)	Electrical resistances and resistance thermometers.
24 274	Oct. 27 ..	Hope	Electric fittings.
24 305	Oct. 27 ..	Akt. Ges. Brown, Boveri et Cie	Rotary converter with commutating poles.
24 337	Oct. 27 ..	Akt. Ges. Brown, Boveri et Cie	Rotary converter with commutating poles.
25 171	Nov. 4 ..	Snyder	Electric furnaces.
25 415	Nov. 6 ..	Jenkins, Pattinson and Wellesley	Electrolytic cells.
25 774	Nov. 11 ..	Western Electric Co. (Franklin Tuthill Woodward, Belgium)	Electric code impulse signalling systems.
26 361	Nov. 17 ..	Engelke and Bloodworth	Adjustable resistances.
26 635	Nov. 19 ..	Bonnella and Bonnella ..	Switches.
26 646	Nov. 20 ..	Ferguson and Johnstone ..	Voltage and output regulators for electrical machines.
26 899	Nov. 22 ..	Hatfield, and Chamberlain and Hookham)	Electrolytic measuring instruments.
27 249	Nov. 26 ..	J. Stone and Co., and Darker	Switches.
27 533	Nov. 29 ..	Automatic Telephone Manufacturing Co., and Newforth, Junr.	Telephone systems.
27 753	Dec. 2 ..	Graham	Telephone systems.
27 754	Dec. 2 ..	Graham	Telephone exchange switchboards.
28 376	Dec. 9 ..	Aitken	Telephone relays, etc.
28 527	Dec. 10 ..	Amberton	Electrical systems and switch mechanism therefor.
28 559	Dec. 11 ..	Murray	Telegraph tape transmitter.
28 746	Dec. 12 ..	Holt	Terminal pieces and contacts for circuit interrupters.
28 826	Dec. 13 ..	British Thomson-Houston Co., and Young	Alternating current meters of induction type.

ELECTRICAL TRADE MARKS.

This list has been specially compiled for us from official sources by* GEE AND CO., *Patents and Trade Mark Agents, 51 and 54, Chancery Lane, London, W.C. 2, from whom further information may be obtained.

Opposition to the registration of the following trade marks can be lodged up to March 13th.

CINETROPE.—495 282. Class 8. Loud speakers and wireless telephonic receiving sets in combination with gramophones. "M.P.A." Wireless, Ltd., 62, Conduit Street, Regent Street, London, W.1 ; manufacturers. September 24th, 1928.

ATTENTOR.—496 591. Class 8. Thermostat devices. G. A. and E. S. Seddon, trading in co-partnership, 11, King Street, West, Manchester : manufacturers and merchants. November 2nd, 1928.

JUNEECO.—497 764. Class 8. Wireless telephonic apparatus and parts. A. T. Smee, trading as The Junction Engineering Co., 149a, Junction Road, Highgate, London, N. 19 ; mechanical and electrical engineer. December 5th, 1928.

FILMAVOX.—497 880. Class 8. Sound reproducing apparatus. "M.P.A." Wireless, Ltd., 62, Conduit Street, Regent Street, London, W.1 ; manufacturers. December 7th, 1928.

TRIALMO.—498 075. Class 8. Wireless telegraphy and telephony apparatus. Hyam Scott, 21a, Barbican, London, E.C.1 ; manufacturer. December 13th, 1928.

KENT'S.—491 709. Class 8. Apparatus for indicating the efficiency of turbo-generators, meters for recording readings at a distance by means of electricity, and automatic water flow regulators. George Kent, Ltd. 199 to 201, High Holborn, London, W.C.1 ; engineers. May 22nd, 1928. (To be associated. Sect. 24.) Advertised before acceptance, the applicants alleging distinctiveness.

FLUST, 496 373, and MAROG, 496 372. Both Class 50. Electric insulators and insulating boxes. Henry Peter Bayon, King's Farm, Little Shelford, Cambridge ; manufacturer. Both October 26th, 1928.

ANHYDRENE. 498 281. Class 50. Electric insulating preparations. Berry, Wiggins and Co., Ltd., Halling Works, Channelsea Road, Stratford Market, London, E.15 ; manufacturing chemists. December 19th, 1928.

Opposition to the registration of the following trade marks can be lodged up to March 20th.

TEFAG CONTINENTAL (Sign).—492 017. Class 8. Telephonic and telegraphic instruments. Telephonfabrik Berliner Aktiengesellschaft, Siemenstrasse 27, Berlin-Steglitz, Germany ; manufacturers and merchants. June 1st, 1928. (To be Associated with No. 464 149 (2 503) and others.) Registration of this trade mark shall give no right to the exclusive use of the word "Continental" or of the device of a wireless aerial.

VOLTEX (Sign).—493 844. Class 8. Electric dry batteries. Matthew Frederick Bockh, 234, Perry Hill, Catford, London, S.E.6 ; radio dealer. August 3rd, 1928. (By consent.) This trade mark is limited to the colours, blue, white and red.

SELECTA.—B493 936. Class 8. Wireless receiving sets. Selecta Gramophones, Ltd., 81, Southwark Street, London, S.E.1 ; manufacturers. August 9th, 1928. User claimed from October 16th, 1922. The applicants undertake that this mark, when registered, and the marks Nos. 390 927 and B457 869, shall be assigned or transmitted only as a whole and not separately.

STRADONELLE.—497 087. Class 8. Sound reproducing and recording instruments for use in wireless telephony and telegraphy. A. J. Balcombe, Ltd., 51, Tabernacle Street, London, E.C.2 ; manufacturers. November 15th, 1928. (To be associated with No. 388 533 (2 142) ix and another.)

PHONOTROL.—494 497. Class 8. Wireless instruments and apparatus. Igranic Electric Co., Ltd., 147, Queen Victoria Street, London, E.C.4 ; electrical engineers, August 27th, 1928. (By consent.)

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PATENT RECORD.

The following information is prepared from the Illustrated Official Journal (Patents) by permission of the Controller of H.M. Stationery Office. Printed copies of full Patent Specifications, when accepted, may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at 1s. each.

Specifications Accepted.

304 882 E. R. Groie. Electric incandescent lamps and holders thereof. (13/12/27.)
304 888 T. H. Tuite. Diaphragms for use in connection with gramophone sound-boxes, and loud speaking telephone receivers, and for like purposes. (17/12/27.)
304 891 J. H. Reyner. Inductances. (22/12/27.)
283 872 Askania-Werke Akt.-Ges. vorm. Centralwerkstatt Dessau and C. Bamberg-Friedenau. Process of and apparatus for the regulation of engine and generator sets. (18/1/27.)
304 906 H. C. Hansen. Sound amplifiers for use with wireless apparatus, gramophones, and the like devices. (12/1/28.)
304 912 Soc. Italiana Pirelli, and L. Emanueli. High-tension electric cables. (20/1/28.)
304 928 Santon, Ltd., and H. C. Sanders. Electric liquid heaters. (26/4/28.)
304 933 F. H. Royce. Electrical training gear for starting internal combustion engines. (14/2/28.)
304 946 R. Ladrier. Device for replacing electric lamps on stationary fittings at any height without the use of a ladder. (15/3/28.)
304 947 Electroflo Meters Co., Ltd. (Republic Flow Meters Co.). Electrical signalling means. (19/3/28.)
304 919 W. Harrison and T. Wood. Amplification of electric currents. (22/3/28.)
304 951 E. Schrack and Dr. R. Ettenreich (trading as Radiowerk E. Schrack). Electric discharge tubes. (21/3/28.)
288 218 A. Piton. Electric current distributing and reversing devices for ringing swinging bells. (4/4/27.)
288 557 Soc. Francaise des Lampes a Incandescence Luxor. Glow lamp filaments. (11/4/27.)
304 978 Electrical Apparatus Co., Ltd., and R. H. Barbour. Electric resistances. (24/5/28.)
304 982 B. Kellermann. Electrical distant observation system with automatic control means. (5/6/28.)
293 051 P. Mourey. Time-controlled mechanisms for actuating valves and electric switches. (30/6/27.)
294 244 Akt.-Ges. Brown, Boveri et Cie. Apparatus for extinguishing back ignitions in mercury vapour rectifiers. (21/7/27.)
294 182 Keller Mechanical Engineering Corporation. Electrical control of planers and the like machine tools. (19/7/27.)
295 603 Electrical Research Products, Inc. Optical sound recording and reproducing apparatus. (21/5/27.)
295 693 Marconi's Wireless Telegraph Co., Ltd. Wireless signalling. (17/8/27.)
298 245 Siemens and Halske Akt.-Ges. Scanning mechanism for the transmission or reception of picture telegrams. (20/7/26.)
298 246 Siemens and Halske Akt.-Ges. Arrangement for the compensation of inequalities in exposure in scanning mechanism for picture telegraphy. (20/7/26.)
305 243 R. H. D. Barklie. Electric fuses. (4/11/27.)
305 160 British Thomson-Houston Co., Ltd., H. W. H. Warren, and R. G. Green. Electric heating devices. (11/9/28.)
291 042 M. Zack. Method for electric arc welding. (25/5/27.)
305 079 J. J. Rowe and C. L. Rowe. Television and other signalling-apparatus employing light-sensitive devices. (26/9/27.)

Applications for Patents.

January 21st.

2 074 Associated Telephone and Telegraph Co. Switches for telephone systems. (27/1/28, U.S.)
2 075 Automatic Telephone Mfg. Co., Ltd., and S. R. Smith. Switch mechanism for telephone systems.
2 084 H. Baron (Ateliers J. Carpentier). Telegraphic systems.
1 992 E. A. Bellow. Combined electric lamp and battery.
2 001 Brandes, Ltd. Electric condensers. (5/3/28, U.S.)
2 012 British Thomson-Houston Co., Ltd. Method of exhausting vacuum tubes. (21/1/28, U.S.)
2 047 Bullers, Ltd., and J. G. Miller. Insulators.
2 077 Bullers, Ltd., and J. G. Miller. Suspension clamps for cables.
2 073 S. G. S. Dicker (N. V. Philips' Gloeilampenfabrieken). Electric discharge tubes.
1 986 V. H. Gilbert, and Radiovisor Parent, Ltd. Operating d.c. relay off a.c. supply.
2 046 F. J. Humphrey. Cable making, etc., machines.
1 966 Kelvin, Bottomley and Baird, Ltd., and F. A. King. Instrument for gauging sensitiveness of bodies to light, etc.
2 018 F. A. Kirsten. Electric immersion heaters.
2 029 M. Leff. Commutator for electric lamps.
1 962 S. Loewe. Electron tubes. (21/1/28, Germany.)
2 010 Metropolitan-Vickers Electrical Co., Ltd. Electric switches. (25/1/28, U.S.)
1 965 G. Thornton-Smith. Electric torsionmeter.
2 066 Telefunken Ges. für Drahtlose Telegraphie. Potential supply devices. (20/1/28, Germany.)
2 078 Westinghouse Brake and Saxby Signal Co., Ltd. Electrical control of railway points. (31/8/28, U.S.)
2 040 Wico Electric Co. Magnetos. (31/8/28, U.S.)

January 22nd.

2 175 J. W. Barstow. Radio apparatus, etc.
2 176 J. W. Barstow. Loud speakers.
2 185 Benjamin Electric, Ltd., and C. Campbell. Shock absorbing mounts for thermionic valves, etc. (2/7/28.)
2 186 Benjamin Electric, Ltd., and C. Campbell. Shock absorbing mounts for thermionic valves, etc. (21/9/28.)
2 120 R. V. Broberg and L. E. Wood. Operating mechanism for electric motors.
2 156 A. C. Clark. Electric junction boxes.
2 218 Fluor Light, Ltd. Electric discharge luminous tubes.
2 133, 2 134 Graham Amplion, Ltd., and W. J. Ricketts. Electromagnetic devices for recording sound.
2 098 W. Lambert. Inductor alternators for modulating carrier waves.
2 191 C. Lipmann, A. Quincha and A. Strahm (F. Strahm). Electric relays. (25/1/28, France.)
2 188 Siemens-Schuckertwerke A.G. Long distance communication cable. (23/1/28, Germany.)
2 209 Siemens-Schuckertwerke A.G. Arrangement for limited power transmission. (24/1/28, Germany.)
2 203 Soc. Technique d'Etudes et d'Entreprises pour l'Industries. Electro-magnetic apparatus for indicating positions at a distance. (1/2/28, France.)
2 097 C. L. Stokoe. Electric switches.
2 218 H. H. A. Wolfe. Electric discharge luminous tubes.

January 23rd.

2 354 Allmanna Svenska Elektriska Aktiebolaget. Arrangements for improving commutation in electric machines. (27/1/28, Sweden.)
2 404 British Thomson-Houston Co., Ltd. Vibration recording apparatus. (23/1/28, U.S.)
2 375 R. H. Cosky. Transformers.
2 347 Electrical Research Products, Inc. Acoustic devices. (31/3/28, U.S.)
2 382 Ferranti, Ltd., and S. Z. de Ferranti. Electricity meters.
2 385 Ferranti, Ltd., and S. Z. de Ferranti. Meter indicator mechanism.
2 321 F. C. Gore. Thermionic valves.
2 244 F. A. Lindemann. Photo-electric cells.
2 257 E. Longbottom and R. Milne. Electric plug and socket connectors.
2 284 R. Scott. Galvanic cells.
2 353 Siemens-Schuckertwerke A.G. Arrangements for limited power transmission. (2/2/28, Germany.)
2 328 P. D. Tyers. Electric gramophone pick-ups.
2 370 P. Wilson. Telephone instruments.

COMING EVENTS.

Friday, March 8th (To-day).

Birmingham Electric Club.—Grand Hotel. Annual dinner.
Ex-British Westinghouse Association.—Hotel Cecil, Strand, London. Annual dinner and reunion.
Institution of Electrical Engineers (North-Eastern Students' Section).—Armstrong College, Newcastle-on-Tyne. Debate on the motion "That the Electrical Industry is Moribund."
Institution of Mechanical Engineers.—Storey's Gate, St. James's Park, Westminster. Informal meeting. Display of a collection of recent industrial cinematograph films of engineering subjects, including one on "Electro-Farming," by Mr. R. Borlase Matthews. 7 *p.m.*
Junior Institution of Engineers.—39, Victoria Street, Westminster. Chairman's address on "Road Transport." 7.30 *p.m.*
Institution of Electrical Engineers (Scottish Centre).—Cowdray Hall, Aberdeen. Faraday lecture by Mr. Ll. B. Atkinson on "How Electricity Does Things." 8 *p.m.*

Friday, March 8th-March 23rd.

"Daily Mail" Ideal Home Exhibition, Olympia.

Saturday, March 9th.

Institution of Electrical Engineers (London Students' Section).—Visit to works of Marconi's Wireless Telegraph Co., Chelmsford. 2.15 *p.m.*
Royal Institution of Great Britain.—21, Albemarle Street, London. Lecture by Sir Ernest Rutherford on "Molecular Motions in Rarefied Gases." 3 *p.m.*

Monday, March 11th.

Electrical Contractors' Association (Hastings Sub-Branch).—Lewcock's Restaurant. Ordinary meeting.
Electrical Contractors' Association (Liverpool Branch).—Ordinary meeting. 3 *p.m.*
Institution of Electrical Engineers (Western Centre).—Merchant Venturers' Technical College, Bristol. Paper by Mr. W. Phœnix on "Electricity in Agriculture, with Special Reference to Electro-Culture." 6 *p.m.*
Institution of Electrical Engineers (North-Eastern Centre).—Armstrong College, Newcastle-on-Tyne. Faraday lecture by Mr. Ll. B. Atkinson on "How Electricity Does Things." 7 *p.m.*

Tuesday, March 12th.

Electrical Contractors' Association (Leicester Branch).—Corridor Chambers. Ordinary meeting.
Electrical Contractors' Association (Swansea Branch).—Ordinary meeting.
Institution of Electrical Engineers (North Midland Centre).—Hotel Metropole, Leeds. Annual dinner. 7 *p.m.* for 7.30 *p.m.*
Institution of Electrical Engineers (Scottish Centre).—North British Station Hotel, Edinburgh. Paper by Messrs. Johnstone Wright and C. W. Marshall on "The Construction of the Grid Transmission System in Great Britain." 7 *p.m.*
Electrical Power Engineers' Association.—Junior Institution of Engineers, 39, Victoria Street, London. Paper by Capt. P. Dunsheath on "The Design of Feeder Pillars, Cable End Boxes, etc." 7.15 *p.m.*

Wednesday, March 13th.

Electrical Contractors' Association (Eastbourne Sub-Branch).—South Street. Ordinary meeting.
Electrical Association for Women.—Visit to the Ideal Home Exhibition, Olympia, London.
Polytechnic School of Electrical Engineering.—307-309, Regent Street, London. Lecture VI (Course of eight lectures) on "Picture Telegraphy" by Mr. E. S. Ritter. 5 *p.m.*
Electrical Contractors' Association (Sheffield Branch).—Ordinary meeting. 5.30 *p.m.*
Institution of Electrical Engineers (North-Eastern Centre Students' Section).—Armstrong College, Newcastle-upon-Tyne. Joint meeting with graduates of North-East Coast Institution of Engineers and Shipbuilders. 7.15 *p.m.*
Royal Society of Arts.—John Street, Adelphi, London. Paper by Mr. R. P. G. Denman on "Loud Speakers." 8 *p.m.*
Institution of Mechanical Engineers (Sheffield Branch).—Paper by Mr. A. P. Hague on "Alloy Steels at Ordinary and High Temperatures."

Thursday, March 14th.

Institute of Transport.—Savoy Hotel, Strand, London. Annual dinner.
Institution of Mechanical Engineers.—Leeds. Paper by Mr. A. P. Hague on "Alloy Steels at Ordinary and High Temperatures."
Electrical Contractors' Association (Birmingham Branch).—Ordinary meeting.
Electrical Contractors' Association (Nottingham Branch).—Ordinary meeting.
Electrical Contractors' Association (East Yorks Branch).—Metropole Hall, Hull. Ordinary meeting.
Institution of Electrical Engineers.—Savoy Place, Victoria Embankment, London. Papers by Messrs. T. N. Riley and T. R. Scott on "Electrical Insulating Papers for the Manufacture of Power Cables," and Messrs. S. G. Brown, F.R.S., and P. A. Sporing on "The Prevention of Ionisation in Impregnated Paper Dielectrics." 6 *p.m.*
Institution of Electrical Engineers (Dundee Sub-Centre).—University College. Paper by Mr. W. Woodiwiss on "Distribution." 7.30 *p.m.*
British Electrical Development Association.—Piccadilly Hotel. Annual dinner. 7 *p.m.* for 7.30 *p.m.*
Electrical Power Engineers' Association (Manchester Group).—St. Mary's Parsonage, Deansgate. Lecture by Mr. G. Cluley on "Modern Switchgear Practice." 7.45 *p.m.*

Friday, March 15th.

Institution of Electrical Engineers (London Students' Section).—Institution, Savoy Place, Victoria Embankment, London. Paper by Mr. C. F. J. Morgan on "Wave-form Analysis." 6.15 *p.m.*
British Electrical Development Association.—Royal Society of Arts, John Street, Adelphi, London. Conference on "Water Heating Developments." Speaker, Mr. M. O. F. England. 7.30 *p.m.*

Saturday, March 16th.

Association of Mining Electrical Engineers (Western Sub-Branch).—60, Wind Street, Swansea. Informal discussion of H.M. Electrical Inspector of Mines' Report for 1927.
Royal Institution of Great Britain.—21, Albemarle Street, London. Lecture by Sir Ernest Rutherford on "Molecular Motions in Rarefied Gases." 3 *p.m.*
Electrical Power Engineers' Association.—New Princes Galleries, Piccadilly, London. Dinner and dance. 7 *p.m.*

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THE ELECTRICIAN

Established 1861. The Oldest Weekly Illustrated Journal of

Electrical Engineering, Industry, Science and Finance.

Bouverie House, 154, Fleet Street, London, E.C.4. Telegrams: "Benbrotric, Fleet, London."
Telephone: City 0244 (Ten lines).

[*Closed on Saturdays in accordance with the "Five-Day Week" plan adopted by Benn Brothers, Ltd., and its associated organisations.*]

No. 2650. [No. 11. Vol. CII.] Friday, March 15, 1929. Annual Subscription, 25s Overseas, 30s.

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Current Topics.

The Balfour Report.

THOSE who are always on the look out for tabloid remedies for this or that commercial disorder will find little to interest them in the long-awaited final report of the Committee on Industry and Trade which has been sitting for four-and-a-half years, under the chairmanship of Sir ARTHUR BALFOUR. Happily the slogans and nostrums of the patent trade-revivers are conspicuously absent from the report, and its many pages are, for the most part, filled with observations which are well worthy of careful study as honest and serious contributions towards the elucidation of a highly complex problem. Possibly the most outstanding feature of the work is the emphasis laid throughout on the need for abolition of restrictions in many directions, and on the futility of looking to others for remedial assistance in cases where the remedy is in our own hands. There is little direct reference to the electrical industry in this report, but it will be remembered that more detailed references were contained in one of the six voluminous interim reports previously issued by the Committee. The real message for our industry seems to us to be contained in the Committee's statement that "British industries' organisation and equipment must be subjected to a thorough process of reconditioning." There is no surer or easier way of doing this than by introducing electrical equipment into the many factories and workshops which are, under present conditions, permanently handicapped by obsolete machinery and lighting. The "reconditioning" of industry will naturally lead to that increased output for which so many are striving, and there is no better aid to greater productivity than the fullest and most up-to-date usage of electrical power, a very effective indication of which was given by the Factory Lighting Campaign.

Electric Vehicles and Petrol Prices.

WHILE electrical engineers, as motorists, may share the general resentment at the big advance in petrol prices, the increase will not be without its redeeming feature if it can be used to regain public interest in the claims of the electric battery road vehicle. At present, except for town work, the private electrically-propelled car has but a poor chance of competing with internal-combustion engine propulsion, but the increased petrol prices will fall most heavily upon commercial transport, a field in which the electric vehicle is even now making some headway. Apart from the special advantages of the electrically-propelled vehicle for short haulage and delivery work, and the many other incidental advantages inherent in the electrical method, wherever applied, owners of electric vehicles enjoy complete freedom from the effects of petrol price manipulation, and can, in fact, look to a steady and progressive decrease in the cost of their "fuel," based on an increasing demand for battery charging facilities during off-peak hours. The present seems a most opportune time for a concerted effort to put more electric vehicles on the road.

Our Export Trade.

THOUGH during February our overseas trade did not maintain the improvement of the previous month, the position was better than it might at first sight appear. With a total of £55 664 975, exports were £11 214 632 less than during January, while imports valued at £91 349 354 were lower by £24 714 791. In spite of the fact that last month had one working day less than February, 1928, a comparison of the respective figures shows that during last month an average daily import trade of £3 806 223 was maintained against £3 954,000 for the same month last year, showing not only an actual but also relative decrease in imports. Similarly, exports for February, 1929, averaged £2 319 374 per working day, against £2 289 445 for February of last year, a relative increase of nearly £30 000 per day. So far as the electrical industry is concerned, the Board of Trade returns abstracted elsewhere in this issue show that exports for the month were valued at £1 462 365, or £19 837 less than the figure for February, 1928. On the other hand the total electrical exports for the two months of this year were valued at nearly £50 000 more than for the corresponding months of 1928. Imports during the month under review also increased, the amount being £28 292 or £53 633 for the two months. The month of February is always slightly misleading as to the position of the electrical export trade, in that considerable business is held up by the British Industries Fair, potential buyers withholding orders, pending decisions on conclusions formed at Birmingham. Further, many of our regular buyers have not by the end of February returned to their native

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shores. These minor setbacks to February trade are with us each year, but this year, in addition, account must be taken of the extreme severity of last month's weather. The frost and snow were responsible for transport difficulties which held up some hundreds of ships, rendered railway transport in many cases almost impossible, and increased the influenza epidemic among workers. Taking all these things into account, the comparison of last month's figures with those of February, 1928, is still encouraging, and does not in any way justify regarding January's increased trade as only a temporary improvement in electrical export business.

Heating of Workshops.

A POLICE court case this week in which a firm of builders was fined for allowing the temperature of a workroom to fall below 50 deg., not only serves as a reminder of the obligations of employers, but also indicates a probable reason for many cases of deficient heating and the remedy therefor. In this workshop, as in others in which inflammable materials are stored, the owners had difficulty in settling on a safe method of heating, and not finding such a method, preferred discomfort to fire risks. In the case under notice an electric radiator heating system has now been put in, thus meeting all the requirements of comfort and safety. Electrical installation contractors will doubtless find numerous factories and workshops in their districts with a heating problem that can be solved by similar means, but without the necessity for preliminary prosecution and fine.

Reparations and British Industry.

IT will be gathered from the recommendations of the Expert Committee on German Reparations, now sitting in Paris under the chairmanship of Mr. OWEN D. YOUNG, that the attempts being made to extend the system of reparation in kind, are, if successful, likely to have a very considerable bearing on trade with our late Continental allies. Under the Labour Government in 1924, Germany was allowed, for the duration of the Dawes Scheme, to supply the allied countries with, among other products, engineering works of all kinds in lieu of cash. France, Italy and Belgium have taken full advantage of this section of the Dawes Scheme, and have encouraged dealing with Germany by allowing discounts and free trade in German goods. As an illustration of the position may be cited the fact that last year, German electrical engineering firms secured contracts on reparation account for large power station work in the Pyrenees, in addition to considerable work at docks and quays in France. Bearing in mind the fact that Germany's allied creditors can, if they so desire, divert deliveries to other countries by way of discharging their own indebtedness to other countries, this peaceful penetration, already referred to in these columns, is likely to flood those countries that matter with German products in direct but unfair competition with our own manufactures. That the true position is not altogether realised is shown by the fact that Sir JOSIAH STAMP, one of the three British delegates on the Committee, stated last week that for every ten letters received by him from correspondents desirous of making Germany pay in full, only one manufacturer expressed concern at the competition of German reparation goods. Though, perhaps, the industry most affected is that of coal, Germany is, nevertheless, a country to be reckoned with from the electrical point of view. It behoves us, therefore, not only to watch developments, but to give even more attention to overseas markets, and their needs.

Another Radio-Gramophone Fusion.

FOLLOWING the recent merger between the Victor Talking Machine Co. and the Radio Corporation of America, the official announcement that an agreement has been reached, by which His Master's Voice acquires the Marconiphone Company, is not altogether a surprise. The Gramophone Company, or in other words His Master's Voice, is controlled by the Victor Talking Machine Co., whereas the Radio Corporation of America is, in its turn, very closely associated with the Marconi Co., and though, as far as we know, neither of the gramophone companies has previously been connected with radio, important developments are expected. This latest merger confirms the opinions already expressed in these columns that the radio and gramophone industries are such that, in order to make the most of the latter, the patents, designs and methods of the former must be adopted. That this view is correct is not only confirmed by the amalgamations of recent months but by the fact that the best instruments manufactured by the gramophone companies all incorporate electric drive, amplifier circuits and moving coil loud speakers. On the other hand, the radio industry also has much to gain from the longer experience of the gramophone trade in catering for the needs of the public, its many exclusive rights of vocal and band performances—rights which have in many cases restricted the B.B.C. programmes—and the knowledge of a very considerable army of acoustical technicians. The long arm of electrical engineering stretches in all directions, and though its reach towards the gramophone industry is of long standing, at no time was it anticipated that the very heart of the trade would rest within its embrace. The development of the radio-gramophone along the lines suggested will, we feel sure, result in an instrument which will reproduce with faithfulness any composition of the full musical scale, an instrument which, at the moment, is mechanically impossible.

A New Aberdeen Story.

A TRUE story connected with the reading of the Faraday Lecture, at Aberdeen last Friday, might well be added to the host of tales centred on the Granite City. According to a reliable correspondent the now famous stocking experiment failed to work, and Mr. LL. B. ATKINSON, who was giving the lecture, attributed this to the damp northern air. A contrary view was, however, expressed by the chairman, Lord ABERDEEN, who thought that any moisture present would automatically be compensated for by the dry humour which was known to prevail in Aberdeen. It was left to Mr. D. S. MUNRO to impart to this incident the normal Aberdonian twist, and, in moving the vote of thanks, he based his regret at the failure of this attractive demonstration on the possibility that some Aberdonian might have seen in it a cheap cure for bow legs.

Railways and Electricity.

THE lukewarm interest of the big railways in electrification is so hard to reconcile with their professions of anxiety to make their systems both attractive and remunerative that we rarely look for signs of grace in this direction. At the L.M.S. annual meeting, for instance, no reference was made to electric traction, and in spite of the recent appalling accidents in which gas-lighted trains have been involved, it was complacently announced that at the present time less than one-quarter of the stock employed in the main line services is fitted with gas lighting, and that the bulk of gas-lighted stock is in use on local services or held in reserve for peak traffic or holiday periods. As many of the accidents involve local trains and excursion trains at holiday times, the retention of gas lighting is less excusable than it would be in other services where the risk of accident is less, though in any case the use of gas for the lighting of British railway trains is quite indefensible. A slightly more progressive attitude characterised the speech of the L.N.E.R. chairman, who spoke of the progress that is being made with the installation of track circuits, with which some 695 miles of track have now been equipped, and of experiments that are being undertaken with higher steam pressures and Diesel-electric locomotives, one of which is now under construction. In view of the potential importance of the Diesel-electric experiments, one is apt to wonder why it has been left to the chief mechanical engineer to carry out the work.

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DETERMINING THE DISTRIBUTION OF ELECTRIC AND MAGNETIC FIELDS.

Some Interesting Experimental Methods—The Principal Qualitative Forms—Important Applications to Practical Problems.

By B. HAGUE, D.Sc., Ph.D., A.M.I.E.E., (Lecturer in Electrical Engineering, Glasgow University).

(*Concluded from page* 187.)

THE qualitative method of examining two-dimensional problems was introduced by de Sénarmont* in a research on the thermal conductivity of crystals and improved by Voigt for the same purpose. Mach has used the process to illustrate the lines of flow of an electric current in a metal plate, while Skinner has applied it to a number of interesting problems. The principle is a very simple one. Let a thin conducting plate be cut out to the shape of the region in which the field distribution is desired, the free edges of the plate corresponding to the boundaries of the field. If now the appropriate edges or other parts of the plate be maintained at differences of temperature proportional to the differences of potential found in the corresponding parts of the magnetic or electric field, it will follow, since the flow of heat in the plate fulfils the condition of continuity and the distribution of temperature satisfies the condition of zero curl, that lines of heat flow and the lines of equi-temperature (isotherms) are analogous to the lines of force and equipotentials respectively and correspond with them exactly in shape. The isotherms can be rendered visible by coating the plate with some indicating substance such, for example, as will show a sharp line of demarcation between its melted and unmelted parts or in which there are marked colour changes with change of temperature; the shape of the isotherm as it passes across the plate can be recorded from time to time. The indicator most often used is wax, or, better, a mixture of wax and elaidic acid, which possesses a sharper melting point; Skinner, however, has made use of the melting line and the oxidation colours on ordinary tinned iron plate. As a visual method the results obtained are fairly good with wax, but are necessarily rather indefinite with the use of colour-changing indicators since the passage of one colour into another is gradual. However, the second process might be made precise by photographing or observing the plate through a sharp-cut absorption filter, which would enable a clear line of demarcation, corresponding to a definite colour, to be obtained.

Electrochemical Method.

Another quantitative method was introduced by Guébhard† and is based upon an experiment described by Nobili in 1827. This observer noticed that beautiful coloured rings are produced upon the surface of a brightly polished metal plate when it is placed in an electrolytic cell in proximity to the electrodes. The phenomenon principally attracted the attention of artists who utilised it as an aid in designing coloured patterns. The dependence of these patterns upon the form and position of the electrodes, their geometric regularity, and in certain cases their obvious similarity to known mathematical curves, led Guébhard to investigate them very completely and to turn the phenomenon to account in the exploration of two-dimensional field problems. In practice the method consists in making an electrolytic cell with vertical walls rising from a plane base the periphery of which has the form of the region wherein the field is to be investigated; the whole can be easily constructed in modelling wax. Upon the base is placed a sheet of thin copper or iron, cut to the same shape as the base and fitted to meet the walls of the cell; the surface of the plate is polished. An electrolyte consisting of an aqueous solution of the acetates of lead and copper is poured into the cell, and suitable electrodes are immersed in it; the electrodes must be parallel to the cell walls and their ends should come near, but not touch, the metal plate. On maintaining the electrodes at appropriate differences of potential electrolysis takes place and beautiful iridescent deposits of lead peroxide are found on the plate. Guébhard showed both experimentally and theoretically that the curves of constant colour correspond in shape exactly with the equipotential lines of a two-dimensional electric or magnetic field in a region having the plan contour of the cell and electrodes in corresponding positions maintained at similar electric or magnetic potential differences. He examined in this way some fifty-seven two-dimensional fields for which the mathematical solutions are known, some giving diagrams of considerable complexity and beauty. As an aid in quantitative work this method, as in the case of the thermal method, might be improved by viewing or photographing the deposit on the plate through suitable colour filters.

The thermal and electrochemical methods are the principal qualitative methods worthy of mention. We may notice in passing, however, another principle which has occasionally been used, namely, Lichtenberger figures. Suitably shaped electrodes are arranged upon a photographic plate in a dark room; to these electrodes a high transient voltage is suddenly applied. Upon developing the plate the lines of force are represented by striæ extending from the position of one electrode to that of the other.*

Hydrodynamical Method.

We now come to a method, which has been used in a number of researches, utilising the fundamental properties of fluid motion. It is well-known that the motion of a perfect inviscid fluid in two dimensions is characterised by two functions, both satisfying Laplace's equation. The first function, called the stream function, expresses the stream lines or lines of flow of the fluid; the second function, called the velocity potential, expresses a system of curves cutting the stream lines orthogonally. The lines of flow are precisely analagous to lines of force in electric and magnetic fields; surfaces of constant velocity potential correspond to electric or magnetic equipotentials; the velocity of the fluid (gradient of the velocity potential) is the parallel of electric or magnetic force (gradient of the corresponding potential).

Prof. Hele-Shaw,† in carrying out some experiments, intended to show the flow of water past solids of various shapes by the expedient of injecting air bubbles into the flowing stream, noticed that there was a narrow, well-defined band at the surface of the solid within which there appeared to be true stream-line flow, i.e., where the flow resembled that in a perfectly inviscid fluid. By using thin sheets of water between glass plates and injecting fine jets of coloured fluid into the stream, the region of steady stream-line flow was increased and rendered more easily visible; a still more marked improvement was obtained when a viscous fluid such as glycerine was employed instead of water. This strange result was shown by Sir G. Stokes‡ to be in accord with the laws of hydrodynamics; in effect, he proved that the stream-lines of an infinitely thin viscous film are identical with those of the two-dimensional flow of a perfectly inviscid fluid. Hele-Shaw

* H. de Sénarmont, "Mémoire sur la conductibilité des substances cristallisées pour la chaleur," *Compte Rendus*, Vol. XXV, pp. 459-461, 1847; "Second mémoire sur la conductibilité des corps cristallisés pour la chaleur," *ibid.*, Vol. XXV, pp. 708-710, 1847. E. Mach., "Mitteilungen über einfache Vorlesungsversuche," *Carl's Rep. für exp. Phys.*, Vol. VI, pp. 8-12, 1870. W. Voigt, "Eine neue Methode zur Untersuchung der Wärmeleitung in Krystallen," *Ann. der Phys.*, Vol. LX, pp. 350-367, 1897. S. Skinner, "Experiments on the flow of heat in metal sheets," *Proc. Phys. Soc.*, Vol. XXVIII, pp. 119-123, 1916.

† A. Guébhard, "Figuration électrochimique des lignes équipotentielles sur des portions quelconques du plan," *Journal de Phys.*, Vol. I, 2nd series, pp. 205-222, 1882. "Sur la figuration électrochimique des systemes équipotentiel," *ibid.*, Vol. I, 2nd series, pp. 483-492, 1882.

*See A. M. Gray, *Trans. Amer. I.E.E.*, Vol. XXXVI, pp. 1055-1056, 1917.

† H. S. Hele-Shaw, "Experiments on the nature of the surface resistance in pipes and on ships," *Trans. Inst. Nav. Arch.*, Vol. XXXIX, pp. 145-153, 1898. "Investigation of the nature of surface resistance of water and of stream line motion under certain experimental conditions. Second paper," *ibid.*, Vol. XL, pp. 21-40, 1898. "Stream line motion of a viscous film." *B.A. Report of 78th meeting*, pp. 136-142, Bristol, 1898.

‡ Sir G. G. Stokes, "Mathematical proof of the identity of the stream lines of a viscous film with those of a perfect fluid moving in two dimensions," *B.A. Report of 78th meeting*, pp. 143-144, Bristol, 1898. See also, *Collected Papers*, Vol. V, p. 278 or Lamb's *Hydrodynamics*, pp. 550-551, 5th edn., 1924.

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and his collaborators thereupon used the method to solve a large number of hydrodynamical, magnetic and electric Laplacian fields. The field diagrams show the paths of the lines of force in a most beautiful way; many of these diagrams have been frequently reproduced in electrical engineering text-books and are well-known to engineers. It is, moreover, quite easy to obtain numerical results by the use of the method, so that it is not merely of qualitative interest.

Hele-Shaw and Hay* have investigated a number of magnetic problems including some for which the mathematical solutions are known, in order to indicate the degree of accuracy attainable. One of the particular features of the method is that by proper adjustment of the thickness of the liquid film any relative ratio between the permeability of the air space and that of the iron masses may be imitated in the hydrodynamical model; it is valuable, therefore, in depicting the refraction of the lines of induction at an iron-air interface. In their paper Hele-Shaw and Hay have, among other problems treated the field in the air-gap and teeth of a toothed armature opposite a plane pole, the iron having a permeability of 100; the flux distribution in a Siemens shuttle armature dynamo with its armature in two positions; and the flux-fringe at the tip of a pole shoe opposite a toothed core. In conjunction with Powell† these same experimenters investigated the permeance of the air-gap magnetic field of a toothed armature with open, parallel sided slots, finding results in agreement with the well-known mathematical work of Carter; while Powell‡ has determined by the hydrodynamical method the air-gap correction coefficient for semi-closed slots.

Thornton§ has used the method to find the magnetic flux distribution in the interpolar space and in the armature core of dynamos either with toothed or smooth armatures. In conjunction with Williams‖ he has made one of the earliest investigations of the electric field in three-phase cables.

Electrical Conductanee Method.

When an electric current flows in a plane metal sheet o uniform thickness from electrodes attached thereto and maintained at suitable differences of potential, the equipotential lines in the sheet have the same form as those of the two-dimensional electric (or magnetic) field produced by infinitely long parallel cylinders having the same shape of cross-section as the electrodes, maintained at corresponding potential differences, and situated in a region having a limiting boundary of the same form as the contour of the metal sheet. This analogy follows at once from the fact that the flow of current in the plate necessarily fulfils the continuity conditions; the problems are mathematically similar.

The method was introduced in 1845 by Kirchhoff¶ and applied, principally to cases where the electrodes on the plate are points (corresponding to the electric field of systems of thin parallel wires), by Smith, Adams, and by Carey Foster and Lodge. In practice the procedure consists in cutting out a thin sheet, sometimes of tinfoil but now more usually of some high resistance alloy, to the shape of the area in which the field is to be explored, soldering copper electrodes of the proper shape to the plate in appropriate positions, and then plotting out with the aid of a potentiometer, exploring needle and galvanometer, the equipotential lines upon the surface of the sheet when a direct current flows through it. The electrical resistance measured between the electrodes of the plate is proportional to the reciprocal of the capacity of the corresponding cylindrical condenser or to the reluctance of the corresponding magnetic field.

Important Applications.

The first application of the method to an engineering problem seems to have been described by Smoot,* who checked by its aid Carter's correction coefficient for open parallel sided slots in an armature. By far the most important use of the method, however, has been made by Douglas†; this experimenter has made by its aid one of the fullest investigations ever attempted of the magnetic field in a dynamo; the field was divided into two-dimension regions, which were treated partly by the theory of conjugate functions and, where that failed, by the Kirchhoff method. His paper should be consulted for full details of the experimental technique involved in determining accurate field maps and in measuring magnetic reluctance by this method.

In most experiments the plate is of thin, high resistivity material to imitate a region of air, while the attached electrodes are made of massive copper to imitate the boundary conductors in an electric field or the highly permeable iron parts in a magnetic field. Roeterink‡ has, however, imitated the influence of iron teeth of finite permeability on the correction coefficient of a slotted armature, by suitably grading the thickness or resistivity of the plate. We can show by the method, therefore, the phenomenon of refraction at the surface separating two media.

An important modification of the method, originally suggested by Adams, and used by Kennelly and Whiting,§ is to substitute for the metal plate a trough containing a liquid electrolyte and to immerse therein parallel, cylindrical electrodes of appropriate cross-sections; the two-dimensional field in the trough can then be investigated by means of an exploring electrode, which is usually a fine wire insulated except at its tip. Moreover, it is clear that the use of a liquid medium enables not only two-dimensional but also three-dimensional problems to be attacked; some progress has been made in this direction, as we shall see. Various electrolytes have been used, such as slightly acidulated or saline water, but in order to reduce to the minimum the effects of polarisation, most workers employ a solution of copper sulphate and use electrodes of pure copper. If measurements are made by means of direct current, occasional reversal of the current is resorted to in order that polarisation may be eliminated as much as possible; the detector is a sensitive galvanometer or a quadrant electrometer. In order to remove polarisation effects completely, many workers have used an alternating current, the detector being either a reflecting dynamometer or a telephone, the latter often in combination with a thermionic amplifier. The position of the exploring electrode may be determined either by the aid of co-ordinate slides and scales attached to the trough or by attaching the electrode to one limb of a pantograph; this latter device is widely used, not only in the electrolytic method, and was introduced by Fortescue and Farnsworth.

The applications of the electrolyte method to electrostatic problems are numerous and important. Förster, Atkinson and Sacchetto have all made investigations of the electric field and electric stress distribution in three-core cables.‖ The general principles of insulation design have been illustrated by the method in a paper by Fortescue and Farnsworth.¶

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* H. S. Hele-Shaw and A. Hay, "Lines of induction in a magnetic field," *Phil. Trans. Roy. Soc. A.*, Vol. 195, pp. 303–327, 1901.

† H. S. Hele-Shaw, A. Hay and P. H. Powell, "Hydrodynamical and electromagnetic investigations regarding the magnetic flux distribution in toothed core armatures." *Journal I.E.E.*, Vol. XXXIV, pp. 21–53, 1905.

‡ P. H. Powell, "The air-gap correction coefficient," *Journal I.E.E.*, Vol. XL., pp. 228–234, 1908.

§ W. M. Thornton, "The distribution of magnetic induction and hysteresis loss in armatures," *Journal I.E.E.*, Vol. XXXVII, pp. 125–139, 1906.

‖ W. M. Thornton and O. J. Williams, "The distribution of dielectric stress in three-phase cables," *Engineering*, Vol. LXXXVIII, pp. 297–299, 1909.

¶ G. Kirchhoff, "Ueber den Durchgang eines elektrischen Stromes durch eine Ebene, insbesondere durch eine kreisförmige," *Ann. der Phys.*, Vol. LXIV, pp. 497–514, 1845. W. R. Smith, "On the flow of electricity in conducting surfaces," *Proc. Roy. Soc. Edin.*, Vol. VIII, pp. 79–99, 1872. W. G. Adams, "On the forms of equipotential curves and surfaces and lines of electric force," *Proc. Roy. Soc. Lond.*, Vol. XXIII, pp. 280–284, 1875. G. Carey Foster and O. Lodge, "On the flow of electricity in a uniform plane conducting surface," *Proc. Phys. Soc. Lond.*, Vol. I, pp. 113–149, 193–208, 1876. This paper is full of valuable references to early work done on the subject.

* C. H. Smoot, "An Experimental Determination of Air-gap Reluctance," *Journal of Western Soc. of Eng.*, Vol. X, pp. 500–511, 1905.

† J. F. H. Douglas, "The Reluctance of Some Irregular Magnetic Fields," *Trans. Amer. I.E.E.*, Vol. XXIV, pp. 1067–1134, 1915.

‡ F. M. Roeterink, "Eine Theoretische und Experimentelle Untersuchung des Nutenfeldes einer Unbelasteten Maschinen," *Arch. für Elekt.*, Vol. VII, pp. 292–319, 1919.

§ W. G. Adams, *loc. cit.*, 1875; A. E. Kennelly and S. E. Whiting, "On an Approximate Measurement, by Electrolytic Means, of the Electrostatic Capacity between a Vertical Metallic Cylinder and the Ground," *El. World*, Vol. XLVIII, pp. 1239–1241, 1906.

‖ R. Förster, "Experimentelle Lösung von Randwertaufgaben der Gleichung $\Delta u = o$," *Arch. für Elekt.*, Vol. II, pp. 175–181, 1914. R. W. Atkinson, "The Dielectric Field in an Electric Power Cable," *Trans. Amer. I.E.E.*, Vol. XXXVIII, pp. 971–1036, 1919. E. Sacchetto, "Studio Teorico Sperimentale Sulle Capacita dei Cavi Trifase Cordati," *L'Elettro*, Vol. VIII, pp. 533–544, 1921.

¶ C. L. Fortescue and S. W. Farnsworth, "Air as an Insulator when in the Presence of Insulating Bodies of Higher Specific Inductive Capacity," *Trans. Amer. I.E.E.*, Vol. XXXII, pp. 893–906, 1913.

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Three-dimension electrostatic problems are represented in the investigation by Rice* of the field of high voltage bushings, while Estorff† has examined the field of disc insulator chains and of petticoated pin insulators. Both these experimenters use the electrolyte to imitate the air region, and make a graphite paste model of the insulator to imitate the porcelain dielectric. Finally, Cramp ‡ has used the method to find the capacity of condensers having a form too complex for mathematical treatment; and Zschaage§ has examined the electric field near transmission lines and communication circuits.

By far the most thorough investigation made by the aid of the electrolyte method is that undertaken by Ahmed.‖ In a preliminary paper this experimenter tests the accuracy of the method by trying cases for which the mathematical solutions are known, and gives a very full discussion of the technique of the method. In a second paper he makes a complete examination of the magnetic leakage field of salient poles, deducing many results of practical value. Ahmed's work has put the electrolyte method on a sound basis and has established its accuracy as one of the best experimental ways of solving field problems.

The method has also been applied to the solution of aerodynamical problems by Relf¶, and to the investigation of water flow in water turbines by Hahn.**

Soap-Film Method.

We now come to an exceedingly original and interesting method first introduced by Griffith and Taylor†† following a suggestion by Prandtl. Consider a soap-film attached to some bounding edge, and let the film have a difference of pressure p between its two surfaces. Then it is shown in text books of physics that at any point on the surface of the film the condition $\frac{1}{R}+\frac{1}{R^1}=\frac{2p}{T}$ will express its equilibrium, where R and R^1 are the principal radii of curvature of the surface at the point and T is the surface tension. If the curvature is slight, and if in addition the difference in pressure between the two sides of the film is zero, the equation of equilibrium becomes $\frac{\delta^2 h}{\delta x^2}+\frac{\delta^2 h}{\delta y^2}=0$, where h is the height of the film above a datum plane in which axes of x and y have been chosen. This is Laplace's equation; hence we may take h as the analogue of potential. Lines of constant height on the film surface will correspond with and have the same shape as the equipotentials of a two-dimensional field in a region having the same shape of periphery as the plan form on the x, y plane of the hole over which the film extends. Lines of greatest slope on the film surface project on to the x, y plane in the form of lines of force; the slope of the film at any point is a measure of the electric (or magnetic) force.

The practical procedure can best be explained by a simple example. Suppose we are to find the field near an armature slot under a plane pole. Let two flat plates be prepared, one having a straight edge to represent the pole-face; the other has a straight edge in which the slot is cut. Arrange the two plates on a horizontal plane until they are in the correct relative positions to imitate the air gap contour, and then raise the pole face plate to a height h_0 above the datum plane; h_0 is then analogous to the difference of magnetic potential between the pole and the armature. The ends of the gap are closed by normal septa. A soap-film is now stretched over the space between the boundaries, clinging to the opposing straight and slotted edges, which are usually bevelled, and to the normal septa. Lines of constant height on the film, corresponding to lines of equipotential, are plotted by the use of a spherometer passing through a glass plate serving as the cover of the box in which the boundaries have been set up. The slope of the film surface, corresponding to the magnetic force, is easily measured by means of an optical clinometer.

The soap-film method was devised primarily for use in solving problems in technical elasticity, and full details of its manipulation are given in the papers cited. It is capable of high precision and is quick in use; it requires, however, not a little care and experimental skill, but the knack of dealing with the delicate films is easily acquired with practice. The writer has used the method at intervals from 1919 to the present time as an experimental aid in a long research on the magnetic and electric field, and has in preparation a description of some of the most striking and valuable results, which will be published in the near future.

Conclusion.

The preceding paragraphs will convince the reader that there are a considerable number of experimental methods which can be used by the engineer to solve his Laplacian field problem with adequate practical accuracy. Of all these methods probably the best, the most useful and the easiest to operate are the electrical conduction method, especially in the form of electrolyte tank, and the soap-film method; and in general research and under works conditions the former method is probably the most convenient. The conduction method has a further great advantage over all others in that it enables the magnetic reluctance or the electrostatic capacity to be found at once, from the result of a single resistance measurement, without the need of plotting out the field distribution.

This paper has been prepared partly to interest engineers in the many beautiful analogies existing between electric or magnetic fields and mathematically similar phenomena in other branches of physics; and partly to aid other workers by providing them with an index to the literature of the subject of field exploration by experimental means.

[Paper read before Section G. of the British Association at the meeting in Glasgow, September, 1928.]

* C. W. Rice, "An Experimental Method of Obtaining the Solution of Electrostatic Problems, with Notes on High Voltage Bushing Design," *Trans. Amer. I.E.E.*, Vol. XXXVI., pp. 905–1051, 1917.

† W. Estorff, "Die Ausmessung der Elektrostatischen Felder von Isolatoren Nach dem Elektrolytverfahren," *Elekt. Zeits.*, Vol. XXXIX, pp. 53–55, 62–67, 76–78, 1918.

‡ W. Cramp, "The Measurement of Capacity by Analogy," *World Power*, Vol. II, pp. 267–273, 1924.

§ W. Zschaage, "Nachahmung des Elektrischen Feldes von Leitungen in Elektrolytischen Trog," *Elekt. Zeits*, Vol. XLVI. pp. 1215–1219, 1925.

‖ A. A. Ahmed, "Theoretical and Experimental Study of the Electric Field in an Electrolytic Cell." *Journal I.E.E.*, Vol. LXII, pp. 301–317, 1924. "Investigation by Electrolytic Means of the Magnetic Leakage of Salient Poles," *World Power*, Vol. II, pp. 334–340, 1924; Vol. III, pp. 91–99, 157–161, 218–222, 1925.

¶ E. F. Relf, "An Electrical Method for Tracing Stream Lines in Two-dimensional Motion of a Perfect Fluid," *Phil. Mag.*, Vol. XLVIII, 6th series, pp. 535–539, 1924.

** E. Hahn, "Méthode Experimentale pour la Résolution des Equations du Mouvement des Fluides," *Rev. Gen. de l'El.*, Vol. XXI, pp. 485–489, 1927.

†† A. A. Griffith and G. I. Taylor, "The Use of Soap Films in Solving Torsion Problems," *Proc. I. Mech. E.*, pp. 755–789, Oct. to Dec., 1917. For various manipulative details see Advisory Committee for Aeronautics, *Reports and Memoranda*, Nos. 333, 334, 399, 1917; 392, 1918.

VARIABLE SPEED MOTORS.

At an informal meeting of the Institution of Electrical Engineers on March 4th, Mr. J. R. Bedford in the chair, Mr. L. J. Hunt opened a discussion on "Variable Speed A.C. Motors." He dealt with the various methods of speed variation by grouping the motors under the three standard types; pole-change, cascade, and commutator, all depending upon the development of the additional counter e.m.f.

Most of the motors he described are now well known and Mr. Hunt's remarks were mainly directed to the application of each type to its particular problem. He said the Scherbius method is an excellent solution of the problem, but the number of machines involves serious complications, and except for some requirements, a better solution is a single Schrage motor. The latter is very expensive, and he thought the all-round advantages were with the cascade method which is simple and robust while the speed can be changed by switching the connections on the slip rings without opening the stator circuit.

Mr. F. V. Schulthess described a new system of Scherbius regulation with a double rotor which seemed to be a development of the Spinner motor. It was a commutator motor with voltage regulation producing variable speed and power factor correction.

Mr. J. H. Johnson said if the user could manage with a pole-change he would be well advised to do so. The commutator motor had limitations of size and was expensive in cost and upkeep. He thought the advantages were often with a motor generator in spite of the space factor.

Mr. A. F. Harmer said the reason why the cost of variable speed machines was large was because the demand was so small. He believed the future would show a more extended use of single-phase than was generally anticipated.

Messrs. H. D. Barlow, J. R. Bedford, B. B. Bryan, B. M. Burt, W. A. Erlebach, A. N. D. Kerr, C. D. King, N. Prentice, E. S. Ritter, D. M. Robinson, L. E. Squire, E. O. Taylor and W. L. Wreford also spoke.

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LIGHTING SERVICE.

New Facilities at E.L.M.A. Bureau Include Architectural Lighting Demonstration Room and Street Lighting Model—Moulded Glassware Fittings in Model Showroom—Forthcoming Series of Lectures on Street Lighting.

THERE can be few supply engineers or contractors who, on a visit to London, have not at some time visited the E.L.M.A. Lighting Service Bureau at 15, Savoy Street, but there are many who are unaware of the fact that this laboratory of lighting progress is continually changing, in order to reflect, and often to anticipate, the latest developments in the art of illumination.

Visiting the Bureau this week we noted a remarkable transformation, for not only has there been a re-arrangement

A view of part of the new architectural lighting demonstration room at the E.L.M.A. Lighting Service Bureau. The luminous wall panels are seen over the alcoves.

of the lighting equipment in the studios, but new demonstration rooms and apparatus have been constructed, thus adding considerably to the interest of the Bureau, and enabling it to give even greater lighting service during 1929.

The first room in which visitors are received, the re-designed reception room, is well equipped with modern fittings, including a large proportion of the new forms of pressed glassware designs. It serves to create a brighter and more cheerful atmosphere and literally says " welcome " with light.

The previous layout of the reception room was designed to represent a model electricity showroom with a rational display of domestic lighting fittings grouped into sections and displayed in connection with appropriate domestic demonstration interiors. In addition to this arrangement, various displays designed to give the visitor useful information on lighting matters were arranged in various parts of the room. In the room as reconstructed, this model showroom principle has been largely retained, since its value is considerable, both to the supply engineer and the contractor.

Luminous Roof Beams.

The centre section of the ceiling, however, has been cleared of pendant lighting fittings, and a modern architectural lighting arrangement, consisting of a rectangular system of luminous beams surrounding an effective modern lighting pendant, will be installed, and this, together with the flush showcase display of modern luminous ornaments, imparts a definitely modern character to the interior.

The four demonstration domestic interiors, comprising kitchen, dining room, drawing room, and bedroom, are considerably modified ; the modern glassware lighting fittings being incorporated in their appropriate surroundings.

With a view to giving architects and engineers facilities to study the new method of architectural lighting, the Lighting Service Bureau has inaugurated an architectural lighting department under the charge of a trained architect, whose whole time will be devoted to study and development of this subject. This department has already collected much important data on the lighting of public and domestic buildings, and the architect has designed a new lighting studio where some of the many aspects of architectural lighting are portrayed.

In its conception, the studio does not represent any particular interior, but is intended to show the effect of lighting in relation to space, and the importance of combining lighting as an intimate element in the architecture ; to this end, various systems of lighting have been incorporated.

Architectural lighting, the new line of thought in artificial illumination, is already revolutionising our conceptions of decorative lighting. The movement, which undoubtedly had its origin on the Continent, and was first described in this country in the columns of THE ELECTRICIAN, has a rapidly expanding sphere of application, and is already responsible for quite a number of striking installations in London and elsewhere.

The new architectural lighting demonstration room is, roughly, 450 ft. square, and is generally finished in pale green, the detail work being picked out in " modern " colours.

Outside the entrance of the room, symbolising the modern tendency, a distinctly novel porch fitting sheds a warm and inviting glow from its one-piece moulded glass surface.

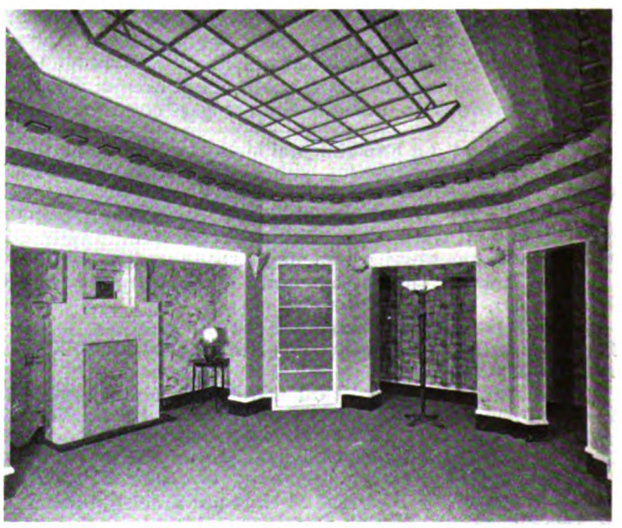
Entering the doorway, the visitor finds himself in the tiny lobby, decorated in the modern style, and lighted by a squat cylindrical fitting of warm tinted glass mounted directly on to the ceiling, while two attractive wall brackets, similar in style to the porch fitting, give additional illumination if required.

A Doorway of Light.

The main interior is reached through a low rectangular doorway which, at a touch of the switch, is transformed into a radiant frame of light by the luminous panels which form the sides of the doorway. To walk through a luminous doorway for the first time is a stimulating experience, and the visitor passes on to the main interior with a growing appetite for lighting novelty.

The main interior presents many fascinating features of a distinctly novel character. The first thing to notice is the pleasing octagonal sub-skylight which forms a large part of the ceiling of the room. Different forms of diffusing glass are employed for the sections of the skylight, which can be illuminated from above by alternative lighting systems of white and orange.

Under the skylight, and forming a strip of ceiling round the room, is a flat band which can be illuminated from concealed light sources, presenting, when the skylight is dark, an interesting feature which gives considerable character to the in-



Another corner of the architectural lighting room, an interesting feature of which is the novel treatment of the fireplace.

terior. Below this ceiling, in the form of continuous bands round the walls, are two rows of glass panels which are quite inconspicuous until illuminated, when they form two striking features which indicate the value of " built-in " lighting in imparting character to a room. Below these bands, the walls are broken into recesses, above each of which a system of

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luminous lintel lighting carries out and emphasises the horizontal lines of the band lighting system.

A notable point about these systems is their inconspicuous appearance when not illuminated. They are not lighting fittings in the ordinary sense, built out from the surface, but are flush with the building line, and consequently form an integral part of the structure.

In one recess a French doorway of diffusing glass adds warmth and cheer to the room when rendered luminous by orange sprayed lamps in reflectors concealed in the background, while on each of the pillars separating the recesses, wall brackets and appliques of modern design add to the striking character of the interior. The recesses are employed to demonstrate various types of modernist pendant fittings, and also to indicate special forms of built-in lighting for shop and domestic interiors.

An interesting system of mirror lighting is shown over the fireplace, where a mirror ornamented by sand blasted designs is illuminated by two flat sheets of luminous glass set at right angles to the mirror surface.

It is the intention of the Lighting Service Bureau to develop this form of interior lighting, and by constant revision and re-arranging of this room to enable visitors who are interested in the possibilities of this new art in lighting to see for themselves the very latest practice.

A Model Street.

For some considerable time it has been the practice of the E.L.M.A. Lighting Service Bureau to employ models for demonstrating different aspects of artificial lighting. The model factory and the model retail shop are cases in point, while in the E.L.M.A. Exhibition stand, first displayed at the I.M.E.A. Convention 1928, miniature lighting demonstrations comprise the major part of the exhibit. These models possess the advantage that they can be employed where full-size demonstrations would be out of the question, due to lack of space.

Street lighting necessitates very extensive facilities if it is to be demonstrated satisfactorily, and usually requires some considerable length of private roadway; consequently, it has always been difficult to arrange effective street lighting demonstrations at the Lighting Service Bureau. The construction of a model street was, therefore, more or less a matter of course, since this field of lighting is recognised to be of considerable importance, and one which is of interest directly, or indirectly, to every member of the community.

The class of street reproduced is a first-class city street of the Kingsway type, which provides the best facilities for miniature demonstration of street lighting, while the scale of ½ in. to the foot, to which the model is built, allows the street lighting apparatus to be faithfully reproduced.

The buildings represented at the sides of the street incorporate the architecture of certain modern London buildings, which give facilities for lighting effects, and at the same time are representative of many thoroughfares.

Obviously, the number of lighting sytems which can be employed in such a model is limited, but by the use of disappearing lamp posts, five entirely different types of street lighting are available, with the additional advantage of having only one system showing at any time above the street surface.

The street length represented by the model is 215 ft., and by the use of a plate glass mirror at the end, this is made equivalent to 430 ft. The width of the street from kerb line to kerb line is 50 ft., representing an average width for a modern thoroughfare, while the pavements are 18 ft. wide.

The following five systems of street lighting are represented: Ten 12 ft. converted gas lamps on 40 ft. spacing, containing 1 lamp, equivalent to 100 W; ten 15 ft. columns on a 40 ft. spacing, carrying single pole top unit, with lamp equivalent to 200 W (5 units per side on kerb line); eight 20 ft. columns with dispersive lanterns on 50 ft. spacing, equipped with lamp equivalent to 1 000 W; eight 3-light pole top units on 20 ft. columns on 50 ft. spacing, with lamps equivalent to 300 W; three dispersive lantern units, on centre islands, with lamps equivalent to 1 000 W.

The system of switching employed in connection with the street lighting fittings enables units in each kerb line system to be controlled so that three spacing arrangements are obtained, and by this means the usefulness of the model is greatly increased, due to the comparisons which can be drawn from different spacing arrangements for any one system. No fewer than 14 different arrangements of street lighting can be demonstrated, while it is intended at a later date to instal additional experimental systems.

In addition to the street lighting itself, other lighting features are incorporated on the buildings, including lighting of the miniature shop windows, the lighting of some of the windows above the ground floor, floodlighting of the shop facades, and facilities are provided for the introduction of electrical advertising devices. By this means the model is not only rendered more valuable from a street lighting point of view, since these effects give added realism, but is also of value to those visitors not directly interested in street lighting, but more particularly concerned with lighting for shops and offices.

The model lends itself, of course, to almost endless change and extension. It is hoped, for instance, to include on the street surface model vehicles and pedestrians, while the introduction of variable street surfaces, designed to represent different road finishes under both dry and wet conditions, will increase the value of the model from a comparative point of view.

The effective model used for realistic demonstrations of street lighting. An ingenious arrangement permits the lamp standards to be changed to allow of five different types of lighting to be shown, with only one system appearing at any time above the street surface.

It is anticipated by the Lighting Service Bureau that this model will prove of very considerable value to all engaged in street lighting problems, and in particular to the non-technical members of public lighting committees.

One of the efforts which the Bureau will make during the present year will be the organisation of a series of street lighting lectures, which can now be delivered in the fascinating manner which is characteristic of all the educational work of the Bureau; every argument being backed by convincing demonstrations which accord with the Bureau slogan: "Seeing is Believing."

POINTS OF VIEW.

We shall move before long into better times.—*The Prime Minister.*

* * *

The electron is a dummy in the same way that a ray of light is a dummy.—*Prof. A. S. Eddington.*

* * *

There is not the slightest truth in the suggestion that the London County Council intends to sell or to lease the trams to the traffic combine.—*Mr. E. H. Kemp.*

* * *

The main characteristic of the broadcasting service is still a restless, unsatisfiable enterprise animated by deep consciousness of public responsibility.—*Sir John Reith.*

* * *

We cannot play our part towards the objective of cheap electrical supply throughout the industry without the co-operation of every organisation within the industry.—*Mr. Frank Hodges.*

BOOKS RECEIVED.

"Omnibus Lighting and Starting." By J. W. Houghton (London: The Fanfare Press.) Pp. 66. 2s. 6d. net.

List of Members of the Institution of Civil Engineers. (Addresses corrected to January 1st, 1929.) (London: Institution of Civil Engineers.)

"Mechanical World" Electrical Pocket Book, 1929. (London and Manchester: Emmott and Co.) 1s. 6d. net.

"Matthew Murray." Edited by E. Kilburn Scott. (Leeds: Edwin Jowitt, Ltd.) Pp. 132. 2s. 6d. net.

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ELECTRICAL SALESMANSHIP.*

Developing Sales in a Small Town—Accurate Survey of Potential Users—Reaching the Local Tradesmen—Applying the "Snowball" Principle.

By "SALES MANAGER."

THE position of the manager of an electricity undertaking seems an enviable one to the man whose job it is to market a highly competitive line which is by way of being a doubtful seller, or rather a seller which needs a great deal of selling. These difficult lines are the acid test of sales-management, and it is rightly argued that a man who can put across a line which bristles with difficulties may be regarded as an "ace" of salesmanship.

The man who has the job of selling electricity has an interested potential clientéle already made for him. His customers want the many conveniences electricity can give them, and they do not use that phrase which has broken the hearts of many would-be salesmen—"Not interested."

Ready-made Interest.

Electricity grips the average man or woman with a sort of wonderment. They do not understand how it functions; they do not know positive from negative; the mysteries of amps and volts are profound to the ordinary citizen. What they do know, however, is the cleanliness and convenience of electricity; and they are willing, anxious indeed, to know more.

Let us assume that this undertaking we are using for illustration purposes has the usual competition of gas to face in its community. A long-established, well-run and courteous service is given by the gas company, and the advantages that gas claims are driven home with a steady persistence that holds gas in its position.

A certain number of customers are already on the books of the electricity undertaking, and the problem before the manager is the rapid extension of the present business. How can he best set about the job?

In the first place, he must make himself a local figure, a man who is known to all the townsfolk and a man who is a good "mixer" has a great advantage over a taciturn, slightly misanthropic individual. The ideal manager is a member of all local societies worth joining. He knows the tradespeople of the town, and he is regarded favourably by the local magnates.

During his "probation"—for that is what it amounts to—as a local inhabitant, he has caused an accurate survey of potential users to be made, and on the return he has obtained he proceeds to canvass his potential customers. He must not expect to run before he walks: he is dealing with one of the most conservative types of community we possess, and that is certainly saying something!

His showroom needs to be a place of real interest, and he can often secure valuable co-operation from other people in the town. He may one day find an opportunity for the local sewing machine people to use his window for a demonstration of hem-stitching by an electrically-driven sewing machine. I cannot imagine anything likely to interest women more than the sight of the beautiful work that is done so speedily by such means, unless it is the comfort and convenience of an electric iron, a demonstration of which can be given on another day. Then he has the opportunity of demonstrating such articles as cookers, washers, suction cleaners, etc. Possibly sales will not be over large in some of these lines, but this need not worry him, as he has a twofold purpose in view—first, certainly, selling, and, secondly, creating interest in the many manifestations of the uses to which electricity may be put.

Simultaneously with his showroom work, our manager will carry on an intensive campaign amongst the local tradesmen and residents. He will be at pains to show how electrical illumination can make the dullest shop front attractive and bring those dull back parts, which so many shops in our smaller towns possess, into active selling agency. He may go so far as to fix up a demonstration in his own showrooms, using a conglomeration of merchandise for the purpose.

The local tradesmen as a general rule are not handicapped by lack of funds, and so the advantages of electricity will not be demonstrated to an impecunious audience. Each local tradesman who adopts electricity will be a "booster" of electricity amongst his customers, and so the "snowball" principle will apply—each new user being determined to get recruits for the new "marvels," to show how wise he has been in moving with the times.

Visitors to the showroom will have been identified, and a card index of callers will have been brought into existence. Each of these obviously interested potential customers will be called upon, and close contact will be kept with those who are not immediate buyers! All the usual arguments, pro and con, will be dealt with, and by degrees there will be created a local prestige atmosphere for electricity. It will not do for Mrs. So-and-so to be ahead of Mrs. This-and-that, and a more or less friendly competition for electricity can be developed. Each buyer of an electric iron, an electric fire, an electric cooker or a suction cleaner will make others anxious not to be outdone, and the possibilities of selling equipment will be continuous so long as manufacturers continue to exercise ingenuity and imagination.

The "shyest" elements amongst the local inhabitants will need more drastic treatment. They must be circularised systematically and ingeniously, with sales-promotion matter calculated to arouse interest and create a desire for possession. Matter of this kind is not easy to define, but local interests can be used to create interest; nothing personal, of course, but local communities are very "community conscious."

All these systematised efforts sound simple enough when you read of them; but no one knows better than the writer that they are all too rarely practised. He knows so well the seeming apathy that is encountered in our smaller towns; the apparent lack of enterprise which seems to possess the local tradespeople: the scarcely veiled antagonism that appears to confront a newcomer.

But all these difficulties are more difficult in imagination than they are in fact. The undercurrent of social and civic life runs very vigorously in these smaller communities. The local tradesmen are as quick of grasp as their metropolitan or urban counterparts, and the apparent antagonism is often enough nothing more formidable than shyness.

The manager who has the right temperament can achieve both success and happiness in the peace of a country town, but he must have patience and courtesy combined with capacity for consistent hard work.

*This is the third article on this subject. Our contributor places himself in the position of the manager of a local electricity undertaking.

CORRESPONDENCE.

The Editor welcomes the free expression in these columns of genuine opinion on matters of public interest, although he disclaims responsibility alike for the opinions themselves and the manner of their expression.

"Electricity Supply and the Consumer."

[To the Editor.]

SIR,—Mr. H. M. Sayers seems to object to my having criticised, or made an occasion of Dr. Lulofs's recent discussion on "Domestic Tariffs." I do not know why, so I am unable to reply to his opening observation.

I am next accused of making sweeping statements. All that I intended to convey was that Dr. Lulofs, having found a workable quantity tariff, considered it wiser to abandon it in favour of a general average, whereas, in this country a large body of opinion, including Mr. Sayers, considers it a duty to afford the maximum of amenity, etc., by tariffs which approximately charge each consumer in proportion to what it costs to supply each. "That this cannot be carried out exactly is obvious and admitted."

In reply to Mr. Sayers's observation that to charge on the basis of consumption is a serious departure from equity and sound commercial principle, I would refer to the quantity tariff indicated by Dr. Lulofs.

With regard to the ordinary man's demand for "equal quantities of the same article at the same price," I suggest that the growing popularity of the rateable value system, recently approved by the Electricity Commissioners, is a sufficient answer. Under this system a consumer buys electricity for any purpose, or for use at any time, at a decreasing rate for quantity. In large power supplies a quantity tariff is extensively used. I leave it to those concerned to defend their position.

With regard to mains, I think that Mr. Sayers agrees that

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it is most improper to charge on the basis of kW demand without regard to the degree of utilisation. Also management charges on the kW demand. If it is agreed that some of these heavy charges should be deleted from the kW demand charge and recovered as a charge per consumer, or per kWh sold, it is obvious that the remaining load factor element must be watered down considerably. In these circumstances it remains to be seen whether an assumed load factor, for a large number of consumers of similar quantity, say, up to 100, 500, 1 000, 5 000 20 000, 100 000 kWh per annum, etc., would not be reasonably equitable, bearing in mind the watered down load factor element of cost.

The only serious difficulty would be the change-over from the many existing forms of tariff; but if it was undertaken in easy stages by a large number of supply authorities it could no doubt be accomplished.

The present dissatisfaction, I suggest, arises more from the comparison of the charges in different areas of supply than from the consumer's estimate of the value of electricity in comparison with other agents.

For example, a 1 H.P. motor at 3d. or 4d. per kWh for small quantities would be cheap compared with manual labour, but a sudden jump from 1d. to 3d. would no doubt raise a storm of protest. It might be done if spread over four or five years.

So long as we use underground mains for l.t. distribution I think that it will be agreed that a supply cannot be given to small consumers, say, 100 kWh p.a., at anything like 4d. per kWh. If the charges all over the country were nearly double for this amount, it would still be saleable, and a more equitable charge might relieve the tax on other quantities where the competition with other agents is more acute. By such a tariff, which covers the whole range, from small consumers up to those of a million or more kWh per annum, the whole system is kept under review, which I suggest is a sounder commercial method than the mixture of tariffs on different principles, applied to various groups of consumers, which is customary to-day.—I am, etc.,

J. RUTHERFORD BLAIKIE.

29, Stanley Street,
Bedford.
March 11th.

[TO THE EDITOR.]

SIR,—Mr. Blaikie's views on the effect of load factor will not be universally accepted. Is it not witnessed, both by theory and by practice, that neglect to take into consideration this important factor will result adversely, both to consumer and to supply authority, in more cases than is convenient?

The writer has never met any fairer system than that adopted by the companies formed by the Power Development Co., as to the means by which a suitable fixed charge (in addition to the unit charge) may be arrived at for each class of consumer.

Mr. Sayers's objection to the defect of such methods—which is admitted, i.e., suspicion on the part of the consumer—can surely be met by good salesmanship, the solution, indeed, to many of our problems.—I am, etc.,

J. A. D. LAWTON.

Electricity House,
Chapel-en-le-Frith.
March 7th.

Steel Conductors for Power Lines.

[TO THE EDITOR.]

SIR,—The writer referred to the use of steel conductors of almost a quarter a century ago, and at a time when the grades and qualities of ferrous metals were different to those of to-day.

For a country such as this, which can hardly be excelled for the maximum amount of rust formation on metal surfaces, etc., the writer cannot very well recommend steel conductors at these times for the majority of branch rural lines.

Two of the chief reasons why they were given preference, in the early days referred to, was because the I^2R loss did not matter much due to hydro-electric excess and so forth, and the climate was a very dry one nearly all the year round. From the conductor viewpoint only, at the present time there are a few high-strength and/or high-conductivity, non-rusting and semi-ferreous and/or non-ferreous, durable and dependable factor-of-safety, composite-metal conductors. In the matter of higher strength, cadmium copper can be drawn to 50% greater tensile strength than ordinary commercial copper; cadmium copper is usually based on a standard alloy giving 60% of the conductivity of *pure* copper as against about 10 to 12 per cent. for steel often used. A conductor of aluminium-bronze is better than steel, and it may well be considered technically, etc., because of its resistance to corrosion, its high tensile strength, and its resistance to fatigue; in manufacture, it can be drawn to a tensile strength of 60 tons per sq. inch. Aluminium-bronze also compares well in weight, being less in weight than copper.

The paper by Mr. Walton has been noted. The discussion would seem to show that the factor of inductive reactance can become serious, as already mentioned. Just what this condition refers to is not mentioned in the discussion. However, based entirely on 15 000 V a.c. overhead-line operating experience of long ago, the excessive voltage drop during heavy current flow or partial short-circuit and other fault conditions differed widely from d.c. circuit conditions, etc. The ratio of resistance to reactance for steel and copper cannot be compared for the two distinct metals.—I am, etc.,

WILLIAM T. TAYLOR.

London, N.2.

Qualifications for Wireless Trade Membership.

[TO THE EDITOR.]

SIR,—Your correspondent "Quizzical" in the issue of your journal for March 8th indicates that "some of the 'dabblers' have far more technical knowledge than some of the radio retailers." The only logical inference to be drawn from this observation would be that he considers "dabblers" more entitled to trade terms than "radio dealers." If, as is to be supposed, he does not really mean this, he would not appear to be helping in the solution of an already sufficiently complicated issue.

As a matter of fact "the exception proves the rule," and there is little doubt that in the great majority of cases the position is the exact reverse of that suggested. Dealers are, indeed, continually complaining that sets constructed by the "dabbling" fraternity are constantly being brought to them to be overhauled.

He goes on to say that "the radio trade in general is at fault in not encouraging the development of its retail sales through electrical engineers." But why blame the trade, and, presumably by implication, the wireless trade associations? Surely electrical engineers started with an advantage over all others than genuine experimenters and students of wireless!

If they neglected their opportunity they cannot blame the trade associations, and certainly not the Wireless Retailers' Association, which has always encouraged the membership of *bona fide* dealers with suitable premises, adequate stock and technical knowledge. It still does, and will continue to do so.

A very considerable number of electrical engineers are already members of the W.R.A., and it welcomes all those who have definitely embarked in wireless as part of their business.

The only reasonable and practical course is for them to join the Association and help to mould their own destinies in the wireless world.—We are, etc.,

CLIFFORD AND CLIFFORD,
Hon Secretaries, The Wireless Retailers' Association.

70, Finsbury Pavement,
London, E.C.2,
March 12th.

Telephones in China and Japan.

[TO THE EDITOR.]

SIR,—From certain statements made in the article—"Telephones in China and Japan"—which appears on page 235 of your issue dated February 22nd, it is evident that the writer is not thoroughly *au fait* with his subject.

Thus, to label the Japanese telephone authorities as unprogressive in respect of telephone system and equipment in Japan is scarcely consonant with their policy in regard to Tokyo, the chief city, already equipped with automatic telephones to the tune of some 57 000, served by 11 automatic exchanges.

Other towns similarly equipped or in process of equipment are Kyoto, 9 300 lines; Kobe, 6 700 lines; Osaka, 10 500 lines; Nagoya, 6 300 lines; and Yokohama, 12 000 lines, all operating, or shortly to operate, on the latest and most approved dial system.

Thus the automatic telephone equipment at Dairen, manufactured by this company and installed eight years ago, although marking an early appreciation by the Japanese of

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the desirability of marching with the times in telephone practice, is not the largest of its kind in the Far East, as stated in the concluding paragraph of the article.

In point of fact, Japan was displaying a close interest in the Strowger dial system over ten years ago, the installation at Dairen being the first practical trial of the system on a large scale. A year later we supplied a small equipment for Teishinsho, Tokyo, the Japanese equivalent of our General Post Office.

So satisfied were the Japanese telephone authorities with these early trials that they were planning to introduce the system gradually in the capital when the great earthquake of 1923 precipitated a complete reconstruction of Tokyo's telephone service, and since that date the automatic network in the city has grown to nearly 60 000 lines, the greater portion of the equipment having been manufactured at our works in Liverpool.

Our engineers are in close and regular touch with the Japanese Telephone Administration, who display marked enterprise, and are straining every nerve to bring the telephone service of their country into line with the latest approved American and European standards.

In the circumstances, we think you will agree that the writer of the article in question scarcely does justice to a nation which is at least on a level with this country in modern telephone practice, if not in development.—I am, etc.,

For the AUTOMATIC TELEPHONE MFG., CO., LTD.
J. W. CATCHPOLE.

[We have submitted this letter to the writer of the article, who replies as follows:—" Japan had about 600 000 telephones in use in 1928 as against a population of over 65 000 000. The trouble is, there are not sufficient telephones to meet the demand, and the organisation by the Department of Communications is imperfect. In some of the larger cities the Japanese Telephone Administration has shown marked progress in recent years, but, taken as a whole, Japan is still far behind American and European standards, and when it comes to actual operation and efficiency, it cannot compare with either. In spite of the remarks your correspondent makes, I am still of the opinion that Japan would benefit by adopting the course suggested in the penultimate paragraph of my article. As regards my statement that the automatic telephone exchange in Dairen was the largest of its kind in the Far-East, a larger one may have been erected since I wrote this article, but this, as well as every statement and all statistics given in it, were carefully checked by reference to reliable reports. I spent nine years in the Far-East (China and Japan) in business."—ED.]

HOW WILL SHODDY WIRING BE STOPPED?

Wide Recognition of the Evil but no Practical Remedy Offered—Recent "Shoddy" Examples include 3 kW Fires and Electric Washers on Lampholder Adaptors.

By HARRY MOSS, A.M.I.E.E.

ALTHOUGH I am told that my articles on "Shoddy Wiring" and "Registration" have made a great impression in electrical circles all over the country, and that the photographs of shoddy work have been a means of focussing the closer attention of supply engineers and their inspectors on the work carried out for connection to their supplies, the absorbing question, "How will shoddy wiring be stopped?" is still unanswered.

During the past few weeks I have been in conversation with many representatives of the supply, manufacturing and contracting sections of the industry, and whilst everyone, without a single exception, is deeply concerned about the whole subject and would like to see an end put to the present state of affairs, not one could see how the desired result would be attained.

It will not, however, be out of place to summarise the opinions and to broadcast what is being done.

A very large manufacturer, noted for his first-class products, is intensely keen on the abolition of the "kerb-stoner" and the complete cessation of shoddy wiring, and thinks that combined action of the respective representatives of the various electrical organisations could do much to curb the evil. Manufacturers and factors, by a careful survey and analysis of their clients, with a weeding out and refusal to supply those, whom they often must know, who are not doing good work and not carrying out an electrical installation business as it should be, and the supply authorities by a much closer inspection of any installation to be connected to their supply that has been put in by a firm that is not a member of the E.C.A. or is not registered.

A central station engineer with whom I was discussing the question has made a point of having every application form carefully scrutinised and if the contractor's name that appears on it is not an E.C.A. or registered firm an inspector goes on the job every day, examines the work and materials, and when any kind of a specification has been given to the customer, sees that he gets his full value and is not "twisted" out of C.M.A. made wire, English accessories and E.L.M.A. lamps, and also keeps a careful watch on the wiring that is going out of sight, and the workmanship that is being put in. In fact, generally speaking, this engineer is a big thorn in the side of the "shoddy" firms in his district, and his efforts will either kill them and their cut-throat prices, or will be the means of improving their work to such an extent that it will be respectably good.

The factors with whom I have spoken do not want the "jerry" man or firm, but their difficulty appears to be that if the big, genuine, reliable factors do not, or will not, supply these "shoddy" firms with small parcels of goods, the same materials are obtained from other firms who call themselves factors; this is a big weakness in the electrical industry. The sooner the list of wholesalers and factors is reduced to about one-tenth of what it is at the present time, the better, as this would be the means of stopping the source of supply to the "parasites" in the contracting industry.

Other people ask why the old-established E.C.A., with its membership of reputable firms, cannot run in double harness with its younger brother, the Registration Authority, and go all out for the "elimination of the unfit" in contracting, as the E.C.A. has a power through its allied associations that the other organisation has not.

How does the "shoddy" man carry on and get the work? Simply on price. Take the following instances, which have come to my notice during the last few days: A cheap-jack man put a 3 kW radiator in a house. Did he wire up a 10-15 A plug for this? Oh, no. He put in a lampholder adaptor and plugged into a lampholder! Needless to say, trouble developed.

I, personally, was called into a house to give a price for an extension of lighting, and was told the previous contractor who had done the work was a very cheap man; he is now bankrupt, and I soon found out why. When this shoddy man added radiators to the old installation he never altered the mains and he hung his wires upon the walls like string. Needless to say, the supply authority was never informed of this extension and it has not been inspected. (I am, however, attending to this.) This prospective customer expected 150 W lighting points, each on a separate switch, complete with shade, at 10s. per point!

The automobile engineer and so-called "electrician" gets a job to fit up some new houses in his locality and uses "jerry" switches of a very doubtful quality, such as are used on some motor cars on a 6 V supply, for controlling the lights in the houses he fits up. Poor devil, he knows no better, but the genuine trade is suffering.

A few days ago one of my men found an electric washer, which has been installed 18 months working on a twin flex with a plug adaptor from a lampholder on a 230 V a.c. supply. When I reported this to the owner and notified him of the risks, he said they had had several shocks since it was installed, but he did not know that there was anything really wrong. This was another case of installation by an incompetent fool. It is now being remedied.

The following conversation on the training of "electricians" took place in a County Court a few days ago:—

BOY, TO THE REGISTRAR: "I have been learning the electrical engineering trade."
REGISTRAR: "Let me test you. What is an ampere?"
BOY: "I don't know."
REGISTRAR: "What is a short circuit?"
BOY: "I don't know."
REGISTRAR: "What did you do?"
BOY: "I painted a fence and broke up two perambulators."

In view of this, I again repeat my question: "How will shoddy wiring be stopped?"

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DOMESTIC ELECTRICAL & RADIO APPLIANCES.

Brief Description of New Apparatus and Equipment—Lighting Fittings, Skirting Panel Heaters—Fountains for Use in the Home—Special Kettles for Electric Cookers—A New Radio-gramophone Instrument.

A WIDE range of "Luminia" fountains has been introduced by Messrs. PHILLIPS AND MACCONNAL, of 16, Conduit Street, London, W.1. These fountains are fashioned in bronze, are easily installed and work automatically, on a given quantity of water, that is to say there is neither inflow nor outflow. The devices produce over forty colour effects during motion.

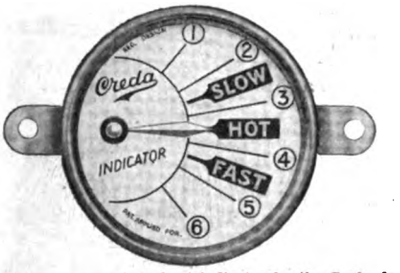
The MIDLAND ELECTRIC MANUFACTURING CO., LTD., Barford Street, Birmingham, has now introduced a larger size of their well-known "Memset" combined double pole switch and 2-way double pole fuses. The new size of this pattern is rated at 30 A and the unit makes it possible to use this very useful combination in small houses where cooking and heating is installed. Each fuse is of the same rating as the switch, so that the load may be split into any convenient values. It is pointed out by the makers that it sometimes happens that the circuits are split into lighting and heating, with practically all the capacity of the switch on one pair of fuses. Another advantage is that the larger the fuses the more effective the protection in the event of serious overload or short circuit.

A range of specially made kettles constructed to the design of Mr. J. Mould, electrical engineer of the Leicester Corporation electricity undertaking, is being manufactured by SIGG, LTD., of 469, Holloway Road, London, N. These kettles do not contain heating elements but have been so made as to exactly fit the hot-plate opening of the cookers supplied by the corporation. The kettle is of the 3-pint size, with an 8-in. diameter and is made entirely in one piece from a single circle, with a welded spout. The makers advise us that the design is for use with the products of the MANOR ELECTRIC OVEN AND FIRE CO., LTD., 305, High Road, Chiswick, London, W., and boils in about 7¾ to 8½ minutes.

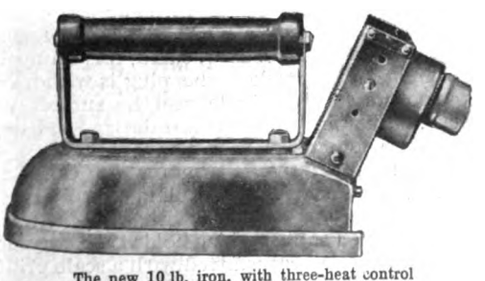
Mr. H. H. PERRY, 23, Holland Road, Kensington, London, W.14, has produced a new type of skirting heater which is intended to fill those needs where it is desired to use other than tubular, though similar, devices. The skirting panel heater is designed so that the projection from a wall will be not more than 1¼ in., and the standard lengths may be joined up as one continuous length by means of saddle covers. The heater is provided with a stout backing of heat resisting material so that only a small proportion of heat is absorbed by the wall, while the greater proportion is radiated at right angles from the wall in the direction most effective for general heating. The heating curve is much the same as with a tube, but it is claimed that the cooling extends over a longer period for the same energy consumption. Heating elements are arranged to give a 2-heat control. The series-parallel arrangement is not advocated by Mr. Perry and in the new heater a tapped series circuit is used so that the low heat can be adapted to any proportions of 100 per cent.—preferably 70 per cent. Three terminals are provided at the ends of each sectional length and are bridged across under the saddle covers where multiple lengths are used. The supply connections can be joined up at either terminal end as may be convenient, or at any of the saddle covers. The appliance is extremely simple, reliable for good insulation and inexpensive to manufacture. The standard lengths are 3, 4, 6 and 7 feet and the covers can be painted in any colour suitable to the surroundings. The heating element is run at a black heat and is therefore not subject to oxidisation. The depth of 4½ in. can easily be accommodated on most skirting.

As recently announced, PHILIPS LAMPS, LTD., 145, Charing Cross Road, London, W.C.2, are introducing a comprehensive range of commercial and industrial fittings. Details are now available of some of the commercial fittings which will be known by the trade name of "Phililite." The accompanying illustration shows type D.B. which is made in two sizes suitable for 40-100 W and 100-200 W lamps respectively. Among the advantages claimed for these fittings are ease of erection, low absorption, three-ply glass being used. The chain suspension is of a new design and permits links to be removed or added for the purpose of shortening or lengthening the chain, with minimum labour and time.

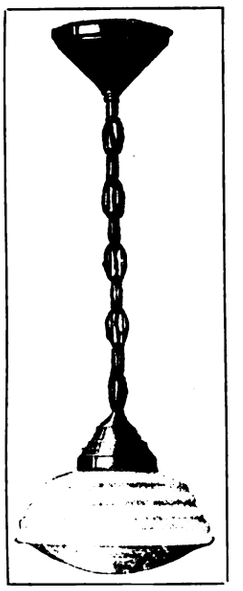
The ATTRACTA ELECTRICAL CO., 2 and 3, Tichfield Street, London, W.1, has put on the market a rotating mirror bowl for spectacular lighting effects in cinemas, dance halls, windows, etc. The bowl is made of aluminium and is studded with a quantity of small glass mirrors. The whole outfit is automatic in action and is suspended on chains to a clockwork motor which will revolve the bowl for 7 to 8 hours with one winding. Beams of white or coloured light are projected on to the bowl by means of one or more spotlight fittings which can be supplied with the bowl if desired and the reflected beams produce a pleasing colour-changing spectacle. The bowl is made in two types, A and B, with diameters of 18 in. and 24 in. respectively. Two types of projector lantern are available with 6 in. lenses, with or without a telescopic stand.



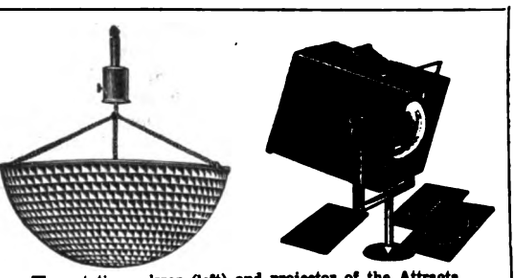
The non-mercury type heat indicator by the Credenda Conduits Co., Ltd.



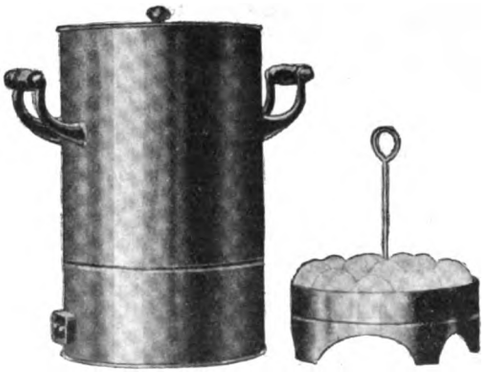
The new 10 lb. iron, with three-heat control by the Electric Heating Co.



The new type D.B. "Phililite" fitting by Philips Lamps, Ltd.



The rotating mirror (left) and projector of the Attracta Electrical Co., for dance halls, etc.



The egg boiler introduced by the Electric Heating Co., two tiers may be used if desired.

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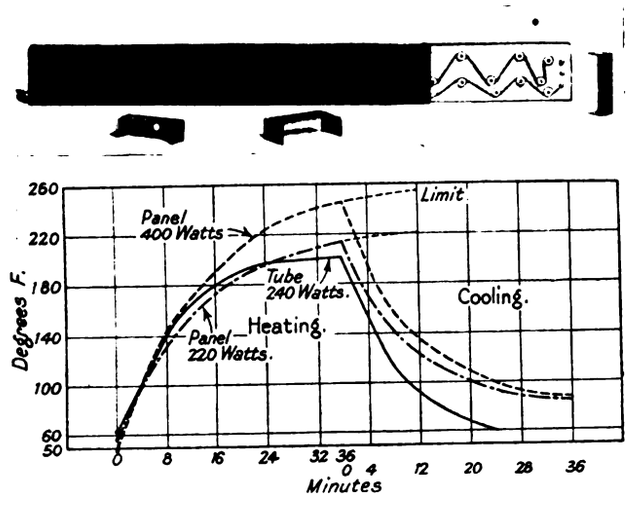
It may not be generally known that WALKER, HUNTER AND CO., LTD., Port Dominic Iron Works, Falkirk, has for some considerable time placed on the market commercial apparatus, such as electric bakers' ovens, baking plates, dough-nut cookers, fish fryers, etc. A large range of fires is also available. Referring to the bakery equipment in particular,



Above, the Perry skirting panel heater and, below, some of the efficiency curves obtained.

the ovens have many special patented features embodied in the design, while the dough-nut and fish fryers are fitted with a special lifting gear which permits of the basket being lifted and suspended directly above the pan, a considerable saving in oil thus being effected, while the cooked products are freed from surplus fat. Another product is a large grill fitted with a warming compartment situated below the grill chamber in which plates are heated on edge. This grill is fitted with a gravy drawer, the base of the grilling compartment being in the form of a chute with a draining hole in the centre through which the fats given off during the grilling, pass into the gravy drawer beneath. Above the grilling compartment another hot chamber is situated for keeping the food hot, this being heated by conduction from the grill. A large roasting oven in several types is also manufactured with the control gear mounted above the ovens. A range of hot cupboards is another line, and these are fitted with heating elements below the bottom shelf of the cupboard, also beneath the top plate which can be arranged either as a plain top or fitted with carving dishes and covers.

The GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C., has recently placed on the market a double-pole double-break interlocked earthed pattern 3-pin switch-plug for 15 A at 250 V. This accessory, which is of robust construction, complies with the I.E.E. regulations. The switch is of the underslung type, having a long throw with rapid make-and-break, and the whole mechanism, together with socket tubes, is mounted in an English vitreous porcelain base. The dimensions of the face plate are 5 in. by 3 in. This plate is of heavy gauge brass and can be fitted either flush with the skirting board or semi-recessed with a teak surround, which is supplied as standard. The finish of the metal parts is of black bronze, but alternative finishes in polished brass, oxidised copper and oxidised silver are also available.

Among the many applications to which electricity was put at the Business Efficiency Exhibition which concluded at Olympia, London, recently, none was more prominent than that of "individual" lighting as applied to desks, etc. A large variety of suitable fittings, shades, standards, etc., was shown by the TYPERLITE COMPANY, LTD., 86, Cannon Street, London, E.C.4. In addition a number of other exhibitors showed these lamps as one of the accessories to their own particular products.

The ELECTRIC HEATING CO., of George Street, Croydon, has sent us particulars of a 10 lb. tailor's iron, having a three-heat series parallel control fitted on the iron. The loading is 200-400-800 W. The control is carried in a special box near the handle and the connecting lead is brought out at the side of the box and guarded at the exit by a special spring and insulation bush. A sliding panel is provided in the switch-box for easy access, the whole being nickel plated. The same company is marketing an egg boiler for hotels, tea rooms, etc. The normal capacity of the boiler is 8 eggs, but a 2-tier egg carrier can be supplied to bring the total capacity up to 16. The apparatus is constructed with a stout copper boiler to reduce radiation losses as far as possible, the loading being 1 000 W.

The CREDENDA CONDUITS CO., LTD., Oldbury, Birmingham, has introduced a new non-mercury type heat indicator, for use with electric cooking apparatus, but nevertheless suitable for any heating device. This indicator is claimed to be more reliable than a mercury type, less easy to break, easier to read, and is in many cases interchangeable. These indicators are made not only for "Creda" apparatus, but also for other interested manufacturers.

MAYFAIR ENTERPRISES, LTD., of 5 and 6, Cork Street, W.1, have recently given us a demonstration of the "Sonodyne" electrically amplified gramophone and wireless receiver. The instrument is made in four models. The ordinary house model consists of a simply controlled wireless receiver and electrically driven gramophone turn-table with either a G.E.C. or B.T.-H. pick-up and utilising two stages of amplification. The loud speaker is built into the cabinet and the instrument is self-contained. The concert model is similar to the house model but has a further stage of amplification. This instrument will work any reasonable number of loud speakers. The cinema model has no wireless equipment but is fitted with twin electric turntables, and change-over switch, two large capacity accumulators, and two loud speakers in plain polished baffles. The instrument is in a steel cabinet complying with Home Office requirements. It has three stages of amplification and gives sufficient volume to fill the largest picture house or dance hall. There is also a junior model without wireless but fitted with an amplifier. It has, however, a plug-in switch from which the output of a wireless receiver can be amplified. The clarity of the tone of these instruments is good and reproduction of the human voice from the ordinary gramophone record is free from background noises.

The REVO ELECTRICAL CO., LTD., Queen Street, Kingsway, London, W.C.2, has introduced a new bowl fire under the name of "Nouveau." The frame is of cast iron and adjustment is obtained by means of a back leg, the whole unit representing a departure from the more orthodox design. The overall dimensions are 14 in. wide, 14 in. high by 8 in. deep, the diameter of the bowl being 11 in. It is rated at 600 W.

The GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C., has just brought out an improved design of watertight quick make-and-break switch. Enclosed in a strong cast iron case, this switch is operated by a solid brass pointer type side handle. A boss on the inside of the operating lever enters a machined hole in the side of the casting and keys with a spindle connected to an inside arm; these components are drawn together by a substantial screw through the gland, which is packed with tallowed hemp, thereby forming a well-lubricated watertight gland. The domed lid is fixed by two roundhead brass screws, and a rubber gasket is provided between lid and box. Two fixing lugs are provided with countersunk holes and a third lug is included into which is fixed a large sized brass round-headed screw with washer for earth connection. The convenient position of the conduit hole renders unnecessary any set or bend in the conduit.

The specially designed kettle for use with electric cookers, by Sigg, Ltd.

We have received from SANTON, LTD., samples of a 5A 3 pin plug made in accordance with B.E.S.A. specification. The design of the porcelain base is unique and, it is claimed, is capable of quenching the arc when the plug is withdrawn. The projecting sockets for each pole are the subject of a provisional patent. The pins are a special design, and being loose adjust themselves for smooth even contact.

We have received from FREDK. J. GORDON AND CO., LTD., 92, Charlotte Street, London, W.1, particulars of the "Break-not" hydrometer. This unit is fitted with a 24-in. nozzle and has a safety base of red rubber which holds the instrument in an upright position. The float is fitted with a scale printed in three colours, and is arranged with heavy glass beads to overcome the difficulty of preventing the float from sticking to the interior of the glass container.

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NEWS IN BRIEF.

LEEDS Electricity Committee has decided upon the purchase of 5 000 prepayment meters.

Telegraphic transmission of pictures between Melbourne and Sydney will begin shortly.

York Education Committee is to obtain estimates for lighting the Fulford Road open-air school by electricity.

Hull Corporation has asked the City Engineer to report on the cost of operating the Drypool Bridge by electricity.

At the Temple Bar (London) telephone exchange a change has been made from the manual to the automatic system.

The Commissioners of H.M. Works, etc., have invited tenders for the erection of telephone exchanges at Leyton and Stockport.

The annual dinner of the Nottingham Branch of the E.C.A. was held on March 7th, with Mr. E. A. Harvey, president of the Branch, in the chair.

Stretford Electricity Committee is making inquiries regarding a suggested site in the Old Trafford district for the erection of electricity showrooms.

The Wiltshire County Architect has been instructed to arrange for an electric light installation at the Methuen Council Infants' School, at Corsham.

Brighton Lighting Committee recommends a scheme for assisted wiring, and has asked the engineer, Mr. John Christie, to obtain tenders from local contractors.

A film dealing with the application of electricity to agriculture was shown by Mr. R. Borlase Matthews on March 8th, at the Institution of Mechanical Engineers, London.

The British Columbia Power Corporation proposes to develop electrical energy at Campbell River Falls, Vancouver Island. It is estimated that 40 000 H.P. can be developed at this site and 75 000 by the use of Buttles Lake in Strathcona Park.

A deputation of Paisley Town Councillors recently visited Edinburgh and various English centres to study the working of automatic traffic signals, and it has now been recommended by them that a trial be given to the system in Paisley.

The first luncheon of the Leeds and West Riding Branch of the Electrical Association for Women was held at the Queen's Hotel, Leeds, on March 8th. The inaugural meeting of the Bristol and District Branch of the Association took place at Bristol Rotary House on March 5th.

A sectional meeting of the World Power Conference on the Utilisation of Water Power Resources will be held at Barcelona from May 15th to 23rd, during the Barcelona Fair. The meeting has been organised by the Spanish National Committee of the Conference. Programme, etc., from the Secretary, 63, Lincoln's Inn Fields, London, W.C.

The Minister of Transport informed the Conservative Parliamentary Agricultural Committee, last week, that the Ministry is considering the appointment of a whole-time expert to study the problems of electrical development in rural areas. Arrangements have been made for a practical experiment, based to some extent on the hire-purchase system.

The Faraday Lecture on "How Electricity does Things," was delivered by Mr. Ll. B. Atkinson on March 8th, at the Cowdray Hall, Aberdeen, to an audience limited only by the size of the hall. The Marquess of Aberdeen presided. Mr. D. S. Munro and Mr. D. M. McLeod proposed votes of thanks to the lecturer and the chairman, respectively.

The British Association has received from the City of London Court of Common Council the expression of a hope that London will be selected as the place of meeting in the centenary year, 1931, and offering entertainment to the Association in that event. This invitation has been accepted. The centenary meeting will be the first meeting of the Association ever held in London.

A new series of specially conducted tours is being arranged, under the auspices of King Edward's Hospital Fund, for London this year. The programme will open with a visit to the Regent and Gerrard telephone exchanges on March 23rd, at 2.30 p.m. After inspecting the two exchanges, the visitors will be entertained to tea. Tickets (price 7s. 6d.) may be obtained from the Secretary of the Fund, 7, Walbrook, E.C.4.

Coun. J. Stanworth, president of the National Chamber of Trade, at a recent gathering at Blackburn, expressed the view that firms who do not advertise pay for the advertising of those who do, for by the influence of good advertising many unbranded and unadvertised articles are being gradually displaced. Character, ability, knowledge and tact are essential to good salesmanship. The chief cause of failure among salesmen is lack of confidence, due to want of knowledge.

OVERSEAS TRADE.

Two Months' Exports of Electrical Goods Exceed Imports by £1 969 755.

EXPORTS of electrical machinery, apparatus and material shipped from the United Kingdom during February, 1929, amounted to £1 462 365, as against £1 482 202 during the same month last year, representing a decrease of £19 837. The total value of British electrical exports for the two months of this year amounted to £3 076 666, as compared with a total of £3 028 893 for the corresponding period of 1928, the increase being £47 773. Imports of similar goods during February last were valued at £508 816, as against £480 524 for the same month last year, an increase in value of £28 292, while for the two months of this year the total was £1 106 911, or £53 633 more than for the same period last year.

A comparison of export figures for the two months with those of imports for the same period shows an excess of exports valued at £1 969 755, while for the month of February only, the balance is £953 549. Among the export items which showed appreciable improvement during the month under review were electrical machinery other than tramway and railway motors, increase £61 972; batteries and accumulators, including parts, £41 349; and telegraph and telephone instruments, excepting wireless valves, £12 071.

We give below detailed figures for the month of February, 1929, and the two months of this year, contrasted with the figures for the same month and corresponding period of last year:—

	Month of February.		Two Months.	
Imports.	1928.	1929.	1928.	1929.
	£	£	£	£
Electrical Machinery	140 376	120 780	288 472	277 434
Electrical Wires and Cables, Insulated—				
Rubber insulated (not being Telegraph or Telephone Wires or Cables)	11 756	13 885	27 481	31 676
Insulation other than rubber (not being Telegraph or Telephone Wires or Cables)	42 840	42 596	89 705	101 256
Telegraph and Telephone Wires and Cables (not being Submarine Cables)	6 195	8 492	18 029	12 273
Submarine Telegraph and Telephone Cables	—	—	—	—
Telegraph and Telephone Instruments and Apparatus (except wireless valves)	48 183	105 114	101 537	219 149
Carbons, Electric	13 107	12 993	24 000	26 164
Electric Lamps and parts thereof—				
Electric Glow Lamps	45 991	20 922	126 689	43 249
Arc Lamps and Electric Searchlights	464	178	884	2 376
Parts thereof (except Carbon Rods)	·968	842	1 140	2 776
Batteries and Accumulators (including parts)	38 035	43 805	86 584	99 314
Electrical Instruments (other than telegraphic and telephonic): Commercial (including ammeters, voltmeters, etc.), House Service Meters and Scientific	22 194	17 837	49 365	39 376
Switchboards, other than Telegraph and Telephone	66	832	66	1 051
Electrical Goods and Apparatus, all other Sorts	110 349	120 540	239 326	250 817
Total of Electrical Goods and Apparatus	480 524	508 816	1 053 278	1 106 911
Exports.				
Electrical Machinery—	£	£	£	£
Railway and Tramway Motors	61 960	31 724	104 080	57 352
Other Motors and Generators	165 952	155 805	391 863	442 605
All other Sorts	262 276	324 248	595 325	675 259
Electrical Wires and Cables, Insulated—				
Rubber Insulated (not being Telegraph or Telephone Wires or Cables)	120 071	119 684	239 688	259 594
Insulation other than Rubber (not being Telegraph or Telephone Wires or Cables)	119 554	99 406	244 450	232 801
Telegraph and Telephone Wires and Cables (not being Submarine Cables)	122 950	79 494	224 119	146 636
Submarine Telegraph and Telephone Cables	8 219	5 983	51 899	18 199
Telegraph and Telephone Instruments and Apparatus (except wireless valves)	265 737	277 808	481 081	452 461
Carbons, Electric	1 600	677	4 452	1 572
Electric Lamps and Parts—				
Electric Glow Lamps	36 984	43 993	80 011	97 355
Arc Lamps and Electric Searchlights	1 200	1 367	2 617	2 457
Parts thereof (except Carbon Rods)	334	1 205	442	1 941
Batteries and Accumulators (including parts)	72 207	113 556	159 949	181 624
Electrical Instruments (other than Telegraphic and Telephonic): Commercial (including ammeters, voltmeters, etc.), House Service Meters and Scientific	27 781	26 787	59 369	57 606
Switchboards, other than Telegraph and Telephone	13 207	2 421	24 972	14 143
Electrical Goods and Apparatus, all other Sorts	202 170	178 207	364 576	435 061
Total of Electrical Goods and Apparatus	1 482 202	1 462 365	3 028 893	3 076 666

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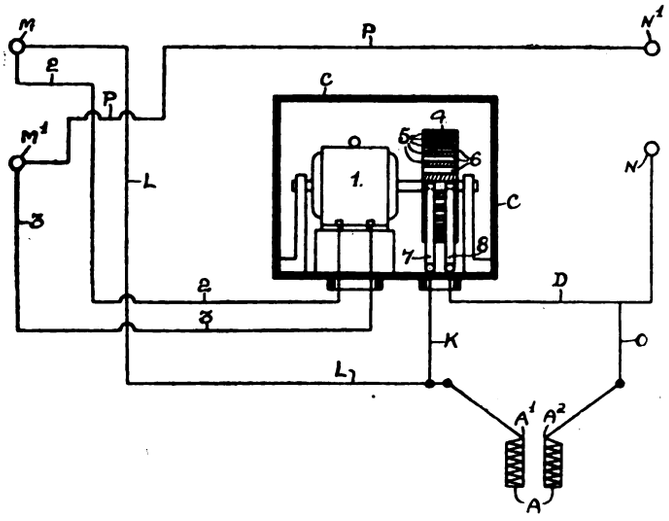
HARRISON-WOOD PATENT.

Complete Specification Now Available—The Device Described in Detail.

IN connection with the patent lodged by Mr. W. Harrison and Coun. T. Wood, for a device which, it is claimed will amplify any voltage applied across its output, Patent Specification 304 949 has now been accepted. It will be remembered that we referred to the matter, as far as we were able at that time, in our issues of November 16th and 23rd, 1928, a picture of the device also being given.

We reproduce below an illustration of the device as it appears in the specification, and a description of the patent



The theoretical arrangement of the Harrison-Wood patent.

reads as follows: "A denotes a static condenser, and C a vacuum chamber within which is disposed an electro-magnetic make and break appliance comprising a small electro-motor and a revoluble commutator with connected brushes, said commutator being coupled with the motor in any convenient manner. 1 designates the motor, which is actuated through leads, 2, 3 connected to the input terminals M, M^1 respectively. 4 generally indicates a commutator which is coupled to said motor 1 and includes brass or like segments 5 separated by insulating elements 6. 7, 8 denote commutator brushes. Said make and break device and electro-motor are sealed in said vacuum chamber C, electrical connection being made from outside said chamber with said brushes 7, 8 by means of two sealed connections K, D. Connection K associates brush 7 with lead L connecting the input circuit terminal M with terminal A^1 of condenser A. Lead D is connected to the output circuit terminal N and connection therewith is made by lead O from terminal A^1 of condenser A. Input circuit terminal M^2 is connected by lead P with output circuit terminal N^1."

ELECTRIC TRACTION.

Proposed Extensions for London Now Under Consideration.

THE London Electric Railway Co. has notified Stoke Newington B.C. that the proposed extension of the Great Northern, Piccadilly and Brompton section of the railway from Finsbury Park in a northerly direction is under consideration.

Doncaster T.C. has applied to the Ministry of Transport for permission to anticipate the sanction to the conversion of the trolley trams on the Hexthorpe route to trackless trams, in order that the necessary work may be commenced immediately owing to road widening and improvement works.

A conference of representatives of Salford Corporation and the local authorities of Eccles, Prestwich, Whitefield, and Swinton and Pendlebury, to consider Salford Corporation's proposal to establish a Tramways and Omnibus Board consisting of representatives of the Councils concerned, was held last week. The representatives of the adjoining authorities asked that Salford Corporation should withdraw its bill, which seeks protection against alleged unfair competition of motor-omnibuses. Ultimately, it was agreed that Salford should furnish to the respective authorities a copy of the evidence being taken in connection with the bill, and a draft of the terms the Corporation proposes to embody in an agreement with regard to the suggested board.

PERSONAL.

ECCLES T.C. has agreed to increase the salary of Mr. H. W. Angus, borough electrical engineer, from £850 to £900

Croydon Town Council has increased the salary of the borough electrical engineer, Mr. A. C. Cramb, from £1 500 to £1 600 per annum.

Sir Hugo Hirst was the guest of Sir Gomer Berry at a dinner at Chandos House, London, on March 5th, in celebration of his return from Australia.

Estate of the gross value of £5 680, with net personalty £4 426, was left by the late Mr. Joseph Flartey Carlisle, of the Eastern Telegraph Co., Ltd.

Sir Philip Dawson, M.P., left London for Egypt on Monday. He will advise the Egyptian Government on a number of important electrical undertakings.

Middlesbrough Town Council has referred back to the General Purposes Committee a recommendation to increase the salary of the chief engineer, Mr. R. H. Scotson, from £750 to £800 per annum.

Mr. W. A. Watson, local general manager and delegate director of the Patent Electric Shot-Firing Co., of Chesterfield, has retired. He was presented with a barometer and two cut-glass vases from the staff.

Estate of the gross value of £210 152, with net personalty of £190 497, was left by the late Mr. Alexander Thomas Hollingsworth, managing director of "Engineering" Ltd., and chairman of Weldons, Ltd.

Mr. G. Rock, general manager of the West Monmouthshire Omnibus Board, has been recommended for appointment as transport manager at Lincoln in succession to Mr. R. Hoggard, who has received a similar appointment at Chesterfield.

In a typing contest arranged by the Stenographic Department of Metropolitan Vickers Electrical Co., Ltd., Miss Helena Oldham attained the highest speed of 57 words per minute, or a total of 5 717 taps for the 20 minutes' typing, with outstanding accuracy.

Mr. Charles Erith has, owing to ill-health, resigned his position of managing director and has severed his connection with the Riley Stoker Co., Ltd. Mr. J. O. Murgatroyd, chairman and one of the originators of the company, has taken over the management of the business.

Hull Electricity Committee has placed on record its high appreciation of the manner in which Mr. C. L. Shuttleworth carried out the duties of acting city electrical engineer for a period of four months, and decided to grant him an honorarium equal to the difference between his present salary and that received by the late city electrical engineer for the four months.

The Minister of Transport has appointed Sir John R. Brooke to be an Electricity Commissioner. Sir John Brooke, who has been secretary to the Central Electricity Board since its formation, is resigning that post and will take up his new duties at once. Mr. R. H. Fox, the present solicitor of the Central Board, has been appointed to succeed Sir John as secretary. (See page 333.)

Obituary.

MR. THOMAS BLACK CALLARD, aged 82 years. He was a director of James Keith and Blackman Co., Ltd.

MR. CLARENCE HUGHES COPE, aged 84 years. He had for over 35 years been on the staff of Fraser and Chalmers.

SIR JOHN DENISON-PENDER, on March 6th, aged 73 years, chairman of the Eastern Telegraph Co., Ltd., and associated companies. Sir John was the third son of Sir John Pender (1815-96), one of the pioneers of submarine telegraphy. Sir John Denison-Pender commenced his career with the Eastern Telegraph Co. and its associates in 1878. In 1881 he was made a director of the Eastern Company, and 12 years later was appointed managing director, a position which later he held in conjunction with Rear-Admiral H. W. Grant. In 1896, the year of his father's death, he was made deputy-chairman, and in 1917, on the death of Sir John Wolfe Barry, he became chairman, his son, Mr. J. C. Pender, succeeding him as managing director. In the South African War he exerted himself to the utmost in the national cause, and was created K.C.M.G. for his services, an honour which had been conferred on his father in 1888. The problem of the cables was naturally more complicated in the last war, and to Sir John was largely due, not only the maintenance intact of our great network of cable communication, but also the cutting off of the enemy's services. (See page 333.)

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BUSINESS ITEMS.

THE WALSALL HARDWARE MANUFACTURING CO., LTD., has opened a new Sheffield branch at 39, Arundel Street.

Mr. E. DANIEL HASBERRY, radio engineer, of Aylesbury, has removed his business to new premises in Temple Street.

The address of BERRY, WIGGINS AND CO., LTD., has been changed to Tensulam House, Water Lane, Stratford, London, E.15.

EINSTEIN'S ELECTRO-CHEMICAL PROCESS, LTD., have acquired offices at Cockpit House, 36/38, Queen Street, Westminster, London, S.W.1.

C. A. VANDERVELL AND CO., LTD., Acton, London, W.3, has issued a special battery window display for service agents and traders throughout the country.

The BRITISH ALUMINIUM CO., LTD., has opened a new branch and warehouse at 66, Kirkstall Road, Leeds, under the management of Mr. C. F. Batstone.

In connection with the pictorial impression of the North East Coast Exhibition published in our issue of February 22nd on page 243, the LONDON ELECTRIC FIRM announces that the two searchlights will be a joint loan with C. A. PARSONS AND CO.

A. F. A. ACCUMULATORS, LTD., announce that the business which they have been carrying on in connection with Varta accumulators, A. F. A. storage batteries for house lighting, etc., and Pertrix dry batteries, has now been taken over by PERTRIX, LTD., of 120, Tottenham Court Road, London, W.1.

The new telephone exchange for the Norbury (London) area, which was opened on February 27th, is fitted with a No. 10 type switchboard with accommodation for 1 900 subscribers' lines, supplied by SIEMENS BROTHERS AND CO., LTD., of Woolwich. It will serve the area until the new automatic director exchange is completed.

We are advised by ATTWOODS SPRAYING EQUIPMENT, LTD., 76/78, Kensal Road, London, W.10, that they are exhibiting at the Oil and Colour Trades Exhibition, which opens at the Royal Agricultural Hall, London, to-morrow (Saturday). A special feature is being made of demonstrating the use of spraying equipment in the electrical and engineering industries.

The "Golden Arrow," with which Major H. O. D. Segrave attained a speed of 231·26 m.p.h. on Monday, is fitted with B.T-H. magnetos. It is interesting to note that similar magnetos were used on the cars with which Capt. Malcolm Campbell and Major Segrave obtained world's speed records in 1927 and 1928, and are fitted to the motor boat "Miss England."

Mr. A. J. Pack, the commercial secretary in the United States, will shortly visit this country on official business. Mr. Pack will be available as from March 18th for the purpose of interviewing representatives of United Kingdom firms interested in the export of British goods to the United States. Application for interviews in London should be addressed to: The Comptroller-General, Department of Overseas Trade, 35, Old Queen Street, London, S.W.1, quoting the reference, 12 796/1.

The merging of MARCONI'S WIRELESS TELEGRAPH CO., LTD., and the EASTERN TELEGRAPH CO., LTD., has involved the acquisition of fresh premises capable of housing a joint concern of this magnitude, with the result that the leaseholds of Electra House (61 850 sq. ft.), Tower Chambers (16 200 sq. ft.) and Marconi House (53 000 sq. ft.) which have hitherto held the headquarters of the two companies, are now available for purchase. Messrs. Knight, Frank and Rutley, 20, Hanover Square, London, W.1, are the sole agents.

In connection with the contracts placed by the Central Electricity Board and referred to on page 330, BRITISH INSULATED CABLES, LTD., Prescot, Lancs, advise us that their portion of the order is for the supply and laying of approximately 90 miles of single cable for 66 000 V working, 30 miles of three-core cable for 33 000 V working, and 15 miles of auxiliary cables. The approximate value of the order is £350 000. These cables will be laid in the following London districts, the total length of route being 25 miles: Islington to St. Pancras; St. Pancras to St. Marylebone; Poplar to West Ham; Willesden; West Ham to link up with proposed overhead lines from Barking; East Ham to link up with West Ham to Barking cables; Kidbrooke to Woolwich; Fulham to Wandsworth; Battersea; Wimbledon to Kingston. Well over 1 000 joints will be necessary, and the following are approximate weights of metal involved: 500 tons electrolytic copper; 1 500 tons lead; and 250 tons galvanised steel wires. The first portion of the order must be ready for work by the end of September, 1929, and the whole contract to be completed by September, 1931.

IN PARLIAMENT.

The Galloway Water Power Bill Before Select Committee in the House of Lords.

A SELECT Committee of the House of Lords began consideration of this Bill on March 5th. Mr. H. P. Macmillan, K.C., for the promoters, said it was proposed to incorporate the Galloway Water Power Co. The real promoters were certain directors of the Power and Traction Financial Co., Ltd., and Mr. R. M. Brand (of Lazard Bros.), Major Wellwood Maxwell, Mr. Jas. M'Queen, and the Earl of Stair. The scheme was estimated to cost £2 770 000. It was proposed to erect generating stations in the county of Kirkcudbright, and to use the water power of the Dee, certain waters of Loch Doon and the water of Idet. The scheme would fit into the Central Electricity Board's scheme. There would be five stations, with an aggregate capacity of 102 000 kW.

Col. W. McLellan (Merz and McLellan) gave evidence in support of the scheme.

The development of the area on the footing of a continuous load would be uncommercial. It was not capable of being developed as a self-contained station, because of the amount of storage required. The scheme was one for collecting one day's water for another day. The peak load thus provided would be developed to work in conjunction with the grid. The scheme was capable of producing 188 000 000 kWh per annum at a cost of under ⅛d. per kWh.

Sir Alexander Gibb said ten reservoirs were contemplated in the scheme.

Opposition by certain millowners was withdrawn. Mr. J. Williamson, chief engineer to Sir Alexander Gibb and Partners, and Mr. Matthew Duff, civil engineer, gave evidence in favour of the scheme. Lord Meston said he was satisfied that there would be no difficulty in getting the necessary finance. Mr. Arthur Collins, financial expert, and Mr. W. Robertson, valuer, also gave evidence. Sir Alexander Walker, vice-chairman of the Ayrshire Electricity Board, also supported the scheme. Mr. Carmont, K.C., on behalf of the Ayrshire County Council and Ayr burghs, protested against the scheme, on the ground that Ayrshire would be deprived of water from the Clyde watershed, while Kirkcudbrightshire would get the benefit in increased rates.

Mansfield District Traction Bill.

A Select Committee of the House of Lords began consideration of this Bill on March 5th.

Mr. Wrottesley, K.C., for the promoters, said the undertaking was subject to purchase by the local authorities, providing they purchased it as a whole, if they gave notice of intention to purchase within six months from May 13th, 1931. This was if the local authorities all agreed. The company seeks powers to substitute trolley vehicles, and on some routes omnibuses, for the trams, and to change the name of the company.

Evidence was given by Col. Sir Joseph Nall, M.P., chairman of the promoting company. He said it would be unreasonable that the railway companies should expect to compete with the tramway company's local services. The proposal in the Bill to extend until 1959 the option of purchase of the undertaking was a reasonable one.

Mr. O. C. Park (Trent Omnibus Co.) said the protection for which the promoters asked would result in serious loss to the revenues of his company.

The Chairman announced that the Committee had decided that the promoting company could have a monopoly, so far as the taking up or setting down of passengers was concerned, on the routes on which their tramlines were already laid, and on the extensions which were being authorised by this Bill. They did not give the same privilege to the route to Clipstone and Blidworth. Other companies would have the right to carry passengers out to districts beyond the limit of the company's working, and equally to set down passengers coming in from outside, but they must not compete with the local traffic. The period for the completion of the trolley vehicle equipment was reduced to three years. The preamble of the Bill was passed.

The Minister of Transport states that so far as his Department and the Electricity Commissioners are concerned, all possible steps will continue to be taken to expedite the supply of electricity to rural areas. The whole of the London area, with the exception of a few parishes in the south, is either already covered by statutory powers for the supply of electricity or by applications which are now before the Commissioners for such powers.

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BUSINESS OPENINGS.

Latest Particulars of Electrical Engineering and Wiring Installation Contracts for which Tenders are being Invited at Home and Abroad.

WE give below the latest particulars of contracts for which tenders are invited. The closing date is given, when available.

ATHERTON URBAN DISTRICT COUNCIL.—Supply of one e.h.t. switch cubicle. Specification, etc., from the Electricity Department.

BECKENHAM URBAN DISTRICT COUNCIL.—Supply of l.t. feeder pillars. Particulars from the Engineer and Manager, Electricity Department, 45, High Street, Beckenham.

EDINBURGH WELFARE HOUSING TRUST, LTD.—Electrical work in connection with erection of 18 houses at Factor's Park, Gorgie. Schedules, until March 15th, from Mr. A. H. Mottram, 59, Frederick Street, Edinburgh.

LEEDS CORPORATION.—Heating installation for dining room and certain bedrooms at Gateforth sanatorium, electrical re-wiring of building, and replacement of engine for driving electrical generating plant.

Irish School Lighting.

BELFAST EDUCATION COMMITTEE, March 15th.—Electric light installation in Riga Street and Montcollyer Elementary Schools. Specifications, etc., from the Education Architect, Victoria Street, Belfast; deposit £1 1s. for each.

BIRMINGHAM GUARDIANS, March 15th.—Two electric refrigerators, for Selly Oak Hospital. Particulars from the Clerk, Union Offices, Edmund Street, Birmingham.

EDINBURGH CORPORATION, March 15th.—One 1 500 kW motor-converter, for Dewar Place sub-station. Specification from Mr. E. Seddon, engineer and manager, Electricity Department; deposit 10s. 6d.

NORTHERN IRELAND MINISTRY OF FINANCE, March 15th.—Electric light and power installation at Malone Training School, Belfast. Form of tender, etc., from the Secretary to the Ministry, 15, Donegall Square West, Belfast.

BELFAST MENTAL HOSPITAL, March 18th.—Twelve months' supply of electrical fittings. Forms of tender from Mr. J. Harper, secretary, at the Asylum, Purdysburn, Belfast.

BRADFIELD RURAL DISTRICT COUNCIL, March 18th.—Electric motors (with switchgear) for driving air compressors, at Pangbourne sewage works. Specification from the engineer, Mr. C. H. Stafford, 209, King's Road, Reading; or the Clerk, Town Hall Chambers, Reading.

DUDLEY HILL WESLEYAN CHAPEL, BRADFORD, March 18th.—Electric wiring and fitting of classrooms. Premises may be inspected on application to the Caretaker, 11, Dudley Street, Bradford.

EDINBURGH CORPORATION, March 18th.—Supply of e.h.t. sub-station switchgear. Specification (No. 99) from Mr. E. Seddon, engineer and manager, Electricity Department, Dewar Place, Edinburgh; deposit 10s. 6d.

EDMONTON GUARDIANS, March 18th.—Six months' supply of electric lamps, and X-ray, light, massage, etc., requisites. Forms of tender from the Clerk, 77, Bridport Road, Edmonton, London, N.18. Stamped, addressed envelope to be sent.

LANCASTER CORPORATION, March 18th.—Two water-tube boilers, to evaporate 36 000 lb. of water per hour, with mechanical stokers, etc., at Caton Road generating station. Specification, etc., from the Borough Electrical Engineer; deposit £2.

RAINFORD URBAN DISTRICT COUNCIL, March 18th.—Wiring of village hall and Council offices. Specification, etc., from the Clerk or Surveyor, Council Offices, Church Street, Rainford.

MANCHESTER CORPORATION, March 18th.—Twelve months' supply of incandescent lamps. Forms of tender, etc., from Mr. H. C. Lamb, Electricity Department, Town Hall, Manchester.

NEWTON ABBOT URBAN DISTRICT COUNCIL, March 18th.—Supply of pumping and other equipment, with electric motors, control panels, etc., for sewer construction works. Specifications from Mr. F. W. S. Stanton, 5, Victoria Street, London, S.W.1.

CARDIFF CORPORATION, March 19th.—Supply of e.h.t. and l.t., paper insulated cables during 12 months, commencing April 1st (specification No. N 64), and supply and erection of natural draught cooling tower (specification N 65). Specifications, etc., from the City Electrical Engineer, The Hayes, Cardiff. Only members of the King's National Roll are invited to tender.

PONTYPRIDD GUARDIANS, March 19th.—Six months' supply of electrical materials. Forms of tender from the Clerk, Union Offices, Pontypridd.

ROTHERHAM GUARDIANS, March 19th.—Supply of electrical sundries. Forms of tender from the Clerk to the Guardians, 26, Moorgate Street, Rotherham.

EARBY URBAN DISTRICT COUNCIL, March 20th.—Electricity distribution scheme. Specification, etc., from Mr. B. Hindle, clerk to the Council, Earby, near Colne; deposit £1 1s.

HOLBORN (LONDON) GUARDIANS, March 20th.—Supply of electrical fittings, for six months. Forms of tender from the Clerk, 53, Clerkenwell Road, E.C.1. Stamped, addressed envelope to be sent.

METROPOLITAN ASYLUMS BOARD, March 20th.—Automatic telephone system at North Western Fever Hospital, Hampstead, N.W.3. Specification, etc., from the Board's Office, Victoria Embankment, E.C.4; deposit £1.

PADDINGTON (LONDON) GUARDIANS, March 20th.—Six months' supply of electricians' sundries, etc. Forms of tender from the Clerk, 313-319, Harrow Road, W.9. Stamped, addressed envelope to be sent.

CHORLEY RURAL DISTRICT COUNCIL, March 21st.—Two electrically-driven pumps, switch and control gears, etc. Specifications from Mr. W. Cotterill, surveyor, High Street, Chorley; deposit £2 2s.

DEVON MENTAL HOSPITAL, EXMINSTER, March 21st.—Supply, for six months, of electric lamps, etc. Further particulars from the clerk, Mr. Cecil Masters.

HULL CORPORATION, March 21st.—Supply of three 1 500 kW motor-converters. Specification, etc., from Mr. J. N. Waite, Electricity Works, Sculcoates Lane, Hull; deposit £1 1s.

HULL CORPORATION, March 21st.—One 2 000 000 gal. per hour, electrically driven circulating water pump, motor, motor starter, etc. Specification from Mr. J. N. Waite, Electricity Works, Sculcoates Lane, Hull; deposit £1 1s.

NELSON EDUCATION COMMITTEE, March 21st.—Electric light installation in Bradley, Walverden and Somerhaye Council Schools. Specification, etc., from Mr. J. Skinner, Education Offices, Market Street, Nelson.

STOURBRIDGE GUARDIANS, March 21st.—Supplies of electric lamps for six months. Particulars from the clerk, Mr. G. F. James, 12, Hagley Road, Stourbridge.

WEST SUSSEX COUNTY MENTAL HOSPITAL, March 22nd.—Twelve months' supply of electric lighting sundries. Forms of tender, etc., from the Clerk and Steward, at the Hospital, Graylingwell, Chichester.

HARROGATE CORPORATION, March 23rd.—Twelve months' supply of cables, joint boxes, joint box compound, service meters, service cut-outs, and transformers. Specifications, etc., from Mr. N. McLean, borough electrical engineer, 33, Swan Road, Harrogate.

HARROGATE CORPORATION, March 23rd.—One year's supply of meter boards, etc. Forms of tender from the Borough Electrical Engineer.

BETHNAL GREEN (LONDON) BOROUGH COUNCIL, March 25th.—Electric lighting installation in seven blocks of tenement buildings. Specification, etc., from Mr. David J. Keep, town clerk, Town Hall, Cambridge Road, E.2; deposit £2 2s.

Annual Supplies of Electrical Stores.

EDINBURGH CORPORATION, March 25th.—Supply of materials to the electricity department for 12 months, including cables, conduits, fuses and fuse boards, electrical material, electricity meters, meter boards, etc. Specification from the Engineer and Manager, Dewar Place, Edinburgh.

FARNWORTH URBAN DISTRICT COUNCIL March 25th.—Supply of l.t. cables. Specifications, etc., from Mr. A. J. Hutchinson, Electricity Dept., Albert Road, Farnworth, Lancs.

GLOUCESTER CORPORATION, March 25th.—Supply and erection of two 1 000 kW motor generators, for conversion of 11 000 V 50 cycle a.c. to 460/500 V d.c. Specification, etc., from the City Electrical Engineer, Commercial Road, Gloucester.

ILFORD CORPORATION, March 25th.—Supply of paper insulated cables. Specification, etc., from the Borough Electrical Engineer, Electricity Works, Ley Street, Ilford.

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KNOTTINGLEY URBAN DISTRICT COUNCIL, March 25th.—Electric light wiring of 48 proposed houses in Weeland Road and Womersley Road, Knottingley. Specifications, etc., from the Surveyor, Town Hall, Knottingley.

BETHNAL GREEN (LONDON) GUARDIANS, March 26th.—Installation of electric fans in parts of Institution, Waterloo Road, E.2, and of Hospital, Cambridge Road, E.2. Specification, etc., from the Clerk, Administrative Offices, Bishop's Road, Bethnal Green, E.2; deposit £1.

BLACKPOOL CORPORATION, March 27th.—Two electrically-driven sewage pumps. Specification, etc., from the Borough Engineer.

BROOK MOTORS, LTD., March 29th.—Electric lighting work in connection with extensions to Empress Works, St. Thomas's Road, Huddersfield. Plans, etc., can be seen at the offices of Mr. J. Arnley, 55, New Street, Huddersfield.

RHONDDA URBAN DISTRICT COUNCIL, March 30th.—Supply of house service, a.c., ordinary and prepayment meters, cable joint boxes, compound, cut-outs, etc., for one year. Specifications, etc., from the Electrical Engineer, Electricity Works, Porth, Glam.

MANCHESTER CORPORATION, April 3rd.—Supply and placing in position at Oldham Road "B" sub-station of one 8 000 kVA forced air-cooled transformer, 32 000/6 600 V, three-phase, 50-period. Specification (No. 232) and form of tender from Mr. H. C. Lamb, Electricity Department, Town Hall, Manchester; deposit £1 1s.

CENTRAL ELECTRICITY BOARD, April 15th.—Supply and erection of 33 000 V overhead transmission lines, in connection with the North-West England and North Wales Electricity Scheme. Specification (No. N.W.E.-S.L.2) from Mr. R. H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2.; deposit £2 2s.

CENTRAL ELECTRICITY BOARD, April 29th.—Supply and erection of electricity meters, in connection with the Central Scotland Electricity Scheme. Specification (No. CS-SS 14) and form of tender from Mr. Richard H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

Overseas.

UNLESS otherwise stated, particulars of overseas contracts are to be had from the Department of Overseas Trade (Room 52), 35, Old Queen Street, Westminster, London, S.W.1. *Note.—An asterisk denotes that local representation is, in practice, essential.*

BENGAL NAGPUR RAILWAY CO., LTD., March 15th.—Supply of five-ton overhead electric travelling crane. Specification, etc. (10s.), from the company's Offices, 132, Gresham House, Old Broad Street, London, E.C.2.

CAPE TOWN MUNICIPALITY, March 15th.—Supply of metal-clad switchgear (specification 449/28). (Reference B.X. 5 004.)

CHILEAN MINISTRY OF MARINE, March 15th (extension of date)—Two electric travelling cranes, for Port of Valdivia. (Reference A.X. 7 353.)

VICTORIAN RAILWAY COMMISSION, March 15th.—Supply of armoured telephone cable (contract 4 2501). (Reference B.X. 5 126.)

VICTORIA ELECTRICITY COMMISSION, March 18th.—Supply of 1 300 strings of suspension insulators, 600 strings of tensioning insulators, 1 300 conductor suspension clamps, 350 conductor tensioning clamps, 50 semi-anchor clamps for "V" strings of insulators, 200 semi-anchor clamps for single strings of insulators, 475 earth wire suspension clamps and 125 earth wire tensioning clamps. (Reference B.X. 4 997.)

LOURENCO MARQUES PORT AND RAILWAYS BOARD, March 19th.—Supply of three-phase, Diesel-driven 50 kVA generating set, and electrically-driven water pumping set. (Reference B.X. 5 050.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, March 19th.—Supply of 110 000 V transformer, for Mangahao electric power scheme (section 204). (Reference B.X. 4 952.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, March 19th.—Supply of 11 000 V switchgear, for Mangahao power development (section 203). (Reference B.X. 4 953.)

DUNEDIN, N.Z., CORPORATION, March 20th.—Supply of hand brake equipment, electrical equipment for magnetic brakes and bogie trucks, for tramcars.

CAPE TOWN MUNICIPALITY, March 21st.—Supply of 300 A fuses (specification 453/1928). (Reference B.X. 5 080.)

JOHANNESBURG MUNICIPALITY, March 21st.—Supply of 65 500 porcelain insulators (contract No. 135). (Reference B.X. 5 114.)

ANTWERP MUNICIPALITY, March 22nd.—Supply of electric cable and accessories. (Reference B.X. 5 124.)

SOCIETE NATIONALE DES CHEMINS DE FER VICINAUX, BRUSSELS, March 27th.—Supply of tramcars and trailers. (Reference A.X. 7 639.)

PORT ELIZABETH MUNICIPALITY, March 28th.—Supply of 33 000 V cable (specification No. 18). (Reference B.X. 5 147.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, April 17th.—Supply of copper earthplates (specification 133). (Reference A.X. 7 556.)

UMTALI (SOUTHERN RHODESIA) MUNICIPALITY, April 18th.—Supply of 1 000 kW turbo-alternators, spray cooling plant, switchgear and crane (contract B). (Reference B.X. 5 145.)

VICTORIAN ELECTRICITY COMMISSION, April 29th.—Supply of two or three steam turbo generator sets, with condensers, etc., for Yallourn power station extension (specification 29/7). (Reference B.X. 5 062.)

VICTORIAN ELECTRICITY COMMISSION, April 29th.—Supply of two swing hammer mills, with electric motors, for brown coal (specification 29/9). (Reference A.X. 7 434.)

TANGANYIKA GOVERNMENT, June 1st.—Concession for utilisation of Pangani River Falls for the development of electric power. Copies of the draft concession may be obtained from the Crown Agents for the Colonies, 4, Millbank, London, S.W.1.

STATE ELECTRICITY WORKS, MONTEVIDEO, July 8th.—Construction and equipment of 50 000 kW power station.

Tenders Accepted.

ADMIRALTY.—Edison Swan Electric Co., Ltd., switches.

GRAVESEND CORPORATION.—Freed Bros., electric lighting at sanatorium, £65.

BRIGHTON CORPORATION.—Ferranti, Ltd., supply of two 200 kVA transformers, £277.

NEWMILNS CORPORATION.—John Morton and Son, wiring houses for electric light, £18.

GENERAL POST OFFICE.—Edison Swan Electric Co., Ltd., telephone switchboard lamps.

READING GUARDIANS.—Erlco, Ltd., electric light installation at Battle Infirmary, £723.

BLACKBURN CORPORATION.—T. Blackshaw, electric lighting installation at Roe Lee School.

DEAL CORPORATION.—Crossley Bros., magneto-ignition for engines at drainage pumping station.

BROMLEY (KENT) CORPORATION.—A. Sutton, wiring 91 houses for electric light, £531 11s. 6d.

PARISH CHURCH AND MEMORIAL HALL, BRENCHLEY.—H. Featherstone, electric light installation.

INDIAN STORES DEPARTMENT.—Greaves Cotton and Co., Ltd., Crompton d.c. ceiling fans, Rs. 1 566.

DEWSBURY EDUCATION COMMITTEE.—W. Angus, electric light installation at open air school, £62 8s.

RAMSGATE CORPORATION.—A. E. Pinto, rewiring electric lighting system at Royal Victoria Pavilion, £137.

PLYMOUTH CORPORATION.—W. G. Heath and Co., electric light installation at the smallpox hospital, £257 10s.

ISLINGTON (LONDON) BOROUGH COUNCIL.—Nelson Electric Co., Ltd., twelve months' supply of electric lamps.

HAMPTON URBAN DISTRICT COUNCIL.—Radio, Ltd., installation of wireless set at Isolation Hospital, £59 10s.

WARRINGTON CORPORATION.—Fuller Electrical and Manufacturing Co., Ltd., supply of 600 kVA transformer.

LEEDS GUARDIANS.—A. Innes, re-installation of electric light wiring in children's block at Rothwell Institution.

WEST HAM EDUCATION COMMITTEE.—Harland and Wolff, electric light installation at South Hallsville school, £545.

GUILDFORD CORPORATION.—Ferguson, Pailin, Ltd., 25 kVA kiosk, £100; W. Lucy and Co., Ltd., 10 kVA kiosk, £35 5s.

SOUTHEND EDUCATION COMMITTEE.—Jackson and Co., electric light installation at the intermediate schools, £497 18s. 2d.

ST. STEPHENS SCHOOL, PADDINGTON (LONDON).—Haine and Co., improvement of electric lighting, £277. (Recommended.)

LEYTON CORPORATION.—Power Lines Construction Co. Ltd., change-over from d.c. to a.c. in the Cann Hall area, £25 000.

BRIGHTON CORPORATION.—Yarrow and Co., Ltd., supply of two boilers, each of 75 000 lb. evaporation, £46 130. (Recommended).

BATTERSEA (LONDON) BOROUGH COUNCIL.—Watson and Sons (Electro-medical) Ltd., lamps and apparatus, for solarium at Southlands, £187 4s.

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BINGLEY URBAN DISTRICT COUNCIL.—L. S. Dyer, electrician's work in 20 houses, and R. White, electrician's work in 28 houses, at Cottingley.

BIRMINGHAM CORPORATION.—Herbert Morris, Ltd., erection of overhead cranes at Chester Street and Water Street sub-stations. (Recommended.)

LONDON COUNTY COUNCIL.—H. J. Cash and Co., for electric lighting at Webber Street school, £185 (approximate). (Recommended.)

HOLBORN (LONDON) BOROUGH COUNCIL.—General Electric Co., Ltd., 12 months' requirements of Osram gasfilled and vacuum lamps.

WESTMINSTER CITY COUNCIL.—Coleby and Co., re-wiring and supplying gearing lanterns, at Buckingham Palace Road baths, £105. (Recommended.)

Switchgear and Cables.

ROTHERHAM CORPORATION.—A. Reyrolle and Co., Ltd., two truck type switches, £256; Callender's Cable and Contruction Co., Ltd., supply of cable, £1 659 6s.

LONDON MIDLAND AND SCOTTISH RAILWAY.—General Electric Co., Ltd., 12 months' requirements of Osram gasfilled, vacuum, and train lighting lamps, etc.

BURTON-ON-TRENT CORPORATION. — Metropolitan-Vickers Electrical Co., Ltd., supply of two 250 kVA transformers, £295; Donovan and Co., supply of switchboard, £147.

LONDON AND NORTH-EASTERN RAILWAY CO.—British Thomson-Houston Co., Ltd., supply and erection of additional 500 kW turbo-generator at Parkeston power station.

LIVERPOOL CORPORATION.—Forest City Electric Co., Ltd., provision of automatic traffic control signals, to be erected at the junction of Lord Street and Church Street, £65.

EAST HAM CORPORATION.—Enfield Cable Works, Ltd., 0·75 cable, £1 280 per 1 000 yards; 0·5 cable, £920 per £1 000 yards, and 0·3 cable, £540 per 1 000 yards. (Recommended.)

BARNES URBAN DISTRICT COUNCIL.—Reliance Telephone Co., Ltd., installation and maintenance of departmental telephones, at Council House, 10s. per instrument per quarter.

STRETFORD URBAN DISTRICT COUNCIL.—Metropolitan-Vickers Electrical Co., Ltd., supply of 33 000 V switchgear, £28 600; supply of transformers, £23 050; and supply of 6 600 V switchgear, at Trafford power station, £17 627.

YORK CORPORATION.—Municipal Electricity Department, installation of cables to police boxes, £158; supply of lighters and heaters, £54; and current, £7 per annum; and electric light installation at Clifford Street Technical Institute, £490 5s.

WANDSWORTH (LONDON) GUARDIANS).—Ashworth and Parker, electric generating plant and motors, £2 604; Anderson, Angell and Co., wiring for electric lighting and power, £1 815, in connection with engineering reconstruction at Swaffield Road Institution.

GLASGOW CORPORATION.—R. J. McIntyre, electrical installation in 318 houses under Haghill rehousing scheme, £1 240, and electrical installation in 174 houses in Saracen Street area No. 1, including lamps, £715; Kennedy, Stark and Co., electric lighting, bell and fire alarm installations at Mearnskirk Sanatorium, £1 571.

BATTERSEA (LONDON) BOROUGH COUNCIL.—British Electric Transformer Co., Ltd., two 500 kVA transformers (£467), and Bertram Thomas, e.h.t. and l.t.-switchgear (£1 167), in connection with supply to Hovis, Ltd. Watson and Sons (Electro-Medical), Ltd., supply of electric lamps and apparatus to Solarium, Southlands, £187.

LEEDS CORPORATION.—W. T. Henley's Telegraph Works Co., Ltd. (£2 565); Enfield Cable Works, Ltd. (£1 808); Hackbridge Cable Co., Ltd., (£1 194); and Greenwich Cable Works, Ltd. (£1 058 15s. 6d.), supply of cables; Metropolitan-Vickers Electrical Co., Ltd., supply of automatic control gear, for electric pump at waterworks, £64.

MANCHESTER CORPORATION.—J. Blakeborough and Sons, supply of electrical operating gear at Lostock booster station; R. H. Clampnett and Co., and Hall and Stinton, Ltd., electrical installations at houses on Barlow Moor estate; C. A. Parsons and Co., Ltd., and English Electric Co., Ltd., supply of static transformers; Metropolitan-Vickers Electrical Co., Ltd., oil purifier for Stuart Street sub-station; Tudor Accumulator Co., Ltd., repairs to battery at Dickinson Street station.

CARLISLE CORPORATION.—A. G. Bullen and Co., electric light installation for 14 houses on Newtown-Raffles estate, 40 on Longsowerby estate, and 22 on Botcherby estate; W. Batey and Sons, electric light installation for 119 houses on Newtown-Raffles Estate, 12 on Longsowerby estate, and 92 on Botcherby estate; British Thomson-Houston Co., Ltd,. supply and erection of 15 000 kW turbo-alternator, £34 874; Mirrlees-Watson Co., Ltd., surface condenser, at Willow Holme generating station, £10 052.

CENTRAL ELECTRICITY BOARD.—British Insulated Cables, Ltd., Callender's Cable and Construction Co., Ltd. and Pirelli-General Cable Works, Ltd., 66 kV and other cables, British Thomson-Houston Co., Ltd., 66 kV switchgear in London area, under South-East England Scheme; Balfour Beatty and Co., Ltd., 132 kV overhead transmission lines, and General Electric Co., Ltd., 132 kV outdoor switchgear, under Central England Scheme; Foundation Co., Ltd., 132 kV overhead transmission lines, under North-West England and North Wales Scheme. Total, approximately, £3 250 000, making with contracts previously placed, £6 250 000. (See page 327.)

LONDON COUNTY COUNCIL.—Edison Swan Electric Co., Ltd., supply of control battery required in connection with new swichgear for Greenwich power station, £452 1s. 9d. Other tenderers:—Alton Battery Co., Ltd., £562 6s. 8d.; Tungstone Accumulator Co., Ltd., £627 19s.; Fuller Accumulator Co. (1926), Ltd., £647 5s.; D. P. Battery Co., Ltd., £672 0s. 6d.; Pritchett and Gold and E.P.S. Co., Ltd., £672 4s.; Chloride Electrical Storage Co., Ltd., £679 1s. 4d.; Premier Accumulator Co. (1921), Ltd., £679 2s. 6d.; Hart Accumulator Co. (1926), Ltd., £683 10s. 7d.; British Thomson-Houston Co., Ltd., £690 10s.; Tudor Accumulator Co., Ltd., £695 5s. 6d.; Siemens Brothers and Co., Ltd., £745 10s. 7d.

LONDON COUNTY COUNCIL.—General Electric Co., Ltd., supply of reactors (£802), and Standard Telephone and Cables, Ltd., supply of cables (£1 234 0s. 9d.); required in connection with new switchgear for Greenwich power station. These were the lowest quotations for reactors and cables, respectively, but the tenders, as originally submitted, included both, the list of tenderers being as follows:—General Electric Co., Ltd., Kingsway, W.C.2, £2 075 3s. 8d.; Standard Telephone and Cables, Ltd., £2 242 0s. 9d.; British Thomson-Houston Co., Ltd., £2 277 10s. 10d. (provisional sum for night work deducted); Callender's Cable and Construction Co., Ltd., £2 339 10s. 10d.; Siemens Brothers and Co., Ltd., £2 342 7s. 4d. W. T. Glover and Co., Ltd., £2 342 17s. 9d.; Macintosh Cable Co., Ltd., £2 371 10s. 6d.; Johnson and Phillips, Ltd., £2 405 7s. 4d.; British Insulated Cables, Ltd., £2 398 14s. 6d. (incomplete); W. T. Henley's Telegraph Works Co., Ltd., £1 383 8s 10d. (one item not quoted for).

BIRMINGHAM CORPORATION.—Thomas Glover, electric light installation, and Callenders' Cable and Construction Co., Ltd., overhead and underground cables at Coleshall mental institution; British Vacuum Cleaner and Engineering Co., Ltd., vacuum dust extracting plant, for Summer Lane power station; Thomas Piggott and Co., Ltd., works in connection with installation of grit collectors at Nechells power station; Hackbridge Electric Construction Co., Ltd., supply of transformers, at Water Street, Chester Street, Freeth Street and Sparbrook sub-stations; Harland Engineering Co., Ltd., supply of rotary converter, at Belchers Lane sub-station; Electricars, Ltd., three electric vehicles, and General Vehicle Co., Ltd., one electric vehicle, for the cleansing department; Ray Electrical Co., electric light installation at King's Norton secondary school; R. H. Newton, electric light installation at Birches Green school; Baxter and Impey, electric light installation at Colmore Road school; Reynolds and Bradwell, electric generating plant and installation at Boys' Camp School Clent, and electric light installation at Dolphin Lane school.

Reconstruction Work.

WANDSWORTH (LONDON) GUARDIANS.—Engineering reconstruction at Swaffield Road Institution: Ashworth and Parker, electric generating plant and motors, £2 604. Also tendered for plant including compound type engine, £3 656. Other tenders: W. H. Allen, Sons and Co., £3 325; Wallace and Sons, £3 211; Harland Engineering Co., £3 086; Newtons of Taunton, £2 964; Robey and Co., Ltd., £2 955; Tate and Co., £2 780, alternative for Hindley's engine, £2 680; H. A. Neale and Co., £2 667; T. Clarke and Co., Ltd., £2 624, ditto, for different speed of engine, £2 784; Electric Installations, Ltd., £2 544; alternative for Hindley's engine, £2 719; alternative for Allen's engine coupled to Crompton-Parkinson dynamo, £2 849, and alternative for Allen's engine and dynamo, £2 944; Anderson, Angell and Co., £2 420, alternative for Allen's engine, £2 791. Anderson, Angell and Co., electric light and power wiring, £1 815. Also tendered: L. G. Tate and Co., £2 851; Burdette and Co., Ltd., £2 774; J. Briggs (Electric Contractors), Ltd., £2 767; R. A. Brooks and Sons, £2 690; H. A. Neale and Co., £2 626; Alpha Manufacturing and Electric Co., £2 522; T. Clarke and Co., Ltd., £2 314; Wallace and Sons, £2 105; Electric Installations Ltd., £1 982.

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TELEVISION EXHIBITION.

Brief Review of Some of the Exhibits of Historical Apparatus.

PROMINENT among the exhibits at the first annual exhibition of the Television Society, which was held at the Engineers' Club, Coventry Street, London, on March 5th, were a number of historical devices, used by Mr. Ll. B. Atkinson in television experiments 47 years ago.

The exhibits included an analysing device (Fig. 1) consisting of a series of mirrors on a wheel, which reflected the image to be transmitted on to a point cell. Each mirror carried one line of the picture across the point, whilst the successive mirrors were inclined parallel to the axis of rotation, so that each mirror projected successive lines. The receiver consisted of a similar series of mirrors which, revolving synchronously with the transmitter, built up from a light point the image transmitted. The apparatus presenting this idea is shown in Fig. 2. In order to avoid all electrical reproduction, Mr. Atkinson projected an image by a revolving mirror on to a point representing the selenium cell, and this same point by means of a mirror behind it gave back a similar impression, which was reflected on to another mirror on the same axis as the first; the resulting light point therefore, going through the required changes and being oscillated, gave in a dark room a reproduction of the original image. Though at the time of these early experiments no very exact information existed as to the speed at which the light charged a selenium cell, it was known that light from an interrupted source falling on such a cell would produce a musical note in a telephone, and so it was assumed that at least telephonic frequency could be reached. In the receiving apparatus shown by Mr. Atkinson two applications of this knowledge were demonstrated. The first included a horse-shoe magnet with a thin ferro-type armature (Fig. 3), operating a small mirror fixed to a fairly rigid wire, so as to have a very rapid period of oscillation. This mirror received an image or beam of light, and reflected this through a small hole in a plate. When the image passed through the plate it was reflected by the moving mirror on to the viewing screen. If the movement of the mirror took the light spot off the hole, a dark spot resulted on the screen. Fig. 5 was fitted up to show the movement of the light spot and was an adaptation of the revolving chalk cylinder of Edison's loud-speaking telephone of about 1878. The chalk cylinder wetted with mercury sulphate had a spring pressing on it. The friction varied by the varying current received from the selenium cell, and the spring operated a small mirror.

Fig. 4 was described as a telephone with an enclosed space in front of the diaphragm. Through this chamber coal gas was passed, and the movements of the diaphragm caused a small sensitive flame to rise and fall behind a slit, thus giving light and dark. A further early device (Fig. 6) was a telephone, to the diaphragm of which was attached a slightly convex mirror; fixed to a front plate was a flat glass. Between these appeared interference rings known as Newton's rings. A movement of 1/100 000 of an inch, working with monochromatic light would, it was explained, give a change of the central spot, from yellow, say, to black.

Other exhibitors were Dr. C. Tierney, who demonstrated molecular bombardment; Mr. R. R. Poole, who showed a polarised light-modulator and mirror assembling device, and a static amplifier. Mr. H. S. Ryland gave a demonstration and talk on selenium cells and the optical methods of making the most of the available light, while Capt. R. Wilson showed a complete shadow transmitter and receiver. Mr. Colin P. Garside exhibited a portable receiver for pictures of about 9 sq. in. Mr. Wilfred H. Troutbeck showed a cathode-ray oscillograph, loaned by Standard Telephones and Cables, Ltd. Mr. J. J. Denton, the General Electric Co., Ltd., Philips Lamps, Ltd., and W. Edwards and Co. also exhibited.

EX-BRITISH WESTINGHOUSE MEN.

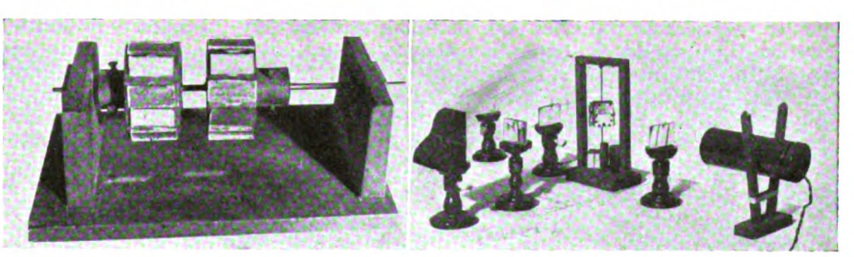
Big Attendance at Eleventh Annual Reunion.

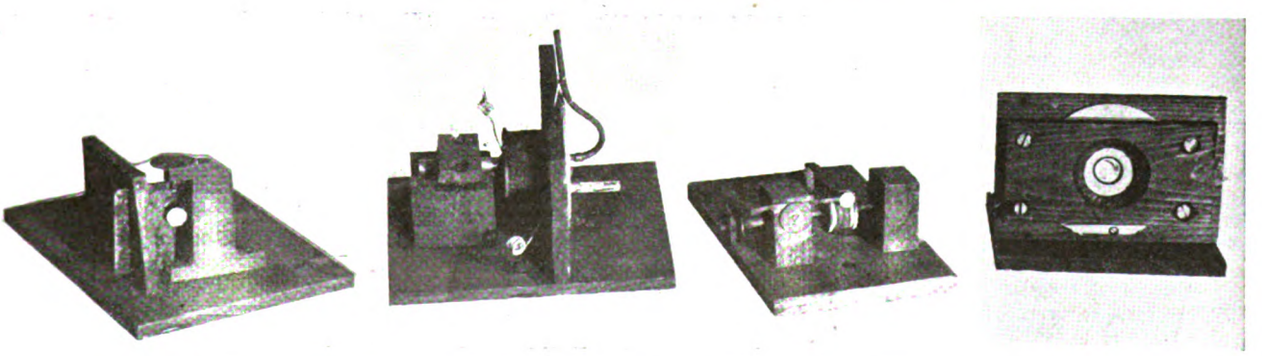
ONCE again ex-B.W. men have met in merry mood, and once more they are looking forward to the next dinner. Mr. F. Massingberd Rogers presided at the Hotel Cecil, on March 8th, over another record attendance, nearly 140 "old timers" turning up from all parts of the country. As it is a family affair the Press is not invited, but we understand that the proceedings were, as usual, delightfully informal.

The chairman was inducted by the hon. treasurer who preceded him to his place with the now famous "half crown" on the end of a long wand; this emblem of the Association was at once illuminated when placed in position behind the chair. Mr. B. P. Boyle gave the toast of the Association, to which the chairman responded in a reminiscent vein, which was greatly to the liking of the company. He emphasised that early pioneer years formed friendships which influenced their careers in later life. He felt that the late George Westinghouse would have liked to see that assembly.

Among the prizes in the 1s. ballot was a genuine Yarmouth bloater, which went to A. F. Bock, who auctioned it for the Association funds. The "Silent Toast" had a touch of sadness this year, the loss to the Association being no fewer than six members who have died since the last reunion—A. P. Ambler, J. A. Henderson, W. A. Hetherington, "Charlie" Parkes and A. Simon. Letters of regret were received from all parts of the world from members unable to attend; the toast "Absent Friends" was submitted with acclamation at 10 o'clock. The entertainment side was ably carried through by J. Gibson Young, himself a member of the Association, with Jacqueline and Imito. Among the usual informal toasts this year that of the "Grandfathers" provoked great merriment, the respondents being Messrs. Dyer, Seaman, Warrilow and Sergt. McCully. The programme would not accommodate the chairman's extreme length so the cartoonist (Mr. E. Sanson) had to wrap him round the covers! See page 333.

THE historical exhibits shown by Mr. Ll. B. Atkinson at the Television Exhibition referred to above. The two right-hand pictures are Figs. 1 and 2, reading left to right, while below in the same order are Figs. 3 to 6.





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ELECTRICITY SUPPLY.

Loans for Mains at Sheffield and Manchester—Rural Supply in Daventry District—Extension of Aberdeen Supply—Revision of Beckenham Tariffs—Brighton's Proposal to Make Wiring Regulations.

SHEFFIELD Electricity Committee has obtained sanction to borrow £49 897 for feeder mains.

Barnstaple T.C. has decided to instal a further 300 kW Diesel generating set during 1930.

The Ascot District Gas and Electricity Co. is to erect overhead electric lines in the Chobham district.

Sanction for a loan of £50 000 for feeder mains has been obtained by Manchester Electricity Committee.

The 100 kW transformer at Shipley Fields Road, Shipley, is to be replaced by a 250 kW transformer, at a cost of about £200.

Electricity sold by the Calcutta Electric Supply Corporation, Ltd., during 1928, was 147 875 086 kWh, increase 18 784 859 kWh.

Walsall Electricity Committee has authorised a programme of extensions involving a cost of £17 000 for mains and sub-stations.

Brighton Corporation Lighting Committee is to extend mains to the Whitehawk housing estate, at an estimated cost of £2 350.

Fulham (London) Electricity Committee has voted £816 for equipment for a sub-station in the vicinity of Bishop's Mansions.

Birkenhead Electricity Committee recommends the purchase of the undertaking of the Gayton Park Electricity Co., Ltd., for £500.

Bolton Electricity Committee is arranging for the erection of overhead lines in connection with the supply to the Over Hulton district.

The Leicestershire and Warwickshire Power Co. have completed the extension of the mains to Heather, which is now lighted by electricity.

Fulham (London) Electricity and Lighting Committee proposes to lay new cables in several thoroughfares, at an estimated cost of £1 430.

The Twickenham and Teddington Electric Supply Co., Ltd., has informed Esher U.D.C. of its intention to lay a cable in Manor Road, Thames Ditton.

Highbridge U.D.C. has approved plan submitted by the North Somerset Electric Supply Co., Ltd., of an extension of the 11 000 V mains in the Council's area.

Wigan T.C. has applied for a loan of £30 000 for transformers, switchgear, mains, etc., for a supply of electricity to Upholland, Standish, Shevington and Wrightington.

Herne Bay U.D.C. has granted permission to the Herne Bay and District Electricity Co. to extend the mains from Margate Road to the Burton Downs Estate.

Newbury Corporation has arranged provisional terms with the Wessex Electricity Co., Ltd., for the supply of electricity for power purposes at the Cold Ash pumping station.

Croydon Corporation is extending the 0·15 triple distributor at the bottom of Aberdeen Road through Aberdeen Road to St. Peter's Road, at an estimated cost of £330.

Reigate R.D.C. has consented to an application by the Dorking Electricity Supply Co., Ltd., for a Special Order to supply electricity to the parishes of Betchworth and Buckland.

Daventry R.D.C. has decided to consent to the Northampton Electric Light and Power Co., Ltd., erecting an overhead line from Daventry to Woodford, with overhead distributing mains in the villages in the district.

Wakefield Electricity Committee has authorised the Electrical Engineer to purchase an additional 750 kVA group of Scott-connected transformers, with a standardised spare limb, at a cost of approximately £650.

Finchley Committee recommends that where a single service already exists for affording a supply to any premises, an extra service should be laid without charge to the consumer for a distance up to 60 ft. from a distributing main.

Bedwas and Machen U.D.C. has received sanction to a loan of £8 575 for the extension of the electricity undertaking, which will enable the Council to proceed with extensions to cover Bedwas, Trethomas, and Maesycwmmer.

Heston and Isleworth U.D.C. proposes to effect street lighting improvements in High Street, and London Road, Hounslow, by the provision of 1 000 c.p. lamps, spaced at a distance of 140 yards, at an estimated cost of £4 612.

The Government Secretary having asked if Douglas (Isle of Man) Corporation is prepared to provide electric light in the Customs House, the Town Clerk has been instructed to forward particulars of the terms on which the supply can be given.

It was reported recently to Darlington T.C. that only three towns in the country produced electricity more cheaply than Darlington, where the cost, on an output of 20 000 000 kWh, was 0·42d. This year it was hoped to reduce it to 0·39d.

A report of the Eastbourne Electricity Committee states that, so far as can be ascertained at present, the profit on the past year's working of the electricity department will probably be a little over £12 000.—Sanction is being sought to a loan of £15 408, for mains extensions, etc.

Aberdeen Electricity Committee has agreed to supply the area on the north side of the Bridge of Don with electricity. There are prospects of considerable expansion in this direction, including a potential demand for supply to the new barracks which are to be erected at a cost of £140 000.

Stoke-on-Trent Electricity Committee has decided that an extension of l.t. a.c. distributing main be laid from High Street West to Direct Timber Supplies, Ltd., and along High Street West, Fenton, and that a circuit breaker be purchased for a sub-station in High Street West, Fenton, at a total cost of £1 200.

The new hydro-electric supply in Ross-shire has been handed over by the contractor, and is now in regular use. The line is being extended to Tain, and farms along the route are being offered special terms for supplies. The service is giving great satisfaction, and the use of electricity for power and heating is being encouraged by the Ross-shire Electrical Supply Co.

St. Pancras (London) Electricity Committee has arranged to provide an auxiliary supply to Maple and Co., Ltd., Tottenham Court Road. At present this firm undertakes its own generation, and now requires an auxiliary supply of about 75 kW, increasing to 100 kW.—The Committee has received sanction to borrow £24 159 for mains, meters, wiring and domestic apparatus.

In consequence of the re-valuation of the district, Beckenham Electricity Committee has revised the percentages of rateable value applicable to the "all in" tariffs as follows: 8% on the first £75 of rateable value instead of 10%; 3% on rateable value above £75, instead of 4%. The price of current to "all in" consumers is also reduced. Consumers not using an electric cooker will pay in the two summer quarters 1d. per kWh instead of 1½d., and consumers using an electric cooker ¾d. instead of 1d.

Dealing with the subject of the regulation of electric wires and fittings, the Town Clerk of Brighton reports that the general law, as it stands to-day, would not enable the Corporation to prescribe standard rules in regard to wires and fittings on consumers' premises. Section 59 of the Brighton Corporation Act, 1900, gives the Corporation power to make bye-laws with respect to any wires, apparatus and fittings in any building or premises within the borough supplied with electricity, but no bye-laws have been made under this section. This section goes part of the way, but it does not, in terms, empower the Corporation to make bye-laws with respect to the nature, material, workmanship and mode of arrangement of wires, apparatus and fittings. The Electricity Committee has instructed the Town Clerk to include such powers as may be necessary in the next Bill which the Corporation promotes.

St. Pancras (London) Electricity Committee is to extend the feeder mains from Highgate sub-station to Fortess Road and Lady Somerset Road, £3 270; from Grafton Road sub-station to Great College Street, £980; and from Tavistock Place sub-station to Gray's Inn Road and King's Cross Road, £2 050.—The Grand Union Canal Co. has called attention to the amount of vapour rising from the surface of the canal, resulting from the discharge of warm water from the Council's condensing plant into the canal. The company's engineer suggests that the water should be discharged below the water level of the canal, and provision is to be made to effect this.—The London and North-Eastern Railway Co. has an agreement with St. Pancras for a bulk supply to King's Cross station, and proposes to arrange for an emergency supply of about 25 kW from Islington. St. Pancras Electricity Committee has no objection to offer.

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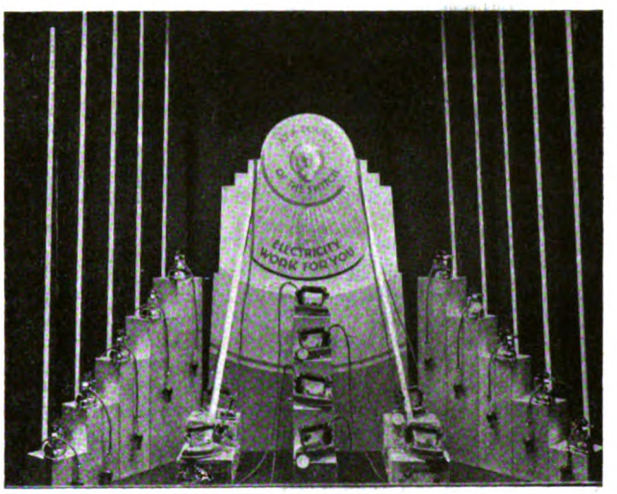
ELECTRICAL NEWS OF THE WEEK IN PICTURES.

Sir John Brooke, who has resigned from the position of secretary to the Central Electricity Board in order to become an Electricity Commissioner. See page 326.

The first of the high-power regional broadcasting stations to be used in this country is here seen taking shape. It is situated near Potter's Bar (London) and it is hoped that the first transmission tests will be made during May next.

Sir John Denison-Pender, chairman of the Eastern Telegraph Co., Ltd., and associated companies, whose death on Wednesday, March 6th, is referred to on page 326.



The March Selling Campaign of the E.D.A. is now well under way, and considerable business is reported to be following in its wake. More than average interest has been shown by electrical contractors in the window displays illustrated above, and a number of these are to be seen up and down the country. The simplicity of the windows, together with the campaign concentrating on one particular type of domestic appliance are features which are making their mark on showroom sales in every town.

Members of the Ex-British Westinghouse Association at the eleventh annual re-union, on March 8th, at the Hotel Cecil, London. The chair was taken by Mr. F. Massingberd Rogers, and the attendance was about 140. See page 331.

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COMPANY NEWS.

Radio and Gramophone Merger—British Insulated Share Bonus—Transfer of Aluminium Corporation's Hydro-Electric Station—G.E.C. British Shares—Progress of North Metropolitan Co.—Metropolitan Co.'s Two-Part Tariff.

A FURTHER relapse of half-a-crown has brought the price of General Electric shares down to 55s., and other electrical share quotations also exhibit weakness, with the exception of Callender's Cable shares, which are 1s. 3d. up on the week. Underground Electric Railways ordinary at 23s. 6d. are 1s. 6d. down, Brush and Siemens each 1s. 3d., and Ever Ready ordinary and Crompton-Parkinson 6% preference 6d. Marconi's Wireless are a shade stronger, but Eastern Telegraph stock has given way a few points. Amongst electricity supply shares, County of London ordinary have dropped 3s. and Newcastle-upon-Tyne Electric Supply ordinary 1s. 3d.

Last Annl. Divd.	Description.	This Week.	Last Week.	1926 to 1928. Highest	Lowest.
%	**Electricity Supply.**				
(*d*)	Brompton & Kensington Ord. ..	27/-	27/-	35/6	23/9
4	Central Elec. Sup. 4% Deb. ..	93	93	95½	88½
(*a*)	Charing Cross Elec. Ord. (£1) ..	26/-*	26/6	51/-	24/3
4½	,, ,, ,, 4½% C.P. (£1)	17/6	17/6	18/3	16/6
(*e*)	Chelsea Elec. Sup. Ord.	27/-	27/-	45/3	24/-
10	City of Lond. Elec. L'ting Ord. ..	31/10½	31/10½	52/10½	26/-
6	,, ,, ,, ,, ,, 6% C.P.	23/-	23/-	24/3	21/6
7½	County Lon. Elec. Sup. Ord. ..	49/-	52/-	68/6	25/9
6	,, ,, ,, ,, 6% C.P. ..	23/-	23/-	24/-	21/3
(*g*)	Kensington & K'bridge Ord. (£1)	27/-	27/-	27/6	23/9
(*b*)	Lon. Elec. Sup. Ord. (£1)	27/6	27/6	37/6	23/-
1/9⅜	Metro. Elec. Sup. Ord.	42/6*	43/9	53/-	24/9
4½	,, ,, ,, 4½% C.P.	17/6	17/6	18/3	16/3
7½	N'castle & Dis. Elec. Ltg. Ord. ..	28/1½	28/1½	31/9	17/6
1/2⅝	N'castle-upon-Tyne Elec.Sup.Ord.	25/-	26/3	30/3	19/3
6	N. Metro. Elec. 6% C.P.	23/-	23/-	23/9	20/10
6	Notting Hill 6% C.P. (£10) ..	10½	10½	11½	9½
(*e*)	St. James & P.M. Ord. (£1) ..	27/6*	27/6	28/6	23/6
1/4½	Shrops.Worcs.&Staffs. Power B.Ord.	37/6	37/6	37/6	21/4
1/9	W'minster Elec. Sup.Ord. (£1) ..	26/6*	27/-	52/9	24/-
4½	,, ,, ,, 4½% C.P. (£1)	17/6	17/6	17/10½	16/7½
8	Yorks. Elec. Power Ord.	35/6	36/-	38/9	24/6
6	,, ,, ,, 6% C.P. ..	24/-	24/-	26/9	20/7
	Railways and Tramways.				
8	Brit. Elec. Trac. Pfd.Ord. Stk ..	128	128	152	117
6	,, ,, ,, 6% Pf. Stk.	128½	128½	133	103½
4	Cent. Lon. Ry. Ord. Stk. (assid.)	72	72	72	54
4	,, ,, ,, 4% Deb.	80	80	83	77½
4	City & S. Lon. 4% Perp. Deb. ..	80	79½	81	70½
5	Lon. Elec. Rly. Cons. Ord. Stk. ..	73½*	75½	75½	42½
4	,, ,, ,, ,, 4% Pf. Stk.	73*	75	77	68
4	,, ,, ,, ,, 4% Deb. ..	80	80	83	70½
5	Lon. & Sub. Trac. A. Deb. ..	97½	97½	97½	74
4	Lon. Un. Trams, 1st Deb. ..	61	61	63	39
4½	Met. Elec. Trams, 4½% Deb. ..	70	70	73½	62
5	,, ,, ,, 5% Deb. ..	69½	69½	70½	65½
3½	Met. Rly. Cons. Ord. Stk. ..	60*	63½	81	54½
3½	,, ,, ,, 3½% Pf. Stk. ..	63*	65	67	60½
3½	,, ,, ,, 3½% Deb. ..	70	71	73½	67½
5	Met. Dis. Rly. Ord. Stk.	76½*	80½	77½	52½
4½	,, ,, ,, 4½% 1st Pref. ..	80½*	82½	84	74½
6	,, ,, ,, 6% Perp. Deb. ..	110½	110½	118½	110
4	S. Met. Elec. Trams, 4% Deb. ..	70	70	70	64½
5	Underground Electric Rlys. Ord.	23/6	25 -	28/2	11/-
—	Yorks. (W.R.) Trams, Ord. ..	5/-	5/-	10/-	3/-
4½	,, ,, ,, 1st. Deb. ..	59	59	78	60
	Electrical Manufacturing.				
7	Brit. Elec. Transformer 7% C.P...	15/-	15/-	19/10	4/6
15	Brit. Insulated Cables Ord. ..	95/-	95/-	80/3	56/-
6	,, ,, ,, 6% C.P. ..	22/6	22/6	23/10	21/-
7	British Thomson-Houston Pref. ..	23/9	23/9	24/9	19/7
7	,, ,, ,, 7% Deb.	104½	104½	109½	102½
10	Brush Electrical Ord.	27/6	28/9	30/9	24/-
15	Callender's Cable Ord.	86/3	85/-	91/3	66/-
6½	,, ,, 6½% C.P. ..	25/-	25/-	25/9	22/-
7½	,, ,, 7½% B. Pref. ..	27/6	27/6	28/3	25/-
8	Crompton-Parkinson 8% Cum. Pf.	25/7½	25/7½	27/-	14/-
6	,, ,, 6% Cum. 2nd Pf.	18/6	19/-	19/6	9/7
7½	Edison Swan Elec. 1st Pref. ..	25/7½	25/7½	13/-	7/4½
5	,, ,, ,, 1st Deb. Stk.	86½	86½	92	81½
7½	Elec. Construction Ord.	20/-	21/3	32/6	23/6
7	,, ,, 7% C.P. ..	22/6	22/6	22/9	21/-
—	English Elec. Ord.	8/1½	8/1½	15/9	5/-
6	,, ,, 6% C.P. ..	9/4½	9/4½	18/9	7/-
7	Ericsson Telephones 7% Pref. ..	18/9	18/9	22/7½	17/6
35	Ever Ready (Gt. Britain) Ord. ..	22/6	23/-	92/3	18/1
6	Ferranti 6% Pref.	18/-	18/-	19/4½	16/9
7	,, 7% 2nd Pref.	21/3	21/3	19/3	13/9
10	General Elec. Ord.	55/-	57/6	46/6	26/6
‡25	W. T. Henley's Ord.	120/-	120/-	120/-	69/3
12½	Johnson & Phillips Ord.	38/9	38/9	67/11	34/-
7½	Lon. Elec. Wire. & Smith's Pref ..	23/9	23/9	25/-	22/3
7½	Siemens Bros. & Co. Ord. ..	26/3	27/6	36/6	24/9
10	Telegraph Const. Ord. (£12) ..	25½	25½	30½	20
	Telegraph.				
3½	Anglo-Am. Tele. Ord. Stk. ..	61½	61½	63½	56½
10	Eastern Ord. Stk.	255	261½	273	135
3½	,, 3½% Pref. Stk.	68½	68½	70½	59
4	,, 4% Deb.	79½	79½	81½	74
10	Eastern Extension Ord. (£10) ..	25½	25⅝	27½	14
22	Gt. Northern Telegraph (£10) ..	32½	32½	43½	26
10	Indo-European (£25)	55½	55½	48½	30
20	Marconi's Wireless T. Ord. ..	80/-	78/9	84/4	12/-
12½	,, Int. Mar.	68/9	68/9	90 -	16/6
10	Western Tel. Ord. (£1)	25½	25⅝	27⅜	12½

(*a*) 19 ⅜d. per share. (*b*) £8 8s. 6.66d. per cent. (*c*) 1s. 6.949d. per share.
(*d*) 1s. 8.706d. per share. (*e*) 1s. 9.3d. (*g*) 1s. 7.223d. * Ex-dividend.
‡ Including 1s. bonus.

POSTAL TELEGRAPH AND CABLE CORPORATION.—Regular qrtrly. div. of 1¾% on 7% non-cum. pfd. stk. will be payable on April 1.

PETERBOROUGH ELECTRIC TRACTION CO., LTD.—Net pft. for 1928, £4 309, agst. £5 464. Brt. in, £4 255. Div. on 6% pref. shs., £1 320; div. on ord. shs. at rate of 10% p.a., £2 500. Fwd., £4 232.

BRUCE PEEBLES CO., LTD.—Dirs. recmd. pmt. of fixed pref. div., at rate of 7½%, less tax, for hlf.-yr. to Dec. 31, and div. of 5%, less tax, on ord. shs. for yr. Transferred from gen. res. to pft. and loss, £10 000.

CHATHAM AND DISTRICT LIGHT RAILWAYS CO.—Net pft. for 1928, £4 153 (agst. £5 198, after provisn. of £4 500 for deprctn. last yr.). Brt. in, £1 259. Fwd., £5 412. No div. (agst. 5% on pref. and 2½ % on ord. last yr.).

DAVIS AND TIMMINS, LTD.—Net pft. for 1928, £23 417, agst. £6 639, plus inc. tax blce. £578 and £18 168 brt. in. Blce. div. at rate of 16¼% on ord. shs., makg. 20% for year, less tax, agst. 8%, tax free. Written off new issue exes., £2 379. Fwd., £21 316.

TELEGRAPH CONSTRUCTION AND MAINTENANCE CO., LTD.—Net pft. for 1928, £106 044, plus £112 618 brt. in. Intm. div. 2½%, paid July 12, 1928, required £22 410, leavg. £196 353. Directors propose further div. of 7½%, tax free; to res. £15 000; fwd. £114 123.

RADIO AND GRAMOPHONE MERGER.—His Master's Voice Gramophone Co. has entered into an agreemt. to acquire the Marconiphone Co., Ltd., and the right to use present and future Marconi patents and inventns. in all fields of public entertainment and education.

BRITISH INSULATED CABLES LTD.—It is proposed to pay fin. div. for 1928, of 10%, makg. 15% (unchanged), plus 25% bonus in ord. shs. and 37½% bonus in new 5½% cum. A pref. shs.; to res. and depreciatn., £400 000 (agst. £300 000); fwd., £250 000 (agst. £305 880).

WAYGOOD-OTIS, LTD.—Pft. for 1928, after deductg. res. for depreciatn., etc., £77 254, agst. £68 115. To res. for contingencies, £30 000, and res. for pensions, £6 000. Net income, £41 254. Fin. div., 7½% on ord. shs., makg. 10% for year (same as last year). Fwd. £15 570, agst. £12 315.

MIDLAND ELECTRIC MANUFACTURING CO., LTD.—Net pft. for 1928 £43 402, agst. £39 360, plus surplus on realisatn. of investmts., £5 250, and £14 314 brt. in. Div. on pref. shs. takes £4 500, and dir. prpse. div. of 10% on ord. shs., less tax, and bonus of 25%. To gen. res., £24 274. Fwd., £13 192.

TILLING-STEVENS MOTORS, LTD.—Pft. for 1928, £81 105; agst. £124 899, plus £8 169 brt. in. On Sept. 1 last div. on acct. of half-year to June, 1926, was paid on pref. shs. It is now proposed to place £10 000 to depreciatn. res., £7 500 to res. for contingencies, and £9 500 to res. for taxation and to pay further div. on pref. shs. for half year ended Dec., 1926.

ALUMINIUM CORPORATION, LTD.—A mtg. of deb. hldrs. on Monday approved proposed sale of hydro-electric porcn. of co.'s undertaking to North Wales Power Co., and, at subsequent mtgs., ord. and pref. shhlders. approved resolutions to reduce cap. from £1 000 000 to £808 058, to convert. £1 pref. shs. into 10s. ord shs., to cancel pref. div. arrears, and to increase cap. to £1 000 000 in 10s. shs.

ENGLISH ELECTRIC CO., LTD.—Net pft. for 1928, after makg. usual provisns. and charging expenditure during year on tools, patterns, drawings, etc., £86 292, agst. a loss of £12 237. Int. on debs. and deb. stk. and transfer fees require £119 908, agst. £122 167; net loss £33 616, agst. £134 404. Debit blce. brt. in is increased to £433 516. Div. on pref. cap. in arrear fm. June 30, 1926.

SCOTTISH POWER CO.—Tradg. pfts. of undertakgs. controlled by co., for 1928, £116 659, agst. £99 449. Res. by the cos., £22 522, agst. £35 855, blce. being paid to Scottish Power Co., accts. of wh. show blce. of £85 840, after mtg. exes, and incldg. £3 253 brt. in. After provisn. for deb. int., div. on pref. cap., and £970 for deb. redemptn., and placing £4 466 to res., div. of 8% on ord. shs. is prpsd. Fwd. £3 399.

BRITISH COLUMBIA POWER CORPORATION.—Net earngs. for six months ended Dec., 1928, £441 479. The corporation, which was formed to take over, as from July 1 last, the whole undertakg. then owned by the British Columbia Electric Railway Co. and its subsidiaries, and whose control was

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transferred from London to Canada, announces decrease of $61 747 (£12 731) in working exs. for Dec., 1928, as compared with Dec., 1927. Net income shows increase $36 190 (£7 462). Six months' workg. to Dec. 31, 1928, shows net earngs. £441 479, increase £50 676.

CITY OF LONDON ELECTRIC LIGHTING CO., LTD.—Total income for 1928, £798 926, rev. carried to net rev. acct. £451 588 after deducting expenditure. Int. on deb. stks. and on loans, deposits, etc., transfers to sinking funds and contingency fund, etc., absorbed £208 880, and, after adding int. on investmts. and discts. on purchases, net rev. w.s £253 341. Divs. paid on 1st and 2nd pref. and ord. shs. in Sept. last required £84 000, one-sixth of consumers' benefit placed to special res. £45 990, and amount apportioned to benefit of co-partners £31 695. Balance divs. recommended, making total distribution for year of 6% on 1st pref., 8% on 2nd pref., and 10% on ord. shares, less tax.

LONDON ELECTRIC SUPPLY CORPORATION, LTD.—Sales in 1928 yielded £692 506, agst. £678 487, total rev. includg. sundry income, being £708 542, agst. £693 927. Purchase of current absorbed £448 601, compared with £358 424, total expenditure being £529 662, agst. £442 713, leaving a pft. of £178 880, compared with £251 214. With £19 709 brt. in and int. from investmts., etc., amt. available was £36 663' and after deductg. int. charges, £23 494, and providing for sinking funds, £30 552, blce. available is £181 206, agst. £127 594. After mtg. divs. on pref. shs., board recommends fin. div. on ord. shs. of 5%, makg. 9%, agst. £4 8s. 6-6-7d. To special reserve—ord. shldrs' benefit under sliding scale for 1926, 1927 and 1928, £50 880. Fwd. £25 437.

G.E.C. Issue.

GENERAL ELECTRIC CO., LTD.—In our last issue (on page 309) we published an announcemt. that on March 13 a mtg. wld. be held to consider a resolutn. to increase the cap. by the creatn. of 1 600 000 new £1 shs. and providing that such shs. shld. only be issued to British investors, and other resolutns. incidental to the scheme. The Co. has since received a cablegram from New York from a committee of holders of a substantial number of the co.'s shs. represented by the certificates issued by the Guaranty Co. of New York, protestg. agst. the action proposed to be taken and stating that if the proposal were carried out it would deprive the foreign hldrs. of these certificates of a substantial property interest. Sir Hugo Hirst, in reply, states that about 60% of the ord. shs. are in American hands. The board believes the committee's protest is due to a misunderstandg. of the proposal. The new issue is being made to the British public generally. When the debs. are redeemed £60 000 additionally will be available for the benefit of ord. shhldrs., regardless of their nationality, and any benefits such as possible increased divs. or cap. bonuses will always belong to all proprietors, without distinction. At the meeting on Wednesday, Sir Hugo Hirst said the reason for this increase of cap. was primarily due to their desire to redeem the outstanding debs. as soon as possible. It had always been his ideal that some day the G.E.C. might mean to the people of this country what the G.E. meant to the people of America and the A.E.G. or Siemens to the people of Germany. On returning from a six months' trip to Australia, he found that considerably more than half their ord. shs. had wandered across the Atlantic, and they realised that they had been deprived of 60%, if not more, of their ord. shhldrs.—that very body to whom they looked for support in their home market, which represented 70 or 75% of their business. It was vital that the British character of the company shd. be preserved, and that their shhldrs. shd. include a considerable percentage of subjects of the British Empire, who played a great part towards securing continuity of employment for the company's 25 000 workers. It was for these reasons alone that it was proposed to confine the present issue to the British Public. They had sold 1 500 000 shs. to the British, Foreign and Colonial Corporation at £2 per sh., leavg. them to allot them at a price not exceedg. £2 2s. p. sh. There was some oppositn. on behalf of the American shhldrs., but the resolutns. were carried by an overwhelmg. majority.

Company Meetings.

CHARING CROSS AND STRAND ELECTRICITY SUPPLY CO., LTD.—At the meeting last week, Mr. W. F. Fladgate (chairman) said in their business last year there had been movement in every department, and he thought that practically in every case it had been in the right direction. In 1928 they sold nearly 65 000 000 kWh, an increase of over 4½ millions. Net revenue increased by over £60 000, and the carry forward was £97 900, an increase of £61 900. On the debit side the most interesting factor had been the reduction in the price of energy. In 1927, 72 000 000 kWh cost £298 000, while in 1928 they paid only £214 000 for 78 000 000 kWh. This had been brought about by the economies which the London Power Co. had been able to accomplish. He had every hope that further economies would be brought about when their new stations at Deptford and Battersea were working. Decrease in the price of coal was a factor in this, but not to a greater extent than 40%, the remaining 60% being caused by economies and efficiency in working rendered possible under the scheme of the London Power Co.

NORTH METROPOLITAN ELECTRIC POWER SUPPLY CO.—Sir James Devonshire, presiding at the general meeting, said the past year showed a continuance of that steady progress and development of the company which commenced after the readjustment upon the change over from war conditions, and had characterised the record of the company since then. The service of the company had increased from 143 million to 164 million kWh, an increase of 14%. Consumers supplied, either directly or indirectly, increased from 85 000 to over 99 000, representing 17 per cent. The total length of trunk and distributing mains at the end of the year was 1 294 miles, served by 311 sub-stations. The directors were recommending a dividend upon the ordinary shares of 10% for the year (on account of which an interim dividend of 4% had already been paid), leaving £28 202 to be carried forward, or £9 000 more than the amount brought in. At the new generating station at Brimsdown, a number of special features were introduced. The number of their consumers who had purchased their own electric cookers had more than doubled since 1926; electric cooking was becoming a pnblic habit, and the rapid growth in this direction was largely due to the fact that those who had adopted electric cooking were so satisfied that, perhaps unconsciously, they became their best canvassers. Last year, 228 000 separate accounts were rendered in connection with electricity supply, sales of electrical apparatus and for installation work carried out by the staff, and resulted in a total revenue exceeding 1 000 000.

Popularity of Two-Part Tariff.

METROPOLITAN ELECTRIC SUPPLY CO., LTD.—Mr. George Balfour, M.P., presiding at the meeting on March 6th, said the increase in consumption and in the number of consumers who had adopted their two-part tariff indicated that it would soon largely supersede the old flat rate. It had resulted in an average increase of 20% in consumption of electricity by those consumers who had adopted it. They had now the greater part of their transmission cables underground on a system of ring mains to give duplicate main transmission to nearly all their customers. The length of high and low tension cables was 621 miles. The output from the sub-stations was 126 000 000 kWh, compared with 106 500 000 for the previous year, an increase of a little over 18%. Of this total, 42 100,000 kWh were sent out in the London area, and 83 900,000 in the Western area. He had had the figures worked out showing the cost of their supply, based on conservative calculations of the cost of operating Willesden power station and allowing 8% on the total capital expenditure of Willesden at the date they sold it, and including a like interest on an additional £570 000 for any extensions to meet their requirements since the date of sale. This brought out an overall cost for operating, management, interest, etc., to £341 127, compared with £387 581 paid to the London Power Co. last year for electrical energy. A final dividend, making a total of 9% for the year, was approved.

WESTMINSTER ELECTRIC SUPPLY CORPORATION, LTD.—Lord Wargrave, presiding at the annual meeting, said the cost of current purchased was £7 000 higher, but they had purchased 5 000 000 more units. An increase of £11 000 was shown in receipts from sale of current, and revenue continued to grow notwithstanding continual reductions in charge for current to consumers. The output increased by 5¼ million kWh. The standard prices, applied to the figures for 1926, 1927, and 1928, showed that the consumers had received benefits in those years amounting to £188 787, and there had accrued to the ordinary shareholders £28 608, representing their proportion of the consumers' benefit for the three years. In 1891, the company sold 627 000 kWh at an average price of 7½d. At the end of 1928 the annual output had grown to 60 000 000 kWh, and the average price charged had dropped to 2·3d. per kWh unit. This compared with the *maximum*

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price of 8d. authorized under their Provisional Orders and the standard price for private consumers of 2¾d. Practically the whole of the company's output was represented by supplies to private consumers, and it was only by keeping tariffs down to the minimum that this result had been obtained. The price charged for a.c. lighting supplies was now 3¾d., and they had also the low rate of ½d. for cooking and water heating. The company was one of the pioneers in introducing a rate of 1d. per kWh for current used for heating, and this had been in operation for over 20 years. There was no evidence in these figures of the consumers being exploited for the benefit of the shareholders. For the current year he thought the prospects were good.

Torquay Tramway Co., Ltd.—At the recent general meeting, Mr. H. T. Barnett (chairman) said traffic revenue for year was £63 649, against £61 624. Profits for the year added to the amount brought forward, were £15 285, the same as for 1927. An interim dividend of 4 per cent., tax free, was paid in August, 1928, leaving £9 285 to be dealt with. The directors recommended a final dividend of 4 per cent., and a bonus of 1 per cent., tax free, for the year, carrying forward £1 785.

Midland Counties Electric Supply Co., Ltd.—Mr. George Balfour, M.P., presiding at the meeting last week, said shareholders would remember that they were carrying on a certain amount of traction business in addition to their electricity supply undertakings. Last year he told them that the traction enterprises were passing through a bad time. Their Bill in Parliament, dealing with their largest traction interest, had become an Act of Parliament, and they were engaged in dealing with the smaller undertakings in a similar manner. They had applied their minds to the consolidation of the services, and he was glad to report considerable improvement, in consequence of the reasonable degree of security they had obtained. Gross receipts were £723 500, of which nearly 85% was derived from electricity supply. Last year they sold 133 596 000 kWh, an increase of more than 29 millions over the year 1927. They connected 5 385 new consumers last year, making a total of 20 577. The additional load amounted to 19 676 kW, bringing the total connected load to 105 300 kW. The maximum load on the generating plant was 42 910 kW, in addition to 2 000 kW purchased. Extensions were carried out to give supplies to two urban districts and 39 rural parishes which had not hitherto been served. They were now supplying in three boroughs, 26 urban districts and 134 rural parishes, in addition to supplies in bulk for ten local authorities and company undertakings. All their generating stations had been classified as selected stations under the Central England scheme. At Spondon a 25 000 kW set was in course of erection. The report and accounts were adopted, the payment of the dividend on the preference shares for the year was confirmed, and the proposal to pay a dividend of 6½% on the ordinary shares was approved.

Marconi International Marine Communication Co., Ltd.—Mr. F. G. Kellaway, presiding at the meeting on Monday, said the balance of the profit and loss account was £193 420 6s. 7d., compared with £179 730 8s. 7d. for 1927. There was brought forward from 1927, £23 677 10s. 1d., from which directors additional remuneration voted at the last annual general meeting was taken, bringing the figure to £22 177 10s. 1d. This carry-forward, together with the profit for the year of £193 420 6s. 7d., left a total of £215 597 16s. 8d. available for distribution. An interim dividend of 7½% had been paid, and the board recommended a final dividend of 7½%, making a total for the year of 15% and enabling them to carry forward £36 689. Designs of ship wireless telegraph and telephone apparatus had been made to meet the new requirements, and this year they were being offered at prices which approximated very closely to the standard figures for spark outfits. The reports from nearly 1 000 ships equipped with the company's four second auto-alarm device had been carefully analysed, and they were satisfied that their device had an efficiency of not less than 90%, with prospects of improvement as further experience was gained. The wireless direction-finder was being employed to an increasing extent. Another feature of 1928 was the increase in the use of wireless on trawlers. To date there were 191 trawlers and drifters carrying the company's apparatus. Under the arrangement which had been made with the Gramophone Co., that company acquired the Marconiphone Co.'s business, and the wireless company would no longer be directly concerned with wireless in its application to the entertainiment and educational fields. In the future, as a part of the wireless and cable merger, it would confine its activities to research and invention in wireless generally, to its manufacturing business as carried on at Chelmsford, and to the development of its traffic services. The report was adopted and the dividends were approved.

Underground Electric Railways Co. of London, Ltd.—Presiding at the meeting on March 7th, Lord Ashfield (chairman) said the London built up area was reaching out in long stretches of houses to the 12 mile limit from the centre, and the problem of planning for the conveniences of these new colonies grew yearly more difficult. So far as receipts were concerned he could foresee nothing which need induce them to pause or to have doubt as to their future. In the last five years, although the index number for the cost of living had fallen from 180 to 167 points, they had slightly increased the average wage paid to their staff; the increase being 6%. They had achieved this result by two means. They had received better service, and had enabled that better service by putting at their disposal the best equipment and machinery that they could obtain. They would have this year to find another £200 000 to meet their petrol bill, assuming that no further advance in price would occur. In last year the transport undertakings in which they were interested paid in rates and taxes £978 000. It was about one-quarter of the net traffic receipts remaining after meeting working expenses. To be taxed at the rate of 25 per cent. upon the real earnings was grievous and far exceeded the charge upon any other industry. The volume of passengers grew. The demand for further facilities became insistent. Just now they had committed their subsidiary companies to the task of seeking from Parliament powers to enable them to enter into agreements on a much wider basis than hitherto for the co-ordination of all the local passenger transport facilities within the London traffic area, in such a fashion that a more certain sense of security would be enjoyed by them all, thus enabling them to raise additional capital for extensions on satisfactory terms. The Bills in no way destroyed or impaired the responsibilities and obligations of those who now owned or controlled the various means of transport. The common management must be the servant of the owners, discharging in full on their behalf all their responsibilities and obligations. The report was adopted, and the final dividend of 4% on the ordinary shares, making 7% for the year, against 5% for the previous year, was approved.

METAL AND CHEMICAL PRICES.

Tuesday, March 12th.

		Price.	Inc.	Dec.
Copper—				
Best Selected ..	per ton	£87 10 0	—	10s. 0d.
Electro Wirebars	,,	£91 10 0	—	—
H.C. Wires, basis	per lb.	1s. 0 7/16d.	—	—
Sheet	,,	1s. 0 7/16d.	1/16d.	—
Phosphor Bronze—				
Wire (Telephone) basis	per lb.	1s. 3 7/16d.	—	—
Brass 60/40—				—
Rod, basis ..	per lb.	9d.	—	—
Sheet ,, ..	,,	11½d.	—	—
Wire ,, ..	,,	11½d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£3 9 6	—	—
Galvanised Steel Wire, basis 8.S.W.G. ..	,,	£14 15 0	—	—
Lead Pig—				
English	per ton	£25 0 0	—	—
Foreign or Colonial	,,	£23 10 0	—	2s. 6d.
Tin—				
Ingot	per ton	£220 7 6	10s. 0d.	—
Wire, basis ..	per lb.	2s. 10½d.	—	—
Aluminium Ingots	per ton	£95 0 0	—	—
Spelter	,,	£26 5 0	—	2s. 6d.
Mercury	per bottle	£22 5 0	—	—

Sulphur—Flowers, Ton £12 0 0 *Sulphuric Acid*—
,, Roll ,, £10 10 0 (Pyrites, 168°) Ton £6 15 0
Copper Sulphate ,, £25 to £25 10 0 *Sodium Chlorate* ,, £5 10 0
Boric Acid (Crystals),, £30 0 0 *Sodium Bichromate* per lb. 3½d.
Rubber—Para fine, 1s. 1½d.; plantation, 1st latex, 1s. 0½d.

∴ The metal prices are supplied by British Insulated Cables Ltd., and the rubber prices by W. T. Henley's Telegraph Works Co., Ltd.

THE LEAD MARKET.

The easier tone which developed at the end of last week was, according to James Forster and Co., in evidence on Monday, prices declining 2s. 6d. per ton all round, but subsequently advanced until on Thursday £23 18s. 9d. was paid for March and £24 2s. 6d. for June. The American price was again raised on March 6th, 15 points to 7.25 cents.

Closing prices on March 8th were £23 12s. 6d. for March, £23 13s. 9d. for April, £23 15s. for May, and £23 16s. 3d. for June, 2s. 6d. lower to unchanged on the week.

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COMMERCIAL INFORMATION.

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debt. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

ARCHER, Bertram, 89, Abbey Road, St. John's Wood, electrical engineer. £21 3s. 4d. January 28th.

BROWNING, Mr. T. E., 28, Playdell Avenue, Stamford Brook, radio engineer. £20 4s. February 1st.

COUNTY ELECTRICAL AND WIRELESS STORES, LTD., Garrick Yard, St. Martin's Lane, W.C. £79 3s. 4d. January 29th.

COWAN, Mr. T. F., 189, Regent Street, W., retailer of wireless. £28 1s. 2d. December 21st.

CROWN ELECTRICAL CO., 82a, Queen Street, E.C., electrical engineers. £13 12s. 2d. January 9th.

GARD, W., Town Hall Chambers, Coleford, electrical engineer. £39 12s. 10d. January 8th.

LENEY, Jno., A., 101, Rowlands Road, Worthing (trading as J. A. LENEY), electrical engineer. £17 17s. February 6th.

SWEET, Mr. R. C., 107a, High Street, Uckfield, wireless retailer. £17 12s. 6d. February 1st.

TEMPEST, Mr. C., 35, Kirkgate, Bradford, electrical contractor. £36 4s. 2d. January 8th.

THORNTON (HUGH) AND SONS, 74, Manchester Road, Burnley, electrical engineers. £22 4s. February 7th.

TUFNELL, Mr. R., 15, Ravensbourne Park, Catford, electrical contractor. £21 18s. 6d. August 22nd.

WALKER, Mr. A. J., 88, Weston Road, Meir, electrical dealer. £69 6s. 4d. January 9th.

WOODWARD, Mr. C. E., 75/85, South Eastern Road, Ramsgate, electrical engineer. £10 7s. January 23rd.

Satisfaction.

CARTER, N. E. W., 8a, Pitville Street, Cheltenham (trading as CHELTENHAM ACCUMULATOR CO.), radio and electrical engineer. £22 5s. 10d. December 14th; satisfied March 1st, 1929.

Deeds of Arrangement.

HUGHES, William, James Street, and Sandy Lodge, Great Orme's Road, Llandudno, electrician. Dated March 9th, filed March 11th. Trustee, J. H. Jones, 69, Mostyn Street, Llandudno, accountant. Secured creditors, £115; liabilities unsecured, £211; assets, less secured claims, £145.

WOODHEAD, Reginald, Main Street, Hathersage, and ASH, Bertram, 74, Doe Quarry Lane, Dinnington, and trading at 31, Church Street, Rotherham, as WOODHEAD BROS., electrical engineers. Dated March 8th, filed March 9th. Trustee, A. Arthur, Imperial Buildings, Rotherham, I.A. Secured creditors, £268; liabilities unsecured, £2 597; assets, less secured claims, £1 115.

YARNIT, Thomas Howard, trading as ELECTRICAL INSTALLATION CO., 25, St. Mary's Row, Moseley, and residing at Belgrave Road, Birmingham, electrical contractor. Dated February 27th, filed March 6th. Trustee, J. W. Blackham, 147, Corporation Street, Birmingham, I.A. Secured creditors, £6; liabilities unsecured, £523; assets, less secured claims, £82.

Receivership.

ELECTRICAL APPLIANCES (BLACKPOOL), LTD. W. B. Haworth, of 35, Cookson Street, Blackpool, was appointed receiver and manager on February 19th, 1929, under powers contained in debenture dated April 10th, 1928.

Mortgages.

[NOTE.—*The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—allowed by the date of the Summary, but such total may have been reduced.*]

MAUGHAN (J. L.) AND CO., LTD., Newcastle-on-Tyne, electrical engineers. Registered February 22nd, £3 000 (not ex.) debenture, to Stella Conduit Co., Ltd., Highfield Works, Bilston; general charge. *£1 950. February 2nd, 1928.

MIDHURST AND DISTRICT ELECTRICITY CO., LTD., London, W.C. Registered January 29th, debenture for £5 000, and further advances with premium of 5 per cent., to Johnson and Phillips, Ltd., Columbia House, Aldwych, W.C.; general charge.

RUSHDEN AND DISTRICT ELECTRIC SUPPLY CO., LTD. Registered February 20th, £550 and £450 debentures, part of £50,000; general charge. *£25 000. March 6th, 1928.

Private Meetings, etc.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

SADLER (THOMAS) LTD., Canal Street, Stockport, electrical engineers, etc. The statutory meeting of the creditors in the voluntary winding-up of this company was held recently at the offices of Frank Harrop and Co., I.A., Palatine Bank Buildings, Norfolk Street, Manchester. Mr. F. Harrop, the liquidator, submitted a statement of affairs which disclosed ranking liabilities of £1 288, and assets estimated to realise £61, subject to preferential claims of £20, or a deficiency of £1 247. The issued capital is £238, and as regards the shareholders, the deficiency is £1 485. It was reported that the company was registered in February of last year, to take over an existing business. The company had a nominal capital of £500 in £1 shares, of which £238 had been issued and were fully paid. It was pointed out that the turnover since the incorporation of the company had been something like £2 000, and that there had been a gross loss of approximately £300. The expenses in the same period had totalled £723, and the deficiency was accounted for by those two items, together with the depreciation written off the assets in the statement of affairs. Mr. T. Sadler was a creditor for £324, representing monies advanced to the company from time to time.

London Gazette, etc.

Company Winding-up.

WHITFIELD ELECTRICAL CO., LTD.—Winding-up Order, March 5th.

Notices of Dividend.

DAVIES, John Arthur, of "Eureka," Church Street, Blaenau, Festiniog, Merioneth, electrical contractor. First and final divi, dend, 3s. 5¾d. per £, payable March 20th, Official Receiver's Office-St. Peter's Churchyard, The Cross, Chester.

KELLY, Stanley Sherzell, 59, North Road, Durham, electrical contractor. First and final dividend, 1s. 7½d. per £, payable March 18th, 2, Sackville Place, Newcastle-upon-Tyne.

PACIFICO, Alexander Pacy, PACIFICO, Jack Pacy, and FEITELSON, Raphael, trading as THE COMTON WIRELESS MANUFACTURING CO., 26-28, Bartholomew Square, Old Street, E.C.1. First and final dividend, 1s. 0½d. per £, payable November 16th, at the offices of Messrs. Corfield and Cripwell, 119, Finsbury Pavement, E.C.2.

Bankruptcy Proceedings.

BUCKLEY, Harry, electrician, 23, Asylum Road, Old Kent Road, London, S.E. A sitting for the public examination of the debtor was appointed in the London Bankruptcy Court on Wednesday of last week, his statement of affairs showing a liability of £1 932 and assets £6. He has attributed his failure and insolvency to his liability under judgment obtained by the petitioning and only creditor for moneys had and received, but he has denied that he received any consideration for the judgment debt. The Official Receiver said that the case was before the Court a week previously when the debtor failed to submit himself for examination, and an order was made ordering the examination to stand over for a week. The debtor had not been in attendance that day although his (the Official Receiver's) examiner had been waiting for him throughout the morning. In these circumstances it was submitted that the examination now be adjourned *sine die*.

This application his Honour granted.

LEE, Edward Francis (trading as FRANCIS NEWTON) electrical engineer, 340a, King's Road, Chelsea, London, S.W. The debtor, who filed his petition on February 22nd, has carried on business as a builder, decorator and electrical engineer. At the statutory first meeting of his creditors it appeared from statements that have been made by the debtor that he resigned his commission in the Army in July, 1926, receiving a gratuity of about £1 000, and, after payment of his personal debts, was left with a capital of £700. He then entered into partnership with another person, and they began business under the style of Francis Newton, builders and electrical engineers, at the above address, which premises they took at a rental of £180 a year. But business from the inception of the partnership proved very poor, and they found that it was insufficient to carry two partners, with the result that in July last the partnership was mutually dissolved. The debtor took over all the assets and liabilities, paying his partner £25 on retirement, and has since traded alone. Creditors have, however, recently been pressing him, and on February 16th last he closed the business. The debtor attributes his failure to bad debts, to heavy overhead expenses and to bad trade. The meeting was closed, and the case remained in the hands of the Official Receiver as trustee in bankruptcy for summary administration, the debtor's statement of affairs showing liabilities £372 and assets £60.

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PATENT RECORD.

The following information is prepared from the Illustrated Official Journal (Patents) by permission of the Controller of H.M. Stationery Office. Printed copies of full Patent Specifications, when accepted, may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at 1s. each.

Specifications Accepted.

305 109 B. Hesketh. Frame aerials as employed in the art of wireless telegraphy and telephony. (27/9/27.)
305 055 British Thomson-Houston Co., Ltd., H. Pearce, and E. D. Regis. Electric switchgear. (29/9/27.)
305 250 R. A. W. Watt and L. H. Bainbridge-Bell. Apparatus adapted for use in radio-telegraphic direction-finding and for similar purposes. (3/10/27.
305 058 A. A. Linsell. Electromagnetic reproducing and recording devices for gramophones. (25/10/27.)
297 093 Weston Electrical Instrument Corporation. Electrical indicating instruments. (16/9/27.)
305 063 Edison Swan Electric Co., Ltd., and L. H. Soundy. Thermionic valves. (16/10/27.)
305 084 W. E. Beatty (Bell Telephone Laboratories, Inc). Coating articles. (26/10/27.)
305 251 C. S. Franklin. Thermionic valves. (28/10/27.)
305 085 W. E. Beatty (Bell Telephone Laboratories, Inc). Methods of an apparatus for covering cores, particularly applicable for insulating cables. (29/10/27.)
305 069 A. Reyrolle and Co., Ltd., and N. Cooke. Electric relays. (29/10/27.)
279 899 Siemens and Halske Akt.-Ges. Push-pull connection for thermionic and like valves. (30/10/26.)
305 073 A. Whitaker and Gramophone Co., Ltd. Microphones. (29/10/27.)
305 074 W. H. Eccles, A. Whitaker and Gramophone Co., Ltd. Means for controlling the intensity of a beam of light for use, for example, in recording sound. (29/10/27).
305 075 A. H. Marks and P. Russell [legal representatives of E. R. C. Marks (deceased)] (J. A. L. Horn). Telegraphic receiving and transmitting apparatus. (29/10/27.)
305 156 P. C. Saccaggio. Electric power-transmission controllers for locomotives and other vehicles. (1/11/27.)
305 158 Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. Telephone systems. (1/11/27.)
280 893 Aktiebolaget Separator. Milking machine having electrically controlled pulsations. (17/11/26.)
305 256 Siemens Bros and Co., Ltd., W. E. Goodwin, and F. Baker. Electrical terminal boards. (2/11/27.)
305 284 W. E. Beatty (Bell Telephone Laboratories, Inc.) Electrical coupling-circuits for transmitting voice and like complex-frequency currents. (7/11/27.)
280 565 Siemens and Halske Akt.-Ges. Telephone systems with amplifiers (15/11/26.)
305 296 British Thomson-Houston Co., Ltd., C. J. Morton, and T. H. Woodfield. Electric junction boxes. (14/11/27.)
305 302 C. A. Vandervell and Co., Ltd., R. C. Paterson, and P. J. Beddows. Pasting of electric accumulator plates. (17/11/27.)
282 368 R. B. Hunter. Method of and means for controlling polyphase induction motors. (15/12/26.)
305 318 W. A. Coates, J. Fowler, and Metropolitan-Vickers Electrical Co., Ltd. Tap-changers for electric transformers. (1/12/27.)
305 322 R. K. Hezlet, V. E. A. Pullin, and A. G. Warren. Radiographic apparatus. (3/12/27.)
282 074 British Thomson-Houston Co., Ltd. Combined automatic and manual electric circuit-controllers. (13/12/26.)
305 327 H. Bold. Electrically driven time-pieces. (10/12/27.)

Applications for Patents.

January 24th.

2 434 A. W. and H. B. Arden. Magnetic pointer device for wireless apparatus.
2 449 R. L. Aspden. Television, etc., apparatus.
2 535 Associated Telephone and Telegraph Co. Telephone systems. (7/1/27, U.S.)
2 519, 2 520, 2 521 H. H. Berry. Electric fires.
2 461 Birtman Electric Co. Vacuum cleaners. (4/2/28, U.S.)
2 507 British Thomson-Houston Co., Ltd. Signalling systems. (24/1/28, U.S.)
2 508 British Thomson-Houston Co., Ltd. Electrodes for electric discharge. devices. (2/3/28, U.S.)
2 470 W. M. Crawfurd, and Siemens Bros. and Co., Ltd. Junction box for electric cables.
2 499 Ferranti, Ltd., and A. Hall. Volume control devices for radio receiving apparatus.
2 500 Ferranti, Ltd., and A. Hall. Radio receiving apparatus.
2 416 Kapella, Ltd. Pedal-operated electric switches.
2 471 Siemens Bros. and Co., Ltd. (P. E. Cheeseman.) Insulation of conductors.
2 514 G. Somajni. Electric control apparatus. (31/1/28, Italy.)
2 501 R. W. Strange. Television. (25/1/28, Australia.)
2 474 Vereinigte Gluhlampen und Electricitats A.G. Recording phenomena by means of cathode rays. (1/2/28, Hungary.)

January 25th.

2 557 W. Aitken. Telephone switching systems.
2 591 Akt. Ges. Brown, Boverie et Cie. Electric rectifiers. (13/2/28, Germany.)
2 668 A. Heyland. Starting synchronous motors.
2 574 C. Lorenz Akt. Ges. Method of wireless transmission. (26/1/28, Germany.)
2 638 K. Manger. Electric lighter for pipes, etc. (27/1/28, Germany.)
2 588 Sir G. C. Marks (Belden Manufacturing Co.). Electric connector plugs.
2 589 Sir G. C. Marks (Western Electrical Instrument Corporation). Testing vacuum tubes.
2 596 Metallges Akt. Ges. Electrical conductors. (25/1/28, Germany.)
2 682 J. Moison. Electrical ringing device for church bells.
2 674 P. S. Newbound. Terminals for conductors.
2 678 H. J. Osborn and A. Wright. Controlling electric circuits.
2 621 C. J. R. H. von Wedel. Electron discharge tubes.
2 662 A. West and Co., Ltd. Tripping mechanism for electrical switches.
2 663 A. West and A. West and Co., Ltd. Electric switchgear.
2 664 A. West and Co., Ltd., and F. Bergmann. Electric control systems.
2 634 M. de Wrangell. Combined electric and mechanical motor control for phonographs. (27/1/28, France.)

January 26th.

2 757 Cambridge Instrument Co., Ltd. Electrical measuring instruments, etc
2 758 Columbia Gramophone Co., Ltd. Supports for electrical reproducing devices.
2 750 S. G. S. Dicker (N. V. Philips' Gloeilampenfabrieken). Battery charging systems.
2 756 S. Z. de Ferranti. Electric radiator fires.
2 772 P. Freedman. Thermionic valves.
2 718 M. H. Goldstone. Insulated lampholders.
2 744 S. Lyle (H. B. Lyle). Electrical pick-ups, etc.
2 688 J. W. C. S. Northcote. Moving coil for loud speakers, etc.
2 760 E. Pacilli. Electrodynamic operation of railway switches, etc.
2 748, 2 749 J. E. Pollak (Associatfd Telephone and Telegraph Co.). Call recording apparatus for telephone systems.
2 787 Radiovisor Parent, Ltd. Controlling automatic instruments, etc.
2 781 Siemens-Schuckertwerke A.G. Electric cables. (26/1/28, Germany.)
2 731 B. A. Spaull. Incandescent lamp holders, etc.
2 757 C. D. Sutton. Electrical measuring instruments, etc.

January 28th.

2 848 English Electric Co., Ltd., and J. O. Wilson. Dynamo-electric machines.
2 839 General Electric Co., Ltd., G. A. Gaw, and C. W. Wilman. Telephone systems.
2 919 V. H. Gilbert, A. Johnson, and Radiovisor Patent, Ltd. Measurement of electric currents, etc.
2 857 International General Electric Co., Inc. Single-phase transformers. (28/1/28, Germany.)
2 859 International General Electric Co., Inc. Vacuum cleaners. (28/1/28, U.S.)
2 912 A. C. Johnson. Remote control of electric lamps.
2 794 Loewe-Radio Ges. Armatures for electrical sound boxes. (27/1/28, Germany.)
2 815 C. Lorenz Akt.-Ges. Arrangement for suppression of self-capacity of conductors. (28/1/28, Germany.)
2 922 N. W. McLachlan. Thermionic amplifiers for gramophones, etc.
2 911 T. G. Mair. Electrical couplings, etc.
2 850 Q. Marino. Electro-leposition of zinc. (28/1/28, France.)
2 851 Q. Marino. Electrochemically cleaning iron, etc. (28/1/28, France.)
2 884 Mullard Radio Valve Co., Ltd. Sound reproducers.
2 898 Akt.-Ges. C. H. F. Muller. X-ray tube installations. (26/1/28, Germany.)

COMING EVENTS.

Friday, March 15th.

Institution of Electrical Engineers (London Students' Section).—Institution, Savoy Place, Victoria Embankment, London. Paper by Mr. C. F. J. Morgan on "Wave-form Analysis," 6.15 *p.m.*

Institution of Civil Engineers, Institution of Electrical Engineers, and Institution of Mechanical Engineers.—Windsor Room, Grand Hotel, Birmingham. Annual joint meeting. Discussion on "A Hydro-Electric Power Station." 7 *p.m.*

British Electrical Development Association.—Royal Society of Arts, John Street, Adelphi, London. Conference on "Water Heating Developments." Speaker, Mr. M. O. F. England. 7.30 *p.m.*

Saturday, March 16th.

Association of Mining Electrical Engineers (Western Sub-Branch).—60 Wind Street, Swansea. Informal discussion of H.M. Electrical Inspector of Mines, Report for 1927.

Royal Institution of Great Britain.—21, Albemarle Street, London. Lecture by Sir Ernest Rutherford on "Molecular Motions in Rarefied Gases." 3 *p.m.*

Electrical Power Engineers' Association.—New Princes Galleries, Piccadilly London. Dinner and dance. 7 *p.m.*

Monday, March 18th.

Electrical Association for Women (Manchester District Branch).—Visit to the Hyde Road Tramways Department. 2.30 *p.m.*

Institution of Electrical Engineers.—Savoy Place, Victoria Embankment, London. Informal meeting. Discussion on "Method in Invention." (Opened by Mr. C. Turnbull.) 7 *p.m.*

Institution of Electrical Engineers (Mersey and North Wales—Liverpool—Centre).—The University, Liverpool. Paper by Mr. E. Y. Robinson on "Radio Sets on the Mains." 7 *p.m.*

Tuesday, March 19th.

Association of Supervising Electrical Engineers.—43, Russell Square London. Annual general meeting.

Institute of Transport (Birmingham and District Section).—Queen's Hotel. Paper on "Transport on Inland Navigations—Its Advantages and Limitations." By E. W. Bayliss. 6 *p.m.*

Illuminating Engineering Society.—E.L.M.A. Lighting Service Bureau, 15, Savoy Street, Strand, London. Paper on "Architectural Lighting," by Mr. Waldo Maitland. 7 *p.m.*

Institution of Electrical Engineers (East Midland Sub-Centre).—Town Hall, Loughborough. Joint meeting with the South Midland Centre. Faraday lecture by Mr. Ll. B. Atkinson on "How Electricity Does Things." 6.45 *p.m.*

Electrical Association for Women.—E.L.M.A. Lighting Service Bureau, 15, Savoy Street, Strand, London. Lecture on "Some Elementary Facts Concerning Electric Motors," by Mr. H. Bourne. 7 *p.m.*

Institution of Electrical Engineers (North-Western Centre).—17, Albert Square, Manchester. Papers by Messrs. T. N. Riley, and T. R. Scott on "Electrical Insulating Papers for the Manufacture of Power Cables," and Messrs. S. G. Brown, F.R.S., and P. A. Sporing on "The Prevention of Ionisation in Impregnated Paper Dielectrics." 7 *p.m.*

Wednesday, March 20th.

Electrical Contractors' Association (Sussex Branch).—Midland Bank Chambers, Brighton. Ordinary meeting.

Polytechnic School of Electrical Engineering.—307–9, Regent Street, London. Lecture VII (course of eight lectures) by Mr. E. S. Ritter on "Picture, Telegraphy." 5 *p.m.*

Overhead Lines Association.—Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London. Paper by Mr. A. Lennox Stanton on "Some Notes on the Labours of the Hydro-Electric Commission of Ontario." 5.30 *p.m.*

Institution of Electrical Engineers (Tees-Side Sub-Centre).—Cleveland Technical Institute, Middlesbrough. Paper by Mr. R. W. Gregory on "Electric Supply to the Rural Districts of England." 7 *p.m.*

Institution of Electrical Engineers (Sheffield Sub-Centre).—Mappin Hall, St. George's Square. Paper by Prof. W. Cramp on "The Cause and Effect of Oscillation in Electrical and Mechanical Apparatus." 7.30 *p.m.*

Thursday, March 21st.

Institution of Electri cal Engineers.—Savoy Place, Victoria Embankment London. Papers by the Hon. Sir C. A. Parsons, F.R.S., and Mr. J. Rosen on "Direct Generation of Alternating Current at High Voltages," and Mr. J. A. Kuyser on "Recent Developments in Turbo-Generators." 6 *p.m.* Preceded at 5.30 *p.m.* by a demonstration by Mr. R. T. Coe, of a portable electric harmonic analyser. 5.30 *p.m.*

Institute of Patentees.—Caxton Hall, Westminster, London. Paper by Mr. C. Davis on "Russia and its scope for the British Inventor." 8 *p.m.*

Friday, March 22nd.

Physical Society.—Imperial College of Science, Imperial Institute Road, South Kensington. Annual general meeting. Presidential address by Dr. W. H. Eccles, F.R.S. 5 *p.m.*

Royal Institution.—21, Albemarle Street, London. Lecture by Sir Ernest Rutherford, F.R.S., on "Penetrating Radiations." 9 *p.m.*

Saturday, March 23rd.

Royal Institution.—21, Albemarle Street, London. Lecture by Sir Ernest Rutherford on "Molecular Motions in Rarefied Gases." 3 *p.m.*

Paisley Association of Electrical Engineers.—Visit to Messrs. The Clyde Valley Electrical Power Company's hydro-electric power station at Bonnington, Falls of Clyde. 3 *p.m.*

Association of Mining Electrical Engineers.—South Wales Institute of Engineers, Park Place, Cardiff. Paper by Mr. C. L. James on "Power Factor: Its Cause and Effect." 6 *p.m.*

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THE ELECTRICIAN

Established 1861. The Oldest Weekly Illustrated Journal of

Electrical Engineering, Industry, Science and Finance.

Bouverie House, 154, Fleet Street, London, E.C.4. Telegrams: "Benbrotric, Fleet, London." Telephone: City 0244 (Ten lines).

[Closed on Saturdays in accordance with the "Five-Day Week" plan adopted by Benn Brothers, Ltd., and its associated organisations.]

No. 2651. [No. 12. Vol. CII.] Friday, March 22, 1929. Annual Subscription, 25s. Overseas, 30s.

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Current Topics.

Developing the E.D.A.

In many ways the report submitted to the ninth annual general meeting of the British Electrical Development Association last Friday is encouraging and reflects real development on co-ordinated lines. The reorganisation of the Provincial Area Sub-Committees has achieved the objects of efficient decentralisation and increased local interest among members of the industry. Most of the sub-committees on special subjects can point to a year of progress, but the size of some of these bodies—the Electric Vehicle Committee has 39 members—seems unfavourable to much originality or despatch. It is difficult to see how an organisation like the E.D.A. can function without a good deal of committee work, but the tendency of such machinery to become clogged is a factor which should not be lost sight of where further specialised activities are receiving consideration. The chief campaign activity of the year was, of course, the factory and workshop lighting campaign, the excellent results of which are still fresh in the mind. The decision to discontinue further short-period special campaigns in favour of a continuous programme of activities, based on seasonal requirements has, we think, provided its own justification, and as time goes on should play an increasingly important part in stimulating and reinforcing individual selling efforts. The least satisfactory feature of the report is, as usual, the small extent to which the propaganda work, so necessary to all sections of the industry, is supported by financial contributions. Of the total revenue for 1928, supply undertakings provided 57% and the manufacturers 39·7%. The electrical contractors furnished 3% of the revenue, but the extent of the wholesalers' support was only 0·3%, a quota which hardly seems adequate in relation to the advantages derived. Apart, however, from questions of proportion as between the various sections, we have no hesitation in saying that a total revenue of less than £37 500 is not nearly enough, and that the Association requires not only additional members, but also bigger contributions from its existing members.

A "Coming-of-Age."

Our congratulations alike to the Institute of Metals and to its versatile president, Dr. Walter Rosenhain, F.R.S., of the National Physical Laboratory. The twenty-first birthday celebrations of the Institute extended from March 13th until March 15th, and at one of the meetings Dr. Rosenhain was able to point to the good work accomplished during the double-decade, in which the membership has increased from 250 to over 2 000. The results have proved of enormous practical value to the non-ferrous metal industries, and notable contributions have been made to the general advance in scientific knowledge. Among recent activities it is of interest that particular attention is being paid to the Corrosion Research Committee's activities by engineers and metallurgists in Germany. Indeed, a request that permission be granted for a reprint in German of all the eight reports issued by the committee has been acceded to, and a pamphlet, also treating of the work of condenser tube research, has been printed in Japanese. When the Institute was founded, scientific knowledge of non-ferrous metals as such did not exist, and the entire field of modern heat treatment has been discovered and developed since that date. In the evolution and perfection of the most important and invaluable processes the Institute of Metals has played an honourable and a prominent part.

Television Demonstrated.

In consequence of our remarks last week concerning the progress made with television, we received and accepted an invitation from Lord Angus Kennedy to witness a demonstration of the Baird system. The demonstration was given last Friday, and, though the form which it took was much the same as that adopted at the last National Radio Exhibition at Olympia, namely, over a metallic circuit, we were pleased to note a decided improvement in the received image. Most of the deep shadows so prominent in the last demonstration attended by us appear now to have developed into shadows of a type that one might reasonably hope to overcome by suitably "making-up" the "televisee." The picture, as it can at present be received by the Baird system is not perfect, but the results are, nevertheless, a distinct improvement on previous reception, and very encouraging. During the demonstration a group of four people was transmitted, and, considering the difficulties attaching to such a transmission, the results were remarkably good. Apart from the general movements of the subjects, the main details of the picture, such as the teeth, whites of the eyes, etc., could be observed.

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Further, having seen a face by television one could recognise its owner in the flesh; this point is one of some importance, for it indicates that the distortion brought about by the transmission is not so serious as one might expect at this stage of development. We were given to understand that negotiations are now pending with a view to experimenting with transmissions by radio, and that when these are completed a further demonstration will be offered. Mr. J. L. BAIRD also gave a practical illustration of the virtues of the "Noctovisor"—an apparatus with which it is possible to see, as if in a lighted studio, a person sitting in a dark room. This device gave a result as clear as that of television, and is waiting further development. In conclusion, we would express the opinion that the ultimate success and perfection of television is dependent upon the close co-operation of those interested in the subject. Mr. BAIRD has done his share, and, as present results show, is still doing useful work; nevertheless, if the past is any indication of the future, such a subject can never be fully developed by a single mind. As in the early days of radio, new thought brought new ideas, and so must it be with television. Mr. BAIRD has made considerable progress so far, and one may ask the question: Is he to carry on, or will someone else show the way?

The Summer Meeting.

THE details which have now been issued of the itinerary of the I.E.E. Summer Meeting confirm the view that it will be one of the most interesting and attractive ever held. Starting in Paris, in and around which 4½ days will be spent, members will then have the opportunity to spend a week in the Pyrenees, and owing to the generosity of the Paris-Orleans and Midi Railways, who are providing free railway transport, the cost of this section of the trip will be particularly cheap. Already it is obvious that those who make a point of attending all the summer conferences and meetings will have a very busy time during June. The month opens with a week at the I.M.E.A. Convention at Torquay, followed, after a week-end interval, by the I.E.E. meeting in France for the next fortnight. Another short interval of two or three days permits recuperation from possible ill-effects of the Channel crossing before the journey is made to the E.C.A. Conference at Bournemouth as a pleasant end to the month. It is therefore to be hoped that other associations contemplating special summer activities will regard the month of June as one that is entirely unsuited to their purposes.

Electricity at the Seaside.

NOW that the widespread use of the petrol-engined road vehicle is fraying the nerves and poisoning the lungs of the long-suffering inhabitants of this country, we are threatened with a further development of uproar and fumes on our rivers and at seaside resorts by means of fast motor boats, which, we understand, are to be sold this year in large quantities at a popular price. We were glad to see in one of Wednesday's papers Mr. H. T. YOUNG'S protest against this outrageous proposal. As he rightly points out, "something should be done to prevent the roar and smell from these boats, or a day by the sea will become more harassing than a day in the City." If the public really desires non-manual means of propelling small craft on the water it should not be beyond the power of the electrical industry to provide a popular-priced electrically-propelled boat, which would give effortless progress without interfering with the enjoyment of others.

Medical Flippancy.

USED as we are to the conservatism so naturally displayed by the medical profession towards new curative forces, we are completely at a loss to understand why the Medical Research Council has denied in its latest report the value of artificial light treatment. Based only upon the experiments of one research worker, of which the full details are not available, this condemnation is not only sweeping, but flippant, when it declares that "artificial light can do no more than a mustard plaster, which is infinitely cheaper." It is true that the development of electro-medical appliances has coincided with the establishment of many "quack" practitioners who make totally unfounded claims for the apparatus which they employ. On the other hand, many hospitals and clinics have been using artificial light treatment for a number of years, at times with varying, but generally with definitely beneficial, results in the majority of the cases treated. It is not unreasonable to think that a form of treatment which has been employed by men of high repute in the medical profession to assist the King's recovery from his very serious illness must at least be worthy of a much more serious and prolonged investigation than it appears to have received at the hands of the Medical Research Council.

Two New Committees.

WE are glad to see that the two new committees which, have been appointed by the Electricity Commissioners to investigate certain aspects of electricity supply have been given a definite mandate to do something constructive and practical. One of these committees is to consider what steps could be taken to ensure that facilities for assisted wiring and for the hire and/or the hire purchase of apparatus are made available, wherever needed, to prospective consumers of electricity in rural and other areas of supply, and to make proposals for a practical financial scheme for the purpose. To the other body is allotted the task of considering the various kinds of charges and tariffs offered by authorised undertakers in connection with the supply of electricity for lighting, domestic, office and power purposes, and to make definite proposals whereby a greater measure of uniformity in respect of charges and tariffs could be brought about in the electricity supply industry. Both problems are of great and immediate concern to the industry, and the issue of the committee's proposals will be awaited with interest.

Monthly Accounts.

ALTHOUGH there are certain obvious difficulties in the way of introducing a system of monthly payments for electricity bought from electricity supply undertakings, the advantages of such a method over quarterly payments are so great that the matter would seem to merit more careful consideration than it has yet secured. The psychological factor involved is an important one. At any time of the year most people find it less difficult to find money to pay monthly accounts than those made up every three months, and when there are severe spells of cold weather, involving a greatly increased consumption of electricity, it is obviously desirable that consumers should pay for their abnormal requirements while the memory of the service rendered is still fresh in the mind. A system of monthly accounting would secure this end and would bring electricity supply into what Mr. H. W. ROBERTS has termed the housekeeping budget. Under such a system a substantial proportion of the extra trouble involved in the monthly reading of meters could be avoided by the use of outdoor meters.

Telephone Propaganda.

REFERENCE has more than once been made in these columns to the excellent work of the Telephone Development Association in increasing the use of telephones in this country. The Association has now incorporated in its publicity drive an attractive competition in which the public are offered cash prizes amounting to £200 for the nearest forecasts of the number of telephone subscribers who will be on the Post Office system on June 30th next. Although at a first glance a competition of this kind does not seem to be of much use in increasing the number of subscribers, closer inspection shows that the competition is ingeniously made to serve as bait for catching and leading public interest in the required direction. The latest statistics show a steady development of telephone usage during 1928, the total number of stations representing an increase of 7·8% for the year.

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THE FACTOR OF SAFETY OF OVERHEAD LINES.

Variation in Strength of Constructional Materials—Stress and Strain—Wind Velocity Considerations.

By W. FORDHAM COOPER, A.M.I.E.E., A.M.I.Mech.E.

THE Electricity Commissioners revised the Overhead Lines Regulations in 1925 and again in 1928 (this must be a record for a Government Department), but there is a general complaint that the rules are still too severe.

The Commissioners would probably reply that winds of 50 miles an hour frequently occur, and ⅜ of an inch of ice does not seem a high estimate, to judge by the appearance of some telegraph wires last winter; further, a factor of safety of 2 is not excessive, Up to the present, power lines have not blown down, but on the data available it is uncertain how near we may be to the danger zone, and we must go carefully and reduce the loading a little at a time.

* * * * *

A factor of safety may be considered as an insurance against the incidence of abnormal stresses or the presence of defective material, and in this section the mechanical properties of the materials will be considered. To continue the analogy, a member of Lloyds may accept a risk which is often little more than a gamble, while the life assurance actuary computes exactly the risk he is taking, and can therefore quote a "cut price" with safety; the basis of his science is the "frequency curve."

If we wish to cut our premium (i.e., reduce our factor of safety) we also may study the question of "frequency" with advantage, and a start may be made with steel plate, the basic material for lattice towers. An analysis of the tensile tests on 250 specimens of steel plate manufactured to the same specification is represented by the "frequency" curves given in Fig. 2. The mathematics of the subject are

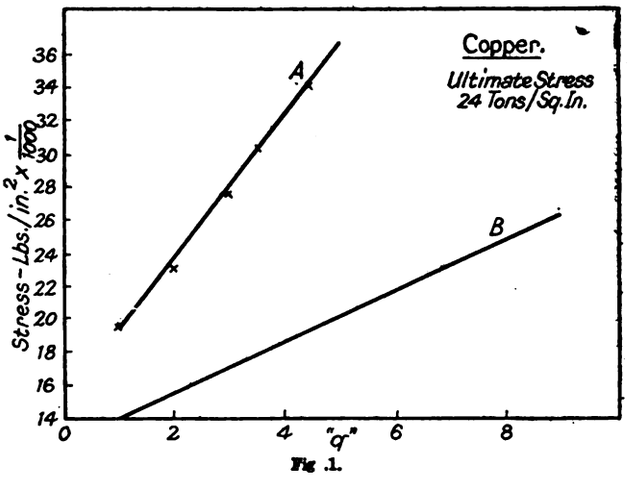

Fig .1.

specialised, though the practice is quite simple, and we can sufficiently explain the curves by stating that they are so constructed that if the total area of the curve represents a very large number of tests, the shaded area between A and B represents that proportion whose strength (or elastic limit) was between the values A and B.

Mathematically, this proportion, $P, = \int_A^B p dT$

If the scale of p is such that the total area of the curve is made unity, then P is a fraction and represents the probability of any one specimen having a strength between the values A and B, and the area of the curve between O and A is the probability of it having a value less than A. This, of course, presumes that the specimens taken are typical of all such material—which we have every reason to believe is true.

From time to time a really bad piece of material turns up, and this happens rather more frequently than the curves would suggest. This corresponds with the occasional very bad errors of observation which Lord Kelvin called avoidable errors—in this case they are definite mistakes in manufacture, and, given sufficient data, a frequency curve may be obtained for these also.

A steel ingot is, however, a very heterogeneous mass, even under the most careful manufacture, its properties varying from point to point in the most remarkable manner, and slag inclusions, etc., can never be completely eliminated.

Variations and inclusions of a macroscopic order which will not materially weaken a steel plate or even a tensile specimen may affect the whole cross section of one strand of a steel cable, and thus we may expect a greater variation of properties.

In the case of copper and aluminium, however, such macroscopic variations are not to be expected, especially when the materials are prepared electrolytically, and are in a comparatively pure state, whereas steel is essentially a very complex

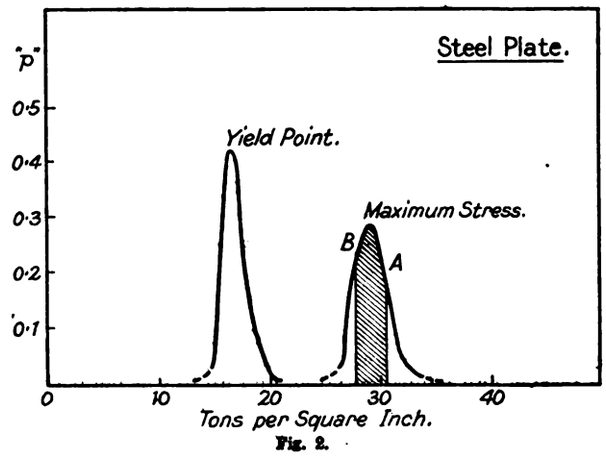

Fig. 2.

structure—in fact, it is the most complicated alloy known—and experience shows that the properties of copper and aluminium cables are more constant than are those of steel.

In any material the variation of stress with strain is highly complex, but we may, to simplify the argument, represent it approximately as follows:

$$\text{Strain} = \frac{f}{E} + \varphi_1(f) + \varphi_2(f, t)$$

f = stress
E = Young's modulus
t = time

The first term represents the elastic extension, and requires no further discussion. The second term represents the plastic extension. The third represents "creep."

These last two terms are not independent, but represent different aspects of plastic or viscous deformation. A material such as steel has a well-marked yield point below which appreciable plastic deformation does not occur at normal temperatures.

Above this yield point plastic deformation occurs, however,

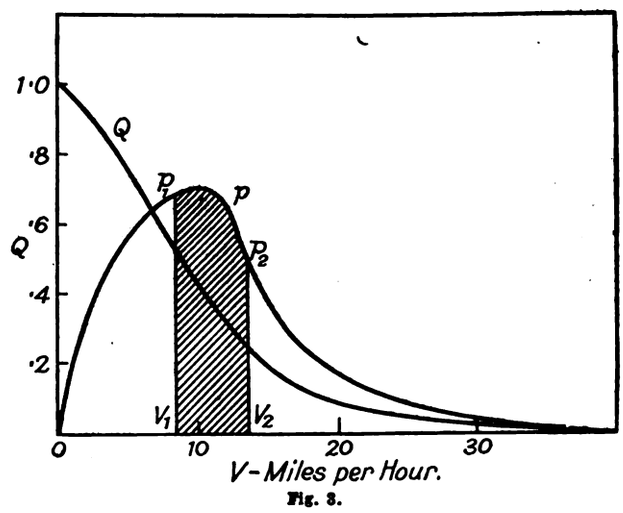

Fig. 3.

and tends to reach a limit depending chiefly on the maximum stress imposed. This deformation is represented by the second term.

In many materials, however, if the stress is maintained after this limit is reached, the strain will gradually increase with

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time; this is represented by the third term. This applies to steel only at very high stress and at the high temperatures reached in furnaces and modern boilers.

In the case of aluminium, however, and to a lesser extent copper, there is no definite yield point, and with sensitive instruments plastic extension and creep can be detected at exceedingly low values of stress (although for practical purposes it is negligible).

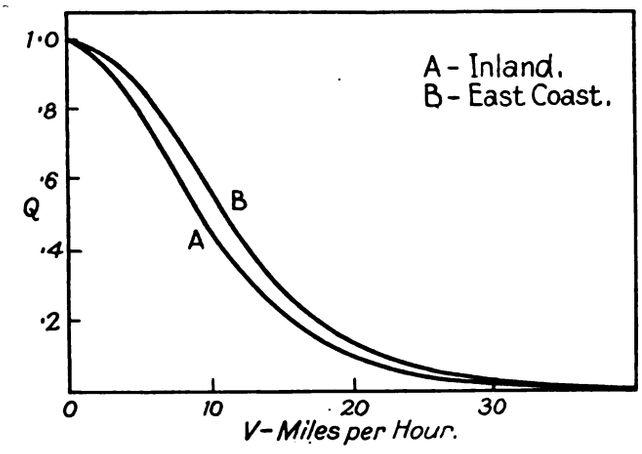


Fig. 4.

When the yield point is passed plastic extension will at first occur fairly uniformly along a wire before "necks" are formed and failure initiated, and up to this point the yield point is progressively raised by work-hardening. This elongation, though proportionally small compared with the "% on 10 inches" when a neck is drawn and failure occurs, is of immense importance, for it will tend to reduce the strain and save the structure at the expense of a small permanent "set."

(The above account is simplified further than can be justified on the facts of the case. For example, the joint effect of the second and third terms is that plastic deformation increases as the speed of application decreases, and this is observable even in the case of steel. The second term must therefore be considered as the limiting value for slowly applied loads when strain increments below a certain value are disregarded.)

In a rigid structure—for example, an overhead line support—the stress is proportional to the loading, thus:

(1) $f = kW$ where f = stress W = load;

or, should there be some initial stress before any load is applied:

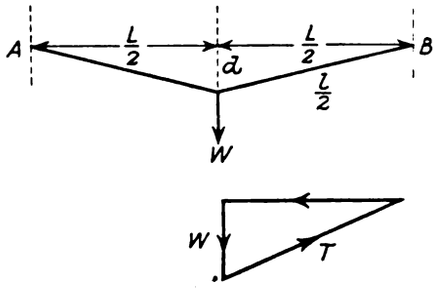
(2) $f = kW + C.$

But in thinking of factor of safety we are apt, subconsciously, to presume the first condition and assume the following relationship:

$$\text{Factor of safety} = \frac{\textit{Ultimate stress}}{\text{Design stress}} = \frac{\textit{Breaking load}}{\text{Maximum expected load.}}$$

And this is in general quite a useful conception (though we may at times design on the elastic limit or yield point rather than the ultimate stress).

When, however, we come to a suspended wire we have the antithesis of a rigid structure, and the simple relations given above are far from the truth; and as this point is of importance, a simple illustration may perhaps be excused. We will suppose a wire suspended between the points A and B to have its whole weight concentrated on the centre, thus:



L = span
l = length of wire
W = load
T = tension
d = sag

Then from the triangle of forces we see that:

(3) $$\frac{W}{T} = \frac{2d}{l} \qquad \text{or } T = \frac{Wl}{2d}$$

Further:

(4) $$d = \tfrac{1}{2}\sqrt{l^2 - L^2}$$

Should the load be increased so that T increases by an amount ΔT, the wire will stretch by an amount:

(5) $$\Delta l = \frac{l}{E}\Delta T,$$

where E is Young's modulus; and the sag "d" will increase by an equivalent amount.

The conditions of a wire whose load is uniformly distributed along its length are similar, and from equations corresponding to (3), (4) and (5) we can deduce a final relation of the form:

(6) $$T^3 \pm K_1 T^2 - K_2 W_2 = 0.$$

K_2 depends only on the span and the elastic modulus, while K_1 depends also on the initial conditions of the tension and loading.

The weight, and therefore the stress, of an unloaded wire is proportional to the cross section, and the intensity of stress is thus independent of the size of wire. We may completely eliminate the question of cross section by transposing (6) to a form which applies to wires of all diameters and for all conditions of loading:

$$f^3 \pm k_1 f^2 - k_2 q = 0$$

where $q = \dfrac{\textit{Total load per foot, including weight of conductor}}{\text{Weight of conductor per ft.}}$

= loading factor and f = stress.

Two typical curves of f and q for the same material are given in Fig. 1.

That the wire will stretch when the loading increases and thus relieve itself of part of the stress is, of course, well known and allowed for in the treatment given in the standard textbooks on overhead lines; but an elementary theory has been set out above to demonstrate that *the stress is not proportional to the load and, further, varies differently according to the elastic properties of the material* (k_2) *and the initial conditions of sag, loading and stress* (k_1 *and* q).

It is seen at once (Fig. 1) that a large increase in loading (q) does not necessarily mean a great increase in stress, and, in fact, our conception of the significance of factor of safety needs adjustment so far as this point is concerned.

Recapitulation.

We may now more clearly define the position. We have found that:

(1) It appears that a comparatively small factor is necessary to guard against unsatisfactory material.

(2) In the case of a suspended wire the stress does not increase nearly so quickly as the loading due to the peculiarities of the catenary.

(3) Though the excess load, which can be carried without a permanent set will depend on the load corresponding to the yield

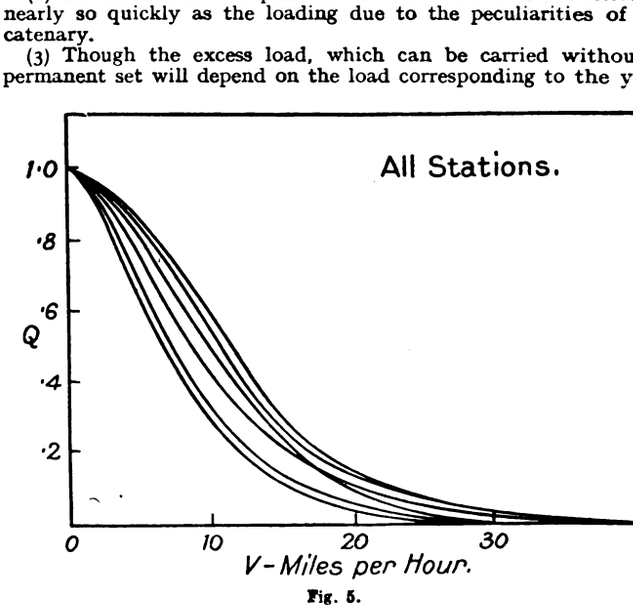


Fig. 5.

point, the actual safety will also depend on the amount of plastic deformation which can occur before the line becomes really dangerous. It may be asked whether we should be prepared to replace a badly stretched wire if a tornado does occur, or put in one that will withstand an earthquake.

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When erecting a material such as copper it is usual to apply some fixed load in excess of the design load to " take out the stretch " or " kill " it before it is finally sagged ; this raises the yield point at the expense of future relief by plastic deformation. It is now necessary to examine the loading which may be expected.

We shall now attempt to find the correct value to be given to the loading factor q which may be defined as :

$$q = \frac{\textit{Total loading with wind and ice}}{\text{Weight of wire}} = \frac{\textit{Max. load}}{\text{Min. load}}$$

This will obviously vary with the size of the wire, since, taking the wind only, the pressure is proportional to the diameter, whereas the weight is proportional to the cross section. The ice load also—though rather indeterminate—will not increase so quickly as the weight, i.e. q must always decrease as the diameter d increases.

To illustrate this variation we must assume some definite loading, and Fig. 8 shows how q varies for solid copper wire

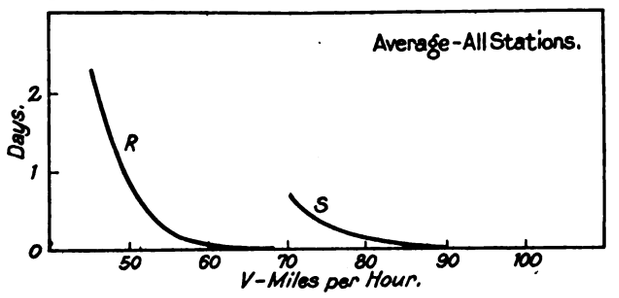

Fig. 6.

under the Commissioners' regulations for high pressure lines. The probability of such loading remains to be investigated.

A frequency curve can be plotted for the velocity of the winds in exacty the same manner as for the strength of steel plate. The following curves are based on the Annual Summaries of the Meteorological Office Reports for 1918–1926. The data set out in the tables is insufficient to give more than the general form of the curves, but the limits of the maximum velocity may be taken as fairly definite.

Fig. 3 gives the average distribution of the mean hourly velocity for all the meteorological stations (for one particular year). The curve of p has the same significance as in the case of steel plate—namely, the proportion of the hours during which the average velocity was between V_1 and V_2 miles per hour is represented by the shaded area V_1, V_2, p_2, p_1.

The value of Q at any point of the curve is the proportion of the year during which the average velocity exceeded the corresponding value of V :

$$\text{i.e. } Q_n = \int_{V_n}^{\infty} p\,dV$$

Fig. 5 gives Q for the years 1918 to 1926 for all stations, and Fig. 4 shows how the average of these curves varies for the different parts of England.

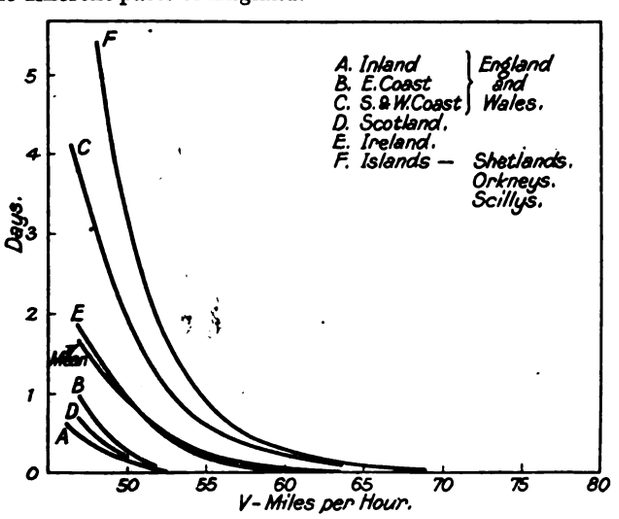

Fig. 7.

For our present purpose we are chiefly interested in the maximum velocity, and Fig. 6 shows this part of the curve in a slightly different form, i.e. R is the number of days per annum on which the highest value of the mean hourly velocity may be expected to exceed corresponding values of V, and in addition S gives the number of days on which the maximum gust may be expected to exceed the corresponding value of V. These are averages for all stations, but Fig. 7 shows how R varies when various districts are taken separately. The corresponding values for S (gusts) can be estimated by comparison with Fig. 6 above.

Generally speaking, the maximum gust in a year may be expected to be about 1·4 to 1·8 times the maximum hourly speed.

The results can be further summarised in the following table, which, however, is based on the average of all the records since the various stations were erected.

TABLE I.

District.	Max. recorded Gust Speed.	Average value of R_{47}.
Central and South England ..	80 miles per hr.	7·17 days
East Coast	80 ,, ,,	19·66 ,,
West and South Coast.. ..	100 ,, ,,	62·66 ,,
Scotland	90 ,, ,,	14·83 ,,
Ireland	112 ,, ,,	47 ,,
Islands : Orkneys, Shetlands, Scilly	105 ,, ,,	155 ,,

R_{47} is the average number of days per annum on which the maximum value of mean hourly speed exceeded 47 miles per hour.

The curves have shown the rapid way in which the probability decreases when high values are approached, and it can be seen that gusts above 100 miles per hour rarely occur even in the most exposed positions. Generally speaking, 80 miles per hour is the maximum.

It now remains to discuss the probability of the coincidence of snow, high winds and low temperatures. That they are all liable to occur about the same time of the year is obvious,

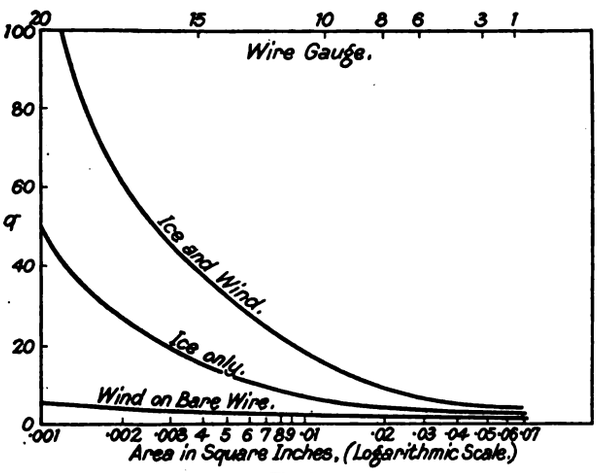

Fig. 8.

but it must be remembered that if the chance of any one of three independent events is 1 in 10, the chance of them occurring together is 1 in 1 000.

Apart from this, large flaky snow, which is liable to cling to an overhead line, only falls when the temperature is very near or just above freezing point. At lower temperatures it is a fine, dry powder. Generally speaking, it would only cling during a high wind if it had fallen at about 0 deg. C., thawed, and then refrozen solid. This very considerably reduces the probabilities.

On account of the complexity of the conditions, statistics are not directly procurable, but we should obviously expect curves similar to those obtained for the probability of high winds, and it is necessary to look for indirect evidence.

Post Office Procedure.

As pointed out in an earlier paragraph, the relation between loading and stress varies differently according to the initial stringing conditions, and Fig. 1 shows two curves for copper wire. A, on a 300 ft. span, adjusted to give a factor of safety of two for a loading factor $q=3$; B, on a span of 100 ft., to give a factor of safety of 4 when $q=1$.

The former is a fair representative of design under the Commissioners' regulations, the latter of the G.P.O. technical instructions which are based on a factor of safety on the free wire.

On the surface it would appear that the latter were the much safer construction, but in practice Post Office lines do blow

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down, whereas a broken power line is as rare as the Greek calends.

If we look a little deeper we shall see the cause of the apparent anomaly. On the Commissioners' loading, a 0·1 sq. in. conductor has a loading factor of 2·7 and corresponds roughly with curve *A*, and, further, the value of *q* can be very greatly increased and still have a factor of safety.

On the other hand, the Post Office use conductors as small as No. 19 SWG, and we see that *q* may approach 100 with the same loading (Fig. 8). It would, of course, fail long before such values were reached.

We have here, therefore, a basis for statistical investigation, for it is at least probable that a survey of the casualties on telegraph lines and the stresses at which the wires were originally strung would give us a clue to the relation between probable loading and diameter of wire. We should, of course, have to exterpolate, and the values of *q* would obviously vary according to the districts (compare Fig. 7 and Table 1).

In this way telegraph lines would at last give some direct assistance to the power supply engineer.

Since these notes were originally drafted last July, Mr. Woodhouse's paper has been published by the Institution of Electrical Engineers, and this renders unnecessary any extensive comment on the factor of safety of supports.

The strength of a chain is the strength of the weakest link, and the Research Association tests clearly prove that the strength of a support is usually the strength of its foundations. The foundations are a very variable quantity, not amenable to exact calculation, and the strength is probably appreciably different for every pole in a line, so that without elaborate precautions it is a statistical certainty that in an overhead system there must be several weak spots. In practice, if a properly built power line does fail, it is the foundations that give—not the conductors or the poles. This so rarely happens that it has not been found necessary to take any such precautions with the foundations, which probably indicates that the loads for which lines are designed do not actually occur.

Conclusions.

The points we have deduced may now be set out as follows :

(1) The load-stress relations are such that it is incorrect to design on a factor of safety on stress, since the actual safety thus obtained will vary widely according to the initial conditions.

It would, therefore, be more scientific to design on a factor of safety on loading. That is to say, fix an upper limit of loading, at which the line should just fail, and design for the stress at this load to have some maximum value. This might very well be the yield point. As explained, the plastic strain beyond this point will make the actual load that can be carried with safety very much larger than the design figure.

In the case of galvanised steel, the yield point may be anything from 60% to 90% of the ultimate stress (calculated on unstrained area), according to the method of production and the degree of hardening. See Table 2. In the case of soft metals such as copper and aluminium there is no true yield point, but when they have been " killed " by stringing for a number of hours at about ¾ of the ultimate strength, this figure or, say, 90% of it, may be taken.

(2) The regulations stipulate a wind velocity of 50 miles per hour. Table 1 shows that in the south-east of England the hourly average exceeds 47 m.p.h. on about seven days in the year (corresponding to a maximum gust of approximately 65 m.p.h.). Other parts are more windy.

TABLE 2.

Strength of Single Steel Strands.

Area. ins.²	Yield Point. tons per sq. in.	Ultimate Stress. tons per sq. in.
0·005	24·1	28·3
0·013	22·6	28·4
0·021	30·9	35·3
0·005	33·2	55·9
0·013	20·6	27·6
0·020	36·9	39·3

Material supplied by different makers.

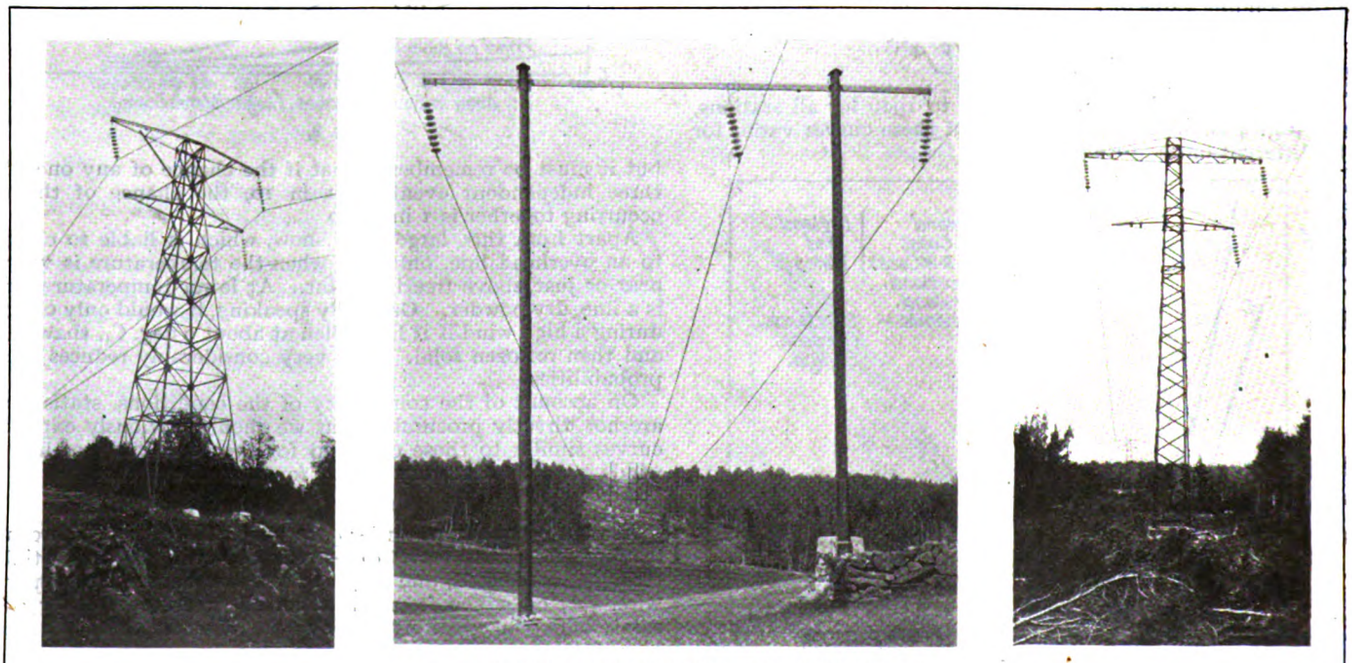
Fig. 8 shows, however, that the wind alone imposes no serious load, and it is the effect of wind on ice and snow, or even the dead weight of the snow alone, that really counts. This load is, however, so very indeterminate that only " field " experiments over a considerable number of years can be of any use—unless data can be obtained of wires that have actually broken.

Telegraph wires do break from time to time, and the factor of safety employed is, therefore, too low for power wires when danger to life is a factor. The writer does not remember any low tension wires designed for ½ in. ice load breaking, and the appropriate conditions apparently lie between these two.

(3) On the data presented there is no proof that a loading lower than the present low tension figure could be justified.

(4) The writer would hate to be responsible for a code or set of regulations, however carefully prepared, for should a typhoon find its way from the East and a few lives be lost—though it had never happened before and were unlikely to recur in the next two thousand years—yet the lay Press would hold him morally guilty of manslaughter.

(5) Not being responsible for the code, he hopes it will be modified.



132 000 *TRANSMISSION IN SWEDEN.*

THESE illustrations, furnished by the Royal Swedish Power Board, show 132 kV transmission lines between Trolhättan and Alingsas. On the left is an angle tower 55 ft. 9 in. high, carrying a normal 656 ft. span of 0·186 stranded copper. On the right is a straight line tower. The central picture shows a wood post line 43 ft. high, taking a 590 ft. span.

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BIRD GUARDING ON OVERHEAD LINES.

Effects of Agricultural Crop Rotation on Bird Danger Areas—Guarding the Conductors—Treatment of Lines with Pin-type Insulators.

By E. KILBURN SCOTT, M.I.E.E.

IT is well known that overhead lines are subject to trouble, owing to the supply being tripped out by birds, such as rooks and crows, which cause short circuits through their bodies, and that even starlings, and other smaller birds, may also, at times, be troublesome.

As, owing to game laws, strict regulations about firearms, and a liking for animal life, we have in this country, relatively speaking, more wild birds than in many other countries, extra precautions have, therefore, to be taken. The following notes embody views of several engineers engaged in maintaining electricity supply on important transmission lines, and, also, some personal observations of the writer.

When a bird perches on a cross arm of channel or angle iron, or on a steel bracket, and pecks a live conductor, there is a trip-out, and current is shut off from important consumers for some time. One bird may be resting on a cross arm, or bracket, and its mate on the live conductor, and they make contact by stretching wings, or by one pecking at the other. There is also a possibility of a trip-out between phases, when several birds are fluttering round a pole and accidentally make contact. Accumulations of hay and straw on the insulators may also cause similar trouble when the material becomes thoroughly wetted.

Bird troubles synchronise with field operations of farmers, and are particularly bad where land is being prepared for seeding and planting. Whenever ploughing or manuring of land is in progress, or roots are being lifted, birds are much in evidence, because of the food turned over by ploughs and forks. Crows, in particular, are attracted by farmyard manure, and by low grade fertiliser collected from towns.

Crop rotation influences all agricultural operations, and the normal working of land adjacent to a long pole line route is such that the bird danger area is always shifting. To make a transmission line immune, the whole length of it must be completely protected. Local guarding is of no avail, except in the case where a line passes near a " bird sanctuary."

Various factors have to be taken into account when deciding on an efficient type of protection; the expenditure to attain the object, and the cost of maintenance.

The type of line most liable to bird trouble is that fitted with pin-type insulators, but lines fitted with suspension-type insulators are also affected in spite of their having larger insulating surfaces.

Guarding a line fitted with pin-type insulators may be effected, *first*, by guarding the iron cross arms, or the bracket insulator, and *secondly*, by guarding the insulators and the conductors themselves.

Guarding Cross Arms.

To guard a cross arm effectively is not an easy proposition, because it is difficult to decide just how much of it should be covered; also, the fixing of the guard material is difficult.

A guard made of earthenware has a clearance hole for the insulator pin, and is held in position by means of metal clips, or wires which contact with the earthed metal work. Unless these clips, or wires, are in turn protected or insulated, they permit a circuit between live wire and earth, via the claws of a bird when it happens to peck at the live conductor.

Owing to atmospheric conditions and galvanic action, the wires and clips are subject to deterioration, especially in the presence of fumes from chemical works or from burning coal pit refuse. If such deterioration occurs, the guard is easily dislodged by a high wind. Earthenware guards are liable to be broken, or dislodged, when a linesman makes use of his ladder during repair or overhaul work.

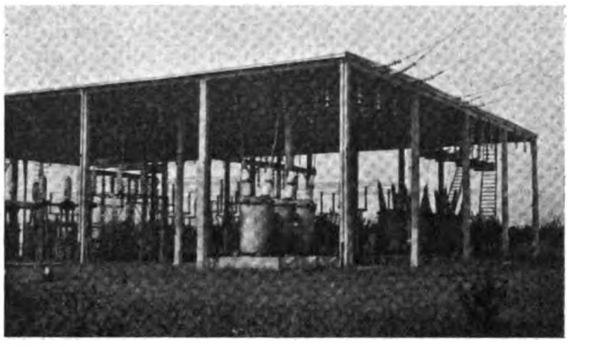
Cross-arm guards can be made of wood, or similar material, but they also have to be attached by means of screws or wires, and the same troubles occur as with earthenware. In addition, there is deterioration of the wood or fibre due to alternate wetting and drying, as the weather changes. Moreover, their use is limited to pressures below, say, 11 000 V.

It is obvious, that if guarding against birds can be done without the above-mentioned disadvantages, then there will be a considerable gain in efficiency of supply, and low cost of maintaining the line. The commercial and engineering staff who have the responsibility of keeping the transmission lines in order, will also have much less anxiety.

The guards should fit so as to prevent insects, and small birds, from getting inside, and, at the same time, the method of attachment should be such that they can be easily removed for inspection.

The Ideal Method.

In the writer's opinion the ideal method of guarding is to take care of that portion of the line which really causes the trouble, namely, the live conductors.



THIS picture from Italy illustrates the use of concrete for the construction of a shelter roof for an outdoor sub-station on a 130 kV line.

The conditions to be met by a guard on the conductors are :—(*a*) the guard should be easily fitted and kept in position; (*b*) it should be made of durable material of high insulating qualities; (*c*) it should not absorb moisture and should be able to withstand high atmospheric temperatures; and (*d*) it should not be unwieldy or unsightly.

A bird guard that meets these requirements called Pernax, made of pliable material, having a high and permanent insulation resistance, has successfully met all conditions in this country, and also of countries overseas, where there are tropical heat conditions.

The material is sufficiently pliable, for it is to be used as tape for insulating the tail ends of conductors, and for insulating staywires at vulnerable points, and it can also be made in the form of split tubing.

In its most usual form this bird guard is moulded to fit over the top of the pin insulator, and to project for a distance of about 1 ft. in each direction along the live conductors. The guard is dropped over the insulator, and the conductors, and then fixed in position by threading a lace through eyelets punched in the material, the lacing cord being covered with Pernax insulation.

Experience has shown conclusively that a bird may perch anywhere on a metal cross-arm, or bracket, and peck at the guard without any untoward effect, whatever the voltage may be. It is difficult to conceive of any method of achieving a similar result short of completely insulating all the earthed metal work, and the cost of doing that would be prohibitive.

During strong winds hay and straw is sometimes blown on to the insulators from adjacent stacks, and when it becomes wet, from rain or fog, it forms a leakage path to the cross-arm or bracket, and may cause a " trip-out." Pernax guards prevent this trouble and permit an accumulation of straw and hay to be left until it is time for the periodical examination.

It sometimes happens that a small puncture or crack develops in the top of a porcelain insulator and, being unprotected, there may be a trip-out during a heavy fall of rain or sleet. If the insulator is, however, covered with one of these guards there is no breakdown, and the faulty insulator can be weeded out at the inspection.

The cost of applying these guards on the conductors is, naturally, much less than covering iron cross-arms with earthenware or other guards. The cost of equipping a new line with these guards, or fitting them to a line already in existence, is amply justified by immunity from trip-outs.

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FURTHER VERTICAL SWITCHGEAR.

Dual Purpose Lowering Mechanism—Some Important Safety Provisions—Points in Design of Main Top Plate.

OWING to the great interest which is being evinced in new types of switchgear construction, we give below some particulars of types of vertical drop-down switchgear which have been manufactured for some time by Messrs. Erskine, Heap and Co., Ltd., who, it is interesting to note, took out a patent covering the vertical drop-down principle of isolation in the year 1910.

Originally they embodied this type of isolation for low tension and 3 300 V gear, but extended it some years ago to cover up to 12 000 V; the illustrations on this page show a 12 000 V unit rated to rupture 150 000 kVA, and having a current carrying capacity of 500 A, the switch taking 23 gallons of oil.

The question of space economy has already been dealt with in great detail in previous articles on the subject, and there does not appear to be any divergence of opinion as to the great saving in floor space which units embodying vertical isolation possess over draw-out metal clad and truck type equipments.

In the case of the unit illustrated, the depth from back to front is 2 ft. 7 in., with an additional 10 in. for the maximum projection of the handle—the overall width being 3 ft. 4 in.

The question of overall height, while of importance, is not as important as the width and depth, as, if the gear is installed in a sub-station, the building must at least be of a height sufficient to allow an attendant to enter; and it is not a particular advantage to kneel in order to operate a circuit breaker in comfort.

Raising and lowering gear is fitted as an integral part of the unit so that a separate carriage for the lowering of the circuit breaker is not required.

There appears to be quite a difference of opinion as to whether an oil circuit breaker should be lowered or not, but as lowering gear is necessary in order to lower an oil tank with its oil, the same raising and lowering gear can quite comfortably lower the complete oil breaker, so that with the gear under review, one set of lowering mechanism only is required for the dual purpose of lowering and isolating the main circuit breaker and for lowering the tank.

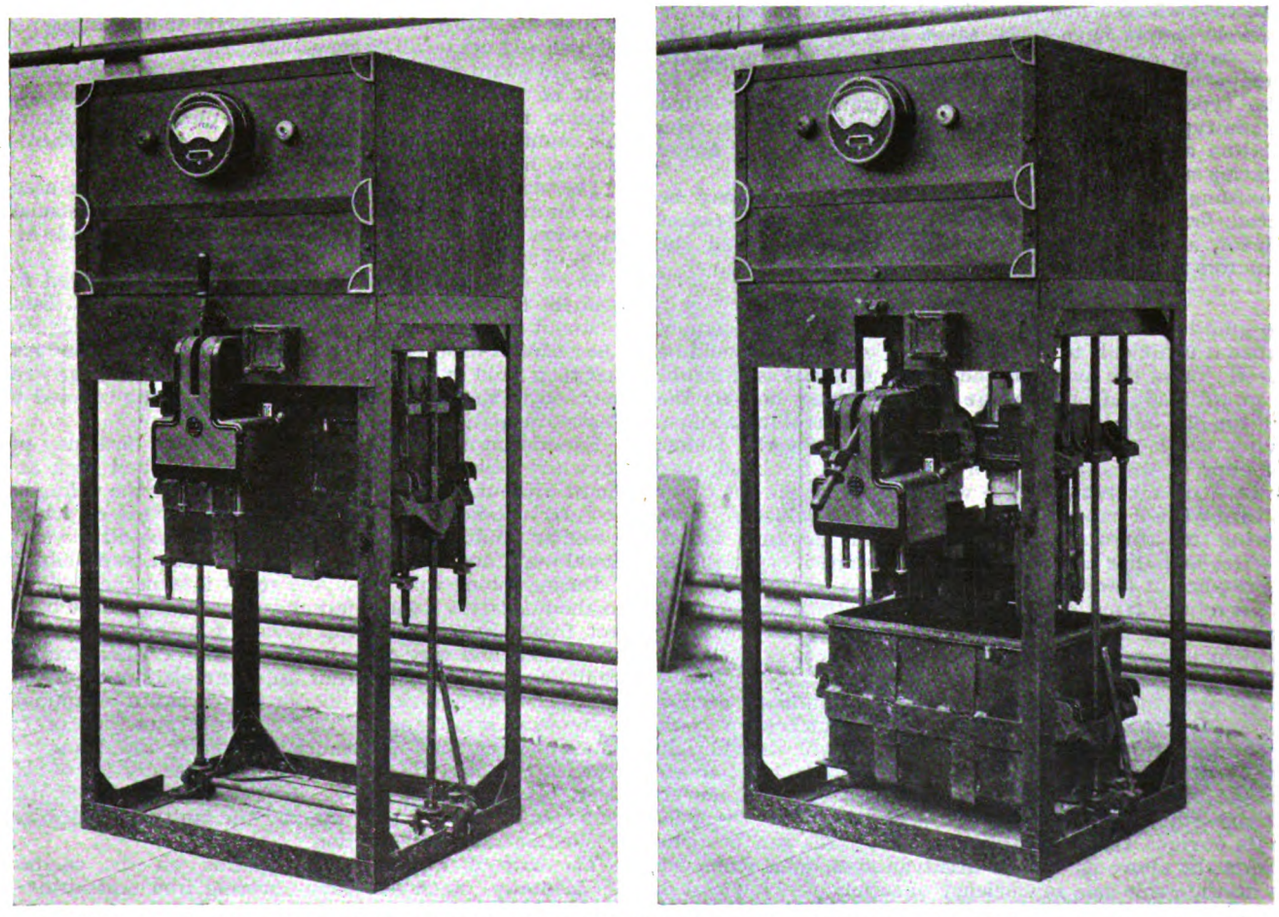
The lowering arrangements are such that the circuit breaker is safely isolated before there is any possibility of an attendant touching any "live" parts, both the isolating and tank lowering being operated by means of a single handle which functions in the following manner:—

The first movement of this handle causes the oil switch to open in the event of the oil switch having been left in the closed position when an attempt is made to isolate. A further movement of the handle causes the oil switch to be withdrawn bodily from the isolating contacts, and if the movement be then continued, the tank is lowered so as to expose the contacts etc. for inspection.

With the switch in this position, it can be operated so as to make quite sure that any renewals to sparking contacts, etc. which may have been required, are in perfect working order before the switch is again placed in circuit.

A further interlock is also introduced, so that in the event of the oil switch being left in the "on" position when an attempt is made to put the gear back again into circuit, this interlock prevents any parts from making contacts until the oil switch has been again placed in the "off" position.

These units have also the additional advantage that as the isolating contacts are not completely encased with insulation, it is possible for the operator, after the switch body has been lowered to the correct position for examination, to *see* that it is actually disconnected from "live" parts before beginning any examination or repairs, an additional safeguard being



A TYPE of vertical drop-down switchgear made by Messrs. Erskine, Heap & Co. It is seen on the left in the closed position, while the other picture shows how isolation and tank lowering operations are carried out with one handle.

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supplied by the interposing of an insulated shutter between the "live" and the "dead" parts.

While on this point, it has been remarked that with the type of isolation which takes place inside tubing, and so completely shrouding the contacts, there would appear to be an element of doubt as to what might be happening inside the tubing, and the suggestion of the manufacturers is that it is "better to be safe than sorry."

The oil switch circuit breaker itself, being of recent design, is well within its rated kVA breaking capacity on the lines laid down in the latest B.E.S.A. Regulations, the units of similar size are interchangeable, and, being vermin proof, are particularly suitable for use in tropical countries.

The contacts are of the wedge and finger type of a special and substantial design, and are easily renewable. All the operating mechanism is contained below the main top plate of the circuit breaker, efficient vents being provided and arranged so that the gases can be taken clear of the unit in any desired direction.

In units of this type, it is essential, owing to the breaking capacity of the oil breaker, that special attention is given to make sure that the main top plate or containing case of the switch is of very robust design, this being a point which is frequently overlooked, with the result that while the tank of a circuit breaker may have been designed to withstand very considerable explosion forces, the main top plate is frequently of weak design.

In the design under review, these two points, namely that of the main top plate and tank have been given special consideration, so as to render them absolutely safe under short circuit conditions.

The operating lever embodies the Erskine Heap standard true free handle mechanism, and in addition is so arranged that a quick break is obtained quite independently of the speed at which the oil switch handle is operated, while the overload coils, being transformer operated, are fitted in the front of the unit, and are therefore quite accessible. The normal construction of these sub-station units does not provide for compound filled busbar chambers, but this filling can be arranged for, if required.

AN AMERICAN LETTER.

By FRANK C. WELLS (News Editor of "The Electrical World").

NEW YORK, *March 1st*, 1929.

THE agreement reached between the governments of the United States and Canada over the "rectification" by engineering methods of the Horseshoe Fall in the Niagara, which has been slowly but steadily receding because of the erosion of the rocks over which it pours, has brought general approval. The necessary cribbing structure in the river above this fall is to be built in co-operation by the Niagara Falls Power Co., which supplies electrical energy to Buffalo and the entire Niagara region in New York State, and the Hydro-Electric Power Commission of Ontario, whose lines gridiron that province. These power producers will share the cost, estimated at $2 000 000 or more, receiving in return the water temporarily diverted while the rectifying works are being constructed. This water will amount to 10 000 cu. ft. per sec. on each side of the international boundary—20 000 cu. ft. in all—and will permit the generation of 80 000 or more additional horsepower in the U.S.A., and of probably more than twice that quantity in Canada.

* * *

One thing the Senate, often so provokingly argumentative, did do in the short session now ending was to take up as unfinished business the Swing-Johnson or Boulder Dam Bill, already passed by the House of Representatives, and promptly pass it by 64 votes to 11. President Coolidge at once affixed his signature, and the Bill became an Act.

This measure apparently assures government construction of a huge dam in the Black Canyon portion of the Boulder Canyon, in the Colorado River, on the Arizona-Nevada border line. This dam is to have the triple purpose of controlling floods, providing irrigation and permitting the generation of power. It is over the last-named feature that the fight has been most bitter. It is likely to involve putting the federal government into the power business on a great scale, and to this the electrical industry has, in common with all conservative business interests, been unalterably opposed.

But such legislation in America has often a fourth hurdle to surmount besides House, Senate and Chief Magistrate. Arizona, dissatisfied with the share of water allotted to her, and a strenuous opponent of the measure, promptly contested its constitutionality, and that point now awaits the adjudication of the United States Supreme Court. There is necessary, too, the adherence of a sixth signatory state of the seven that contain the Colorado basin. California and Nevada of the lower basin states, Colorado, New Mexico and Wyoming of the upper basin, have approved, but Utah, an upper basin state, though favourably inclined, is still withholding her signature in an endeavour to bring Arizona, of the lower basin, round and make the agreement unanimous. What with seven-state, six-state, four-state and three-state complications it looks as if construction might be long deferred, though eminent engineers have pronounced the project a feasible one, and Congress has appropriated $165 000 000 for it.

* * *

If Boulder Dam were Castor, Muscle Shoals would be Pollux in the legislative firmament at Washington. The President's pocket veto of the act for government operation of the Wilson Dam and nitrogen fixation plants owned by the United States on the Tennessee led to a cessation of activity on the part of Senator Norris and his fellow-believers in government ownership when the short session opened. A Bill to turn the plants over on lease to the American Cyanamid Co. has been reported in the House, but it is likely to be left dead on the calendar with scores of others when the members adjourn.

* * *

The Federal Trade Commission's inquiry into the electric and gas utility companies hangs fire awaiting the outcome of a contest in the courts over the commission's power to compel the Electric Bond and Share Co. to divulge certain information and produce certain records which the company maintains are not pertinent to the investigation and should not be spread before competitors. The company, an investment and managing rather than technically a holding, organisation claims that, having no subsidiaries as it interprets the term, it is not engaged in inter-state commerce. The commission regards this contention as a subterfuge. Eminent counsel are now arguing the point.

Meanwhile Gifford Pinchot, famous as a fighter for the conservation of the nation's natural resources and formerly Governor of Pennsylvania, has issued a fat pamphlet aimed at the power monopoly which, he maintains, exists. He says that all save a few of the larger light and power companies of the country are under the control of one or another of six closely allied groups, and he accuses those who control these groups of ruthless exploitation and extortion. He even goes so far as to assign each one of a list of 4 362 light and power companies to its proper owner in the six-headed combination now threatening to enslave the people. Mr. Pinchot, however, would be more convincing were he less specific. Some of the classifications of his compilers are so wide of the mark that they are more likely to cause the monster he has conjured into existence a fit of laughter than a fit of indigestion.

* * *

Budgets of the operating companies for 1929 show another year promising large expenditures and much activity. It is to be noticed, however, that the sums appropriated are to a great extent for completing installations already begun. Not so many orders for huge prime movers or plans for long transmission lines at voltages running up to 220 000 are included as has been common in recent years. This perhaps indicates a slight relaxation in pace while the industry regains its breath and surveys its still unsaturated territory afresh.

CORRESPONDENCE.

The Editor welcomes the free expression in these columns of genuine opinion on matters of public interest, although he disclaims responsibility alike for the opinions themselves and the manner of their expression.

"Glass Insulators."

[TO THE EDITOR.]

SIR,—In reply to your correspondent, "P. M. W.," in your issue of February 22nd, I hope he has appreciated that the remarks in my article concerning sealing were intended for general conditions, such as would apply to varying classes of labour and conditions of service.

The use of cement has been disastrous when entrusted to unskilled labour, particularly when the correct time for setting has not been allowed.

Your correspondent does not say whether he is referring to glass or porcelain insulators, but I agree that where mechanical strength is the most important factor under consideration

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cement may be utilised with advantage, provided that it is used with care and mixed with 20% silica sand and allowed to stand for at least three months. For general conditions, I have not found that the plaster of paris and glue combination has the serious objection suggested, and I know of a very large number of insulators which have been so fixed which are giving entire satisfaction.

In regard to the letter from Messrs. Taylor, Tunnicliff and Co., Ltd., in your issue of March 1st, I regret that the information contained therein does not add to my knowledge of the subject; rather does it emphasise the necessity and importance of glazing. If further proof is required I would suggest that they have insulators installed on a suitable three-phase line, utilising glazed porcelain, unglazed porcelain and glass for each phase. I am quite sure that the results will be interesting to most engineers engaged in the profession, and I shall be very happy to arrange for the free supply of the glass insulators, provided that the test results after service are published in the technical Press. Three sites should be chosen, one in an industrial area, another close to the open sea, and a third near, say, some cement works.

In regard to the remainder of the letter, since I have actually seen the conditions to which I refer, no remarks would convince me otherwise.

Referring to the temperature cycle test, it is well known that glass is capable of resisting all natural temperature and climatic conditions throughout the world, whether the changes are sudden or otherwise.

In considering a liquid immersion test we must not forget that glass absorbs less calories than porcelain under similar conditions, but under such suitable test glass will resist indefinitely—not only for five minutes—any tension approaching the dry flashover figure, whereas alternatively I agree that when porcelain is submitted to similar tests, the longer the test the more considerable becomes the deterioration.

The value of a polished or glazed surface is, therefore, of considerable importance, and, moreover, is somewhat surprisingly emphasised by one of my critics. In his article on the "Influence of Atmospheric Pollution on Performance of Line Insulators," in your issue of January 25th, Mr. Goodlet says:—

"It should be noted that the performance of an insulator in the fouled condition cannot be characterised solely on the basis of its sparkover voltage. Usually luminous discharges are present at very much lower voltages, and, with certain types of insulator, at the higher humidities these discharges assume the form of partial arcs between the sheds, developing considerable heat and noise, but without causing complete arc over. The action of such discharges, if prolonged, is very damaging to the surface and glaze of the insulator, and the useful life of the latter will be considerably reduced."—I am, etc.,

NORMAN E. NORTH.

86, Strand, W.C.2.
March 13th.

Electrical Salesmanship.

[TO THE EDITOR.]

SIR,—I was interested in the suggestions made in the article on the above subject in your issue of March 8th. While it is not necessary to answer any criticisms of E.D.A. made, or implied, by the writer, it is perhaps desirable to put forward a few facts.

Almost every day this Association receives communications from those who have ideas on the direction in which propaganda should be carried out, and these are all carefully considered.

The policy of the Association is directed by a Council representative of the whole industry, and this Council and its committees give a very large amount of time and thought to the work of the Association; new ideas are being developed, as can be seen by anyone who receives the E.D.A. literature and programme of activities.

With regard to the particular suggestions which your correspondent made, I would make the comments set out below.

The Association has a strong Exhibition Advisory Sub-Committee who are assisting and advising promoters of exhibitions, and who consider on broad lines the policy of the Association as regards exhibitions.

The need for national selling of electricity has been realised by this Association, and this year's programme definitely visualises this, and puts before the industry a definite national selling programme which it is hoped that everyone in the industry will support.

The suggestion for a national Information Bureau has been made more than once, and I would like to say that the E.D.A. is already carrying out the functions of such a bureau. We receive inquiries from members of the industry in all parts of the country, and, indeed, from all parts of the world, on all kinds of matters connected with the commercial use of electricity.

During this winter we have had several thousands of inquiries from the general public in reply to the advertisements which have been inserted in the Press and letters which have been circulated.

Finally, I would say that the E.D.A. does endeavour to interest the Press in the use of electricity, and to influence them to accept articles on various aspects of the subject.

Very considerable success has been obtained in this work, and a survey of daily, weekly and monthly papers will show that there is a constantly increasing number of articles published on electrical matters, though from the nature of this work, the connection with E.D.A. is not necessarily apparent.

The support received by the E.D.A. during the year 1928 was greater than in any previous year in the history of the Association. My Council are very gratified by this, but still feel that although the work of the Association is having a considerable effect on public opinion, a great deal more could be done if further funds were available. They, therefore, appeal to every supply undertaking, every manufacturing firm, and every contracting firm to support this work, from which—whether they subscribe to it or not—they are receiving substantial benefits.—I am, etc.,

W. A. VIGNOLES,
Director and Secretary,
British Electrical Development Association, Inc.
London, W.C.2,
March 12th.

[TO THE EDITOR.]

SIR,—In view of the prominence given in your columns to salesmanship questions, your readers may be interested to hear of a rather smart effort for which a certain Leeds firm is responsible. Some of its customers received a few days ago a monthly statement dated February 28th. Typed across the statement was the following: "No account against you this month. We are sorry for this. Will you be ordering soon? Useful pad enclosed herewith."—I am, etc.,

Bradford, "SALESMAN."
March 16th.

Ex-Siemens Men.

[TO THE EDITOR.]

SIR,—The undersigned have had inquiries from time to time as to whether there is an organisation where ex-Siemens men can foregather, and it appears that such an organisation would meet the wishes of many.

We are, therefore, seeking the courtesy of your columns to invite those who have been connected with any of the Siemens concerns in the past—both at home and overseas—to communicate with one of the undersigned.

If there is sufficient response, it is proposed to form a small committee, to arrange, in the first instance, a reunion.—We are, etc.,

J. SNOW HUDDLESTON,
Union Cable Co., Ltd., Dagenham.

E. P. BARFIELD,
Wild-Barfield Electric Furnaces, Ltd.,
Elecfurn Works, North Road, Holloway, N.7.

Plate Type Turbo Rotors.

[TO THE EDITOR.]

SIR,—In your issue of March 8th, on page 298, you are good enough to make some appreciative references to myself. I feel compelled to correct, at any rate, one item inferentially credited to me; this is the more necessary as a similar paragraph has also appeared elsewhere.

The design of turbo generator rotor, in which the body portion is built up of plates without a through shaft, was suggested by B. A. Behrend, and the feasibility of the construction was demonstrated by him. This was clearly set out in the description of the construction which I was allowed to give to the Institution of Electrical Engineers in 1915 (see I.E.E. Journal, Vol. 54, page 67).—I am, etc.,

A. B. FIELD.

Marple.
March 18th.

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BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION.

Annual Dinner and Meeting—Lord Birkenhead Indicates Prospects of the Electrical Industry—Recapturing the Personal Relationship.

THE annual dinner of the British Electrical Development Association was held at the Piccadilly Hotel, London, on March 14th, Sir John M. Gatti (President) in the chair.

LORD BIRKENHEAD proposed the toast of the "British Electrical Development Association." After commenting upon the fact that he was a newcomer to the electrical industry, he referred to the early association of Sir John Gatti's father with the introduction of electricity into London. Continuing, he said he understood that the objects of the Association were very simple: there was no profit making-desire, but simply the belief that the extension of the uses of electricity was to the benefit of the nation as a whole. It was altogether admirable that there should exist an organisation whose sole purpose was to make known the possibilities which lay in front of the development of electrical energy in this country, and it was essential that such an organisation, if it were to be effective and successful, should be one that was not founded upon a commercial principle.

He desired to avoid controversial topics that evening, and did not wish to involve himself in a discussion as to whether it would be an advantage to the trade in this country, and to the particular trade in which they were all interested, if we were to say to the whole world "Keep your money away, we do not want it; we will continue to pay not only our own war debts but the war debts of our allies; we will maintain the gold standard, but at least let us protect ourselves by saying that you shall not invest a penny of foreign money in this country." He wished that some historical economist would examine the question of how much British capital had been invested in foreign countries since the Napoleonic wars, and with what results, and he also wished that some contemporary economist would tell us at this moment how much British capital was invested abroad without any differentiation between the British and the foreign investor, and with what result. These were problems which had assumed great prominence in recent days.

No organisation was, he thought, more variously supported than the British Electrical Development Association. Anybody who was interested in the electrical industry was eligible for membership of the Association, and that made it necessary to ask how great was the importance of the industry which they all represented. What were the developments likely to be, and what would be the effect of those developments on the future life and prosperity of the people of these islands, if we had the wit, or prescience, to understand them and to make our own individual contribution to this development.

He supposed that 40 years ago the gas companies could have purchased the whole of the electrical industry of this country for a sum which, measured in relation to their capital, would have been negligible. Looking at the development that had taken place since that date it was unquestionably true to say that if we took the domestic uses of electricity, hardly one house in six, even within the areas which were closely contiguous to the great sources of supply, was to-day using electricity for lighting. Was it to be supposed that these people would be satisfied for ten years to be denied access to the enormous convenience, the greater cleanliness, and the greater hygienic qualities of electric light? It was absolutely inconceivable that there would not be a development in domestic consumption, which at the present moment was incalculable, even to the most imaginative among them. That development must come; it must come swiftly, and it must come in our time. It was the duty of all engaged in the industry to concentrate, in the first place, upon the production of electric power, and in the second place upon its distribution as cheaply as the existing economic conditions made possible.

When we considered those great continents removed from us by 4 000 miles of ocean, we were apt to be discouraged that we had not the great water forces which were at their disposal for electrical purposes. On the other hand, we could console ourselves with the fact that the very compactness of the areas with which we had to deal provided conditions which were not inferior to those in the other countries. He was certain that the economic difficulties of this country in the next ten years would be profoundly influenced, and might possibly ultimately be determined by our development of electric power.

Incalculable Forces.

The Electricity Bill introduced by the Government was a bold and courageous attempt to enlist powerful forces upon the side of this new movement. The Central Electricity Board and the Electricity Commissioners were doing their best, and he saw many signs that they were successfully devoting themselves to the task of making electrical power the most vital element in the development of trade and movement in this country. We had at hand incalculable forces, the strength, facilities, and utmost resources of which were not yet completely realised. It was the work of the Association to make them known by propaganda, by illustration, and by instruction.

SIR JOHN GATTI, replying to the toast, said that Lord Birkenhead's survey of the position of the electrical industry represented not the fanciful dreams of people who had long struggled in the industry, but the outlook of a man who came to it with a unique experience of men and matters. Having explored all the avenues that were open to him, and all the claims that were made, Lord Birkenhead was able to say that the electrical industry was one with which he would be glad to be identified, and, indeed, he was now identified with it in a material and potent manner.

Lord Birkenhead had pointed out the relative positions occupied by the gas and electrical industries, and, curiously

Some of the members and guests of the British Electrical Development Association at the annual dinner, held at the Piccadilly Hotel, London, on March 14th.

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enough, in a daily paper of the previous day he saw two paragraphs relating to gas. One was that the chairman of a very big gas concern had made the proud boast that gas was helping to ripen bananas. It was his sad duty to confess at once that the electrical industry had no bananas to ripen, but it did claim to have made possible the preservation of hundreds and thousands of tons of food. The other paragraph stated that the progress of a particular gas company was equal to that of any other gas company in the country, and showed an increase of 1 per cent. The electrical industry, however, preferred to put at least one o on to such a figure before it felt there was any ground for self-congratulation.

An appeal had been made to all those interested in the electrical industry to continue and to strengthen the movement of co-operation amongst all branches and sections, municipal or company, manufacturers or distributors. It was an appeal to co-operate to make known to the general public the advantages of the commodity which they had to sell. He hoped that advice would be taken to heart, remembering the results that had already been achieved, and remembering that in an Association such as the E.D.A., when a certain stage had been reached—and he claimed that such a stage had been reached—every additional effort told four-fold and ten-fold.

Mr. J. W. BEAUCHAMP, who was greeted with prolonged applause, proposed "Our Guests," and coupling with the toast the name of Sir Herbert E. Morgan, asked all those present when they got back to their respective spheres of influence to tell the people whom they met that the Association stood for something worth while. It carried on work where the Electricity Commissioners and the Central Electricity Board were, perhaps by the nature of things, compelled to leave off. It tried to educate the whole mass of the people in the best uses of electricity for their own advantage in order to get the most value from it, and it tried to do one more thing, perhaps the most important, namely, slowly to build up in the minds of every section of the public a sort of personality in electricity.

In recent years many businesses and organisations had become so big that the element of personality had to a large extent left them. We spoke in an airy way of public service, but he was afraid most of them rather missed the old relationship between buyer and seller. In the modern large organisations, which included electricity supply, the chief must necessarily be very remote from his consumers, and therefore it was necessary to find some new method of giving the consumer a feeling of personal interest in this great service.

SIR HERBERT E. MORGAN, in his reply, urged the necessity for keeping charges for electricity down to the lowest possible figure and suggested that this would be one of the greatest boons that could be conferred, not only upon the users, but also upon the electrical industry itself.

Electricity had followed the candle, the oil-lamp, and gas, but there was no reason to heat a room with an imitation coal fire, and there was no reason to light a room with an imitation candle. If the industry would only go into these matters and get the ladies to help, and if only it would present electricity in the way in which it could best be presented, he believed a great step forward would be made so far as the public was concerned. He suggested that the right course to pursue was to estimate the possible consumption in each locality, treat that as an economical unit, and offer the public in that area current at a pre-determined price. Finally, Sir Herbert said he was exceedingly pleased to realise from Lord Birkenhead's speech that it was Britannia who would illuminate this Empire, and not the Statue of Liberty.

The Annual Meeting.

The ninth annual meeting was held at the Hotel Cecil on March 15th. The report of the Council for the year 1928 showed that the Association made steady progress throughout the year, greater support having been received from all sections of the industry than in any previous year in the history of the Association. A feature of the year's work had been the reorganisation of the E.D.A. Provincial Area Sub-Committees on a new basis, with a definite constitution and rules as to election of members, together with the appointment of area officers in four of the eight areas into which the country is divided.

The work of the Area Committees and officers has already had a considerable effect in increasing the interest of those connected with the electrical industry in the provinces, and has brought new supply members to the Association, while manufacturers and contractors have also been attracted by the work being done, and a number have become members of the Association.

A continued growth in membership is a satisfactory feature of the year's work. Twenty-seven additional supply undertakings were enrolled during the year, and an increased rate of subscription was adopted by twelve undertakings.

A considerable amount of investigation work has been carried out by the Industrial Heating Sub-Committee, with the assistance of panels formed in various parts of the country, to study industrial heating processes. Papers have been read, and industrial electric heating exhibitions have been held. The Sub-Committee is considering the production of a cinematograph film demonstrating electric heating processes.

At the invitation of the Electricity Commissioners, the Rural and Agricultural Electrification Sub-Committee prepared a preliminary report on "The method of propaganda and educational publicity best adapted for the advancement of Rural and Agricultural Electrical Development in Great Britain," and this was included in the official Report of the Electricity Commissioners' Conference on "Electricity Supply in Rural Areas." The Sub-Committee produced a film dealing with rural electrification on the farm and in village industries from a practical standpoint; the film, which is called "Country Currents," is in four reels, and is about 3 500 ft. in length.

An exhaustive inquiry into the suitability of British domestic electrical refrigerators was made by the Refrigeration Sub-Committee and a Report (E.D.A. No. 698) issued, showing that British plant of this kind is satisfactory in every way. The Sub-Committee is preparing further booklets on refrigeration for general circulation.

Campaign Activities.

The E.D.A. Circle Campaign, which commenced in October, 1927, terminated at the end of March in the year under review, and a report containing summaries of the activities undertaken was prepared and circulated to all electrical interests. The principal results disclosed in the report are that 122 demonstration houses, exhibitions, and special electrical demonstrations were organised, mainly through the Electric Circles, securing an attendance of approximately 1 200 000 persons, while it was estimated that one-and-a-quarter million pamphlets were circulated.

In September, 1928, an intensive Factory and Workshop Lighting Campaign, planned by the E.L.M.A. Lighting Service Bureau, was commenced. The principal features of the Campaign included: five successive direct mail letters and educational publications to over 100 000 factories and workshops; over 100 lecture-demonstrations to industrial consumers, factory owners and managers, and industrial associations, and editorial articles in a considerable number of trade journals, circulating amongst manufacturers. Some 2 400 inquiries for further information were dealt with, and it is quite obvious that the Campaign caused considerable interest in all parts of the country and brought about direct results and definite business. During the autumn of 1929 it is intended to circulate to a specially prepared list of factory owners a booklet containing photographs of new or improved installations, which have been provided as a result of the recommendations made in this Campaign, and expressions of opinion by users on the value of these modern installations.

Instead of a special campaign of short duration the Council, last autumn, decided to introduce a special continuous programme of E.D.A. activities, and for this purpose provided a sum for special propaganda. Each month a programme is issued to the industry, giving particulars of what the Association is doing, and setting out examples of the national Press advertising that is being carried out; illustrations of blocks for local newspaper advertising that can be purchased from the Association are shown, together with particulars of posters, advertising blocks, lantern slides, and literature that can be provided by the Association in connection with the month's subject. The lectures suitable for the month's activity are also indicated, and the Area Committees and Circles are asked to co-operate in the various activities by arranging local conferences, providing lectures, etc. Further, month by month, photographs and instructions are given in the supplementary programme, showing methods of window dressing suitable for displaying the goods dealt with during the month.

A window display background is supplied free of charge to all members of E.D.A. who care to apply for it, while a special set of cube fittings, etc., suitable for dressing the windows in a number of ways, is offered at a price of £2 15s. For this outlay it is possible for anyone, by following the instructions given month by month in the programme, to have throughout the year a bright and fresh window display related to the subject of the national advertising for each period.

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A NEW METAL-CLAD SWITCH UNIT.

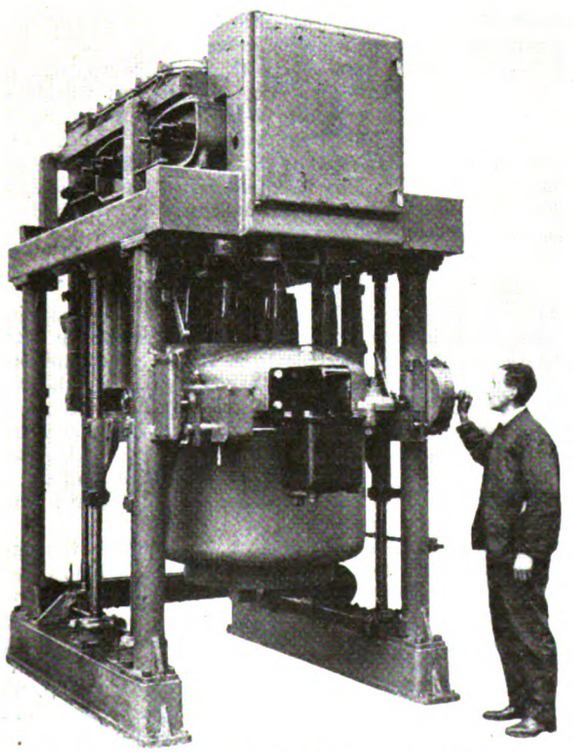
Heavy Rupturing Capacity in Small Space—Features in Oil Circuit Breaker Design—Interlock Arrangements.

ANOTHER interesting development in their metal-clad vertical switchgear has just been produced by Messrs. Ferguson Pailin, Ltd., the new equipment having been designed to meet the demand for a 750 000 kVA rupturing capacity unit in a small space, and, at the same time, afford safe accessibility to all parts. The current and voltage ranges are from 900 A at 33 000 V to 4 000 A at 11 000 V. On the duplicate busbar unit the breaker transfer method of busbar selection is incorporated, this arrangement being quicker and more positive than plug changing. With this scheme to effect bus transfer, the circuit breaker is lowered by the motor operating gear, moved horizontally along its supporting carriage, and then motor raised to the operating position on the other set of busbars.

The gear is built on the unit principle, which on duplicate busbar systems, enables additional units to be added without shutting down. Furthermore, it is jig assembled so that similar parts are strictly interchangeable.

The busbars are insulated with bakelite bushings and run in solid with compound, whilst the current and protective transformers may be solid compound-filled or immersed in a fluid-compound, which makes them accessible for changing for others of different ratio or capacity. The voltage transformer is oil immersed. The cable terminal chamber is normally arranged for solid compound filling, universal type glands being fitted. Special high pressure chambers can be provided for oil or fluid-compound filled cables. Expansion boxes are fitted on all compound filled chambers. The insulation consists of best quality bakelite throughout, condenser bushings being employed for the higher voltages.

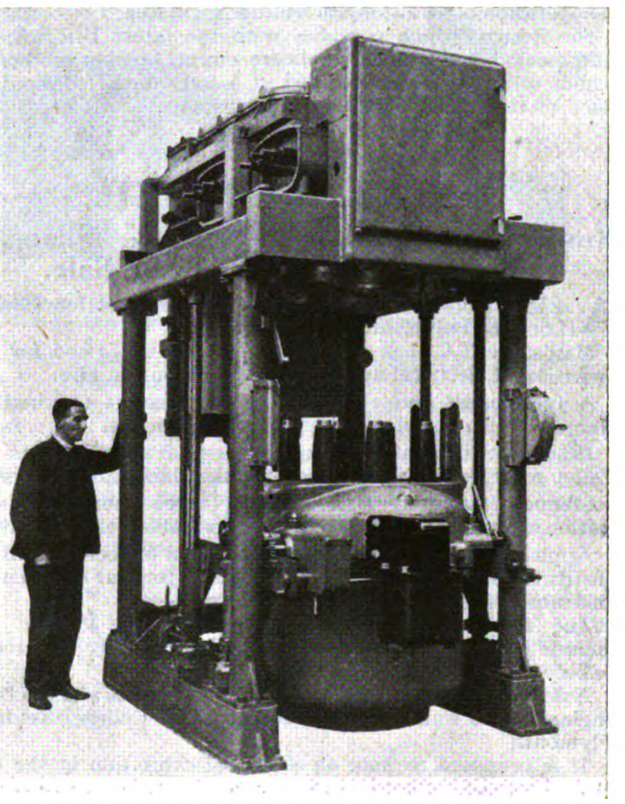
The movement of the circuit breaker for isolation, for inspection of contacts, for removal of tank or for complete



Front side view of the unit, showing the circuit breaker isolated.

removal of the breaker, is downwards. The circuit breaker is raised and lowered through motor operated worm gearing and substantial screws mounted in pairs on each side of the unit, and traversed by nuts to which the supporting carriage is bolted. The operations are controlled by means of an ironclad switch from the front of the unit. The socket members of the isolating features form an integral part of the circuit breaker bushings, and are of the self-aligning type. The problem of obtaining an effective disconnecting device for heavy currents, which permits easy insertion and withdrawal of the circuit breaker, yet ensures high contact pressure when in operation, has puzzled designers for many years. Messrs. Ferguson Pailin claim that the patented arrangement which they have evolved definitely solves this problem.

All operations are claimed to be mistake-proof, a full yet simple system of interlocks being incorporated. The makers state that it is impossible to make or break load on the plugs,



Front side view of the unit with the circuit breaker in the transfer position.

to close the breaker before the plugs are fully engaged, to remove the circuit breaker tank whilst in the operating position, or to replace the circuit breaker unless the tank is in position. Stops prevent over-travel, and efficient means are provided to ensure correct registration of the circuit breaker. The fixed plug members are automatically screened by metal safety covers on withdrawal of the circuit breaker, these covers being arranged for padlocking in the closed position.

An Outstanding Feature.

An outstanding feature of the unit is the oil circuit breaker. The design of the breaker, which is based on conclusions arrived at from the results of high power rupturing capacity tests, definitely prevents emission of flame, hot gases and oil. It is characterised by its massive construction, single cylindrical welded steel tank with dished bottom, high domed steel top plate ensuring an ample air cushion, internal link mechanism, high pressure oil gauge, and pebble filled gas vents, the baffling of which prevents oil throw. These vents are automatically connected to the exhaust chambers on the fixed portion of the unit when the breaker is inserted. The chambers are provided with unions, so that the exhaust gases may be led away as desired. The contact details are of special design to deal with the enormous currents developed when the circuit breaker ruptures a heavy fault. The operating gear is of the patented mechanically trip-free type, and is of an extremely simple design which eliminates complicated link gear. It can be arranged for solenoid or motor operation, and means are provided for emergency manual operation. A truck with roller bearing wheels is supplied with an initial installation to facilitate removal of the breaker or tank.

Both current and protective transformers are located on the feeder side of the circuit breaker, and on account of the heavy short circuit currents which might be developed, they are

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of the single turn primary pattern. A patented self-compensating type of current transformer is provided where a low ratio is required. Additional secondary windings or double ratio transformers can be supplied. The voltage transformer is mounted complete, with its resistances and fuses, in an oil filled chamber, which is fitted with a breathing device. Independent isolation is provided to enable inspection or repairs to be carried out whilst the unit is in commission. The fixed contacts are arranged for screening with metal safety covers when the transformer is withdrawn.

Simple mechanical interlocks prevent insertion or withdrawal of the transformer unless it is completely enclosed. The chamber will accommodate three single phase transformers or a three-phase transformer with an additional winding for the operation of an automatic voltage regulator.

The design, which complies with the latest B.E.S.A. requirements, enables the duplicate circuit breaker method of busbar selection to be installed at a later date if desired, in place of the transfer breaker arrangement.

NEWS IN BRIEF.

Russia and American Radio — Shanghai Electricity Undertaking for Sale.

A FULL time lecturer in physics is required for Chelsea (London) Polytechnic.

Maidstone T.C. has applied for a loan of £3 000 for the provision of electrical apparatus to be let out on hire.

A mechanical and electrical draughtsman is required by Hammersmith (London) Electricity Department.

Bradford Corporation's annual visit of inspection to the Valley road generating station is to take place on April 10th.

Stepney (London) B.C. reqüires three temporary sub-station attendants during holiday period (about three months).

Applications are invited for the position of secretary of the Institute of Physics and editor of its " Journal of Scientific Instruments."

The forthcoming electrical exhibition at Preston will include wireless and trade electricity, a feature being a model bakery.

A demonstrator for laboratory work in physics and electrical engineering is wanted for the Royal Naval College, Keyham, Plymouth.

It is proposed to hold an electrical exhibition in the Oak Rooms at the Ealing Palladium, London, from April 6th to April 13th inclusive.

Since July 1st, 1928, the Russian Soviet Government has placed orders with the General Electric Co., of New York, for £120 000 worth of radio equipment.

On behalf of the Edison Electric Co. of Milan, Signor Motta has presented Signor Mussolini with £100 000 to institute scholarships for foreign travel and scientific research.

The Swansea Branch of the Association of Mining Electrical Engineers will hold a meeting to-morrow (Saturday), when Mr. C. L. James will read a paper entitled " Power Factor : Its Cause and Effect."

Burnley Electricity Department fixed 174 appliances during February, new consumers being connected numbering 99, prepayment meters fixed 66, and consumers connected on the rateable value system 32.

A system of road traffic control has been put into operation in certain parts of Manhattan, whereby the mechanical devices, operating the light signals in unison, are controlled from one room. All vehicles go east and west or north and south simultaneously.

In the course of a lecture on " Electricity in Agriculture, with special reference to Electro-Culture," at a meeting of the Western Centre of the I.E.E. at Bristol, last week, Mr. W. Phœnix said it had been established that the increase in crops under electricity was 20%.

The Ministry of Education for Northern Ireland invites applications for scholarships from persons employed in various industries, including electrical installation work. Form of application (No. H.75) and further particulars from the Secretary of the Ministry, Parliament Buildings, Belfast.

The North-Western Power Co., a subsidiary of the Winnipeg Electric Co., has placed the contract for a dam, spillways, sluices, concrete foundations and sub-structures for the power house for the 225 H.P. hydro-electric power development of 225 000 H.P. at Seven Sisters' Falls, on the Winnipeg River.

At the annual dinner of the Devon and Cornwall Section of the E.P.E.A. at Plymouth, on March 9th, Mr. E. G. Okell, city electrical engineer, Plymouth, remarked upon the valuable work done by the local sections, and the improvement which the Association had brought about in the working conditions of the industry.

In an address on " The Changing Conditions of the Twentieth Century " to the Manchester Luncheon Club on Monday, Sir Stephen Demetriadi said commercially we lived in a world of sellers ; the methods of yesterday would not do to-day. Acting upon theories which had become obsolete would, if long pursued, ultimately result in disaster.

At a recent meeting of the Chester-le-Street Rotary Club, Mr. Frank Hayton spoke on " Distribution of Electricity." He said the history of electrical legislation made a particularly depressing story, and it was a tribute to the vision of the British scientist and to the courage of the pioneer that, despite the handicaps of the politician, they had brought the electrical industry to the proud position it occupied to-day.

The annual dinner of the North Midlands Section of the I.E.E. took place at Leeds last week. Lt.-Col. K. Edgcumbe, referring to the general trend of trade, expressed the opinion that things were on the mend. Mr. W. B. Woodhouse said a modern phase in industry was the trend towards the larger commercial unit, while another good sign was the increasing importance attached to the better scientific training of those engaged in industry.

A report on telegraph and telephone progress in the Western Telephone District (South Western Engineering District) for 1928 states that the number of telephones increased by 3 414 to a total of 35 284, and 1 269 subscribers were served by 131 rural party lines. A main underground track is being laid between Plymouth and Torquay, a new repeater station has been opened at Taunton, and the work of providing a station at Tavistock is well advanced.

Sir John Snell, speaking at a meeting of the British Research Association for the Woollen and Worsted Industries at Bradford last week, said that confirmation had been obtained of a former estimate that there would be a reduction in the cost of electricity under the five new schemes of working for various parts of the country. Compared with the old regime of multiplicity of stations, the difference in cost ten or twelve years hence would be about £40 000 000.

It is understood that negotiations are in progress between Wireless Pictures, Ltd., and Prof. Denes van Mihaly, a Hungarian expert, for a public demonstration in England of apparatus invented by Prof. van Mihaly, and by means of which he claims that moving pictures can be transmitted and received by wireless. If the demonstration is successful, the British Broadcasting Corporation will be approached as to the possibility of establishing a regular service.

Electricity in Mines.

At a meeting of the Western District of the Association of Mining Electrical Engineers at Swansea on March 16th, notes prepared by Mr. W. J. Charlton, inspector of mines for the Swansea division, who was absent through ill-health, were read. Mr. Charlton said there had been a fairly steady increase during the last five years in the use of electricity in mines. The horse-power installed was 1 684 123. Electricity was used in 55·7% of the mines in South Wales, and the average horse-power of installed motors was higher than in any other region of the country.

Shanghai Municipality desires to transfer the municipal electricity works to private enterprise. Tenders have been invited, the highest received being that of the American and Foreign Power Co., of New York, which bid over £10 000 000. The British Trusts Association, London, offered approximately £6 380 000, and submitted a leasing plan. A leasing plan was also submitted by Lord Mexton's group, which includes Willans and Robinson, the Power and Traction Finance Co., and the English Electric Co. The Council will make a decision late in April.

The Commission of Inquiry, which, headed by Mr. L. Simon, recently visited the United States to investigate the methods of the American telegraph companies, has recommended that in the larger post offices in this country there should be glass-topped tables for the use of writers of telegrams, that attractive leaflets and folders suggesting the usefulness of the telegraph system should be available at post offices, etc., that messengers, summoned by telephone, should collect telegrams and that special forms and envelopes should be used for Christmas, Easter or birthday greetings, etc.

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IN PARLIAMENT.

Galloway Water Power Bill Approved by House of Lords Committee.

DURING the proceedings regarding the Galloway Water Power Bill before a Select Committee of the House of Lords last week, Mr. Graham Robertson, K.C., for the promoters, said they had made some concessions with regard to the preservation of domestic water supplies, they had conceded Ayr County Council's requirement that they should make up diverted roads and maintain them for three years, and they had agreed that if the Doon fishings were damaged the proprietors should have monetary compensation.

Mr. J. Carmont, K.C., for Ayr burgh and Ayr County Council, said his clients might be content to take less than the 65 000 000 gallons of water a day if the promoters undertook to bear a part of the expense of the sewage disposal works which would have to be erected in consequence of the diminished flow.

Mr. A. B. Muirhead, consulting engineer, estimated that the production of 188 000 000 kWh a year under the scheme would displace about 445 miners through the loss of output of coal, and that loss would have to be borne by Ayrshire.

Mr. Abady, for the Mining Association of Great Britain, said the promoters had not made out a clear case that they could produce a cheap supply of electricity. Unless the promoters made a firm offer to supply electricity at a certain price the Central Electricity Board could not make a contract.

Sir John Snell said that, so far as he could gather, the engineering scheme was very well thought out, and that, having regard to the watershed and rainfall, it was getting the maximum power which could commercially be developed. He agreed that the scheme could not be a commercial success unless the current produced could be taken on the grid.

The Committee approved the preamble of the Bill.

Pontypridd Urban District Council Bill.

A Select Committee of the House of Commons considered this Bill last week. The Council sought powers to abandon its tramways and substitute trackless trolley cars.

Mr. F. G. Thomas, K.C., for the promoters, said if the trams were to be retained the Council was faced with an expenditure of about £30,000 in the relaying of tracks. The Council proposed to purchase ten trolley vehicles and ten petrol omnibuses.

Mr. J. E. Teasdel, general manager of the tramways, said the Council would not think of handing over to private enterprise the whole obligation to provide the transport necessary.

It was announced later that there was virtual agreement between the petitioners.

The Chairman said the Committee were not disposed to give Llantrisant power to exercise an absolute veto on any application for additional routes. The clauses providing for appeal to the Ministry of Transport could be put in the Bill.

London Passenger Traffic

A Select Committee of the House of Commons commenced, on Tuesday, consideration of the Bill promoted by the London Underground Railways Group and London County Council to authorise agreements for the co-ordination of London traffic.

Sir Lynden Macassey, K.C., for the underground companies, said since 1836 there had been a growing insistence by Royal Commissioners and others as to the necessity of co-ordinating the London passenger carrying system. The proposed scheme provided for the consolidation of the passenger transport services of London, with such public control as was required to protect the interests of the community in the matters of the level of fares, adequacy of services and development to the limit of available resources. It also provided for the setting up of a common fund and common management. No scheme of co-ordination of traffic was possible in London unless the Underground Co. and London County Council were parties to it. Those bodies represented between 84 and 85% of the whole of London's passenger traffic, excluding the main line railways.

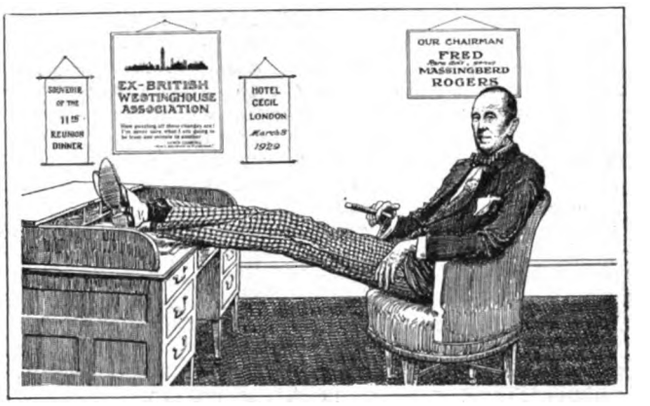
The agreement would be laid before Parliament, whereupon it became within the power of Parliament, if it thought fit, to declare the agreement null and void. He was prepared to have inserted in the measure a clause providing that if an agreement were reached between the Underground Co. and the L.C.C., any other local authority or traffic-owning body could demand to be admitted as parties to the agreement on a basis not less favourable than that of the existing agreement, having regard to dissimilarity in circumstauces or conditions.

PERSONAL.

MR. W. E. Bush has returned to duty after a three months' illness.

Mr. A. C. Fenwick, has been appointed general manager of Bury Corporation Tramways.

Dr. S. Z. de Ferranti, F.R.S., has been elected president of the E.D.A. for the ensuing year.



A cartoonist's impression of Mr. Massingberd Rogers, who presided at the 11th re-union dinner of the Ex-British Westinghouse Association.

Mr. T. D. Martin has been elected president of the Electrica Power Engineers' Association for 1929.

Major-General Sir Philip A. M. Nash has left London for Egypt, and expects to be away about a month.

Sir Robert Donald has been appointed chairman of "The Electrical Times," Ltd. in succession to Mr. Wm. May.

Mr. G. S. Haydon, resident engineer and manager at North Wilford power station, is severing his connection with that station on account of ill-health.

The name of Mr. A. J. Fuller, borough electrical engineer, Fulham, has been mentioned in connection with the I.M.E.A vice-presidency for the ensuing year.

Mr. D. N. Dunlop, director of the B.E.A.M.A., on Wednesday delivered a lecture, under the auspices of the Anthroposophical Society in Great Britain, on "The Supersensible Being of Man."

Obituary.

MR. FRANK WALKER METCALFE, on March 13th. He was manager of the machine section of the contract department of the British Thomson-Houston Co., Ltd., Rugby. Mr. Metcalfe was educated at the Blackburn Municipal Technical School, and joined Yates and Thom, Ltd., of Blackburn, as an apprentice. He joined the B.T-H. Company in the turbine drawing office in 1915, and was transferred to the contract department in 1919 as a member of the turbine section. He went to Japan on behalf of the company in 1926, and returned in 1927, rejoining the contract department as manager of the machine section. Mr. Metcalfe, who had recently been appointed to the Warwickshire Further Education Committee, was a member of the Rugby Further Education Committee since 1925, as one of the representatives of teachers, employers and workers, nominated by the Urban District Council. At the time of his death he was also serving on the General Purposes and Commercial Advisory Sub-Committees.

MR. ANTONY SIMON, on March 8th, at his residence in London after a short illness. Mr. Simon was born of French parents in Moscow, and was educated in that city. Following graduation from the Imperial University in Moscow he joined the Russian Dynamo Co. as a sales engineer. This company was at that time representing the old British Westinghouse Co., and in 1914 Mr Simon was transferred to the British Westinghouse Co.'s staff then maintained in Russia. Although at first acting purely as a technical translater, within a few months he demonstrated his outstanding ability as a sales engineer, and up to the time of the revolution he carried out many important negotiations for the British Westinghouse Co. In the disturbances following the revolution he lost practically all his possessions. After several adventurous months he came to England, where he rejoined the British Westinghouse Co.'s staff, first in Manchester and later in London. For many years past Mr. Simon has held the position of manager of continental sales for the Metropolitan-Vickers Electrical Co., and he was also a director of several subsidiary companies operating on the Continent. See page 361.

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BOURNEMOUTH PAVILION.

Decorative Lighting Installation in New £250 000 Building.

BOURNEMOUTH'S new Pavilion, which was opened on Tuesday by the Duke of Gloucester, is of particular interest to our readers on account of the decorative lighting treatment and also because it is the building in which the forthcoming conference of the E.C.A. will be held.

The building, which cost £250 000, houses under one roof a concert hall seating 2 500 people, a dance hall to accommodate 800; a first-class restaurant to seat upwards of 500, besides a number of lounges, tea rooms, promenoirs, soda fountains and the like. Outside are a number of tea terraces, beneath which provision is made for an illuminated waterfall.

In the main entrance vestibule are imposing octagonal lanterns, glazed with amber-tinted glass panels. Around the walls several cast brass brackets are fixed with long shafts finished bright red, relieved with gilt, and surmounted by 16 in. alabaster dishes, lined with white opal glass reflectors. The staircases, left and right of the main hall, are illuminated by handsome octagonal lanterns, suspended from the centre of the glazed dome above. From four short bracket arms fixed in the body of the lantern are suspended four 6 in. Equiluxo globes, equipped with orange-sprayed lamps to colour tone the illumination of the lower staircase and floor below.

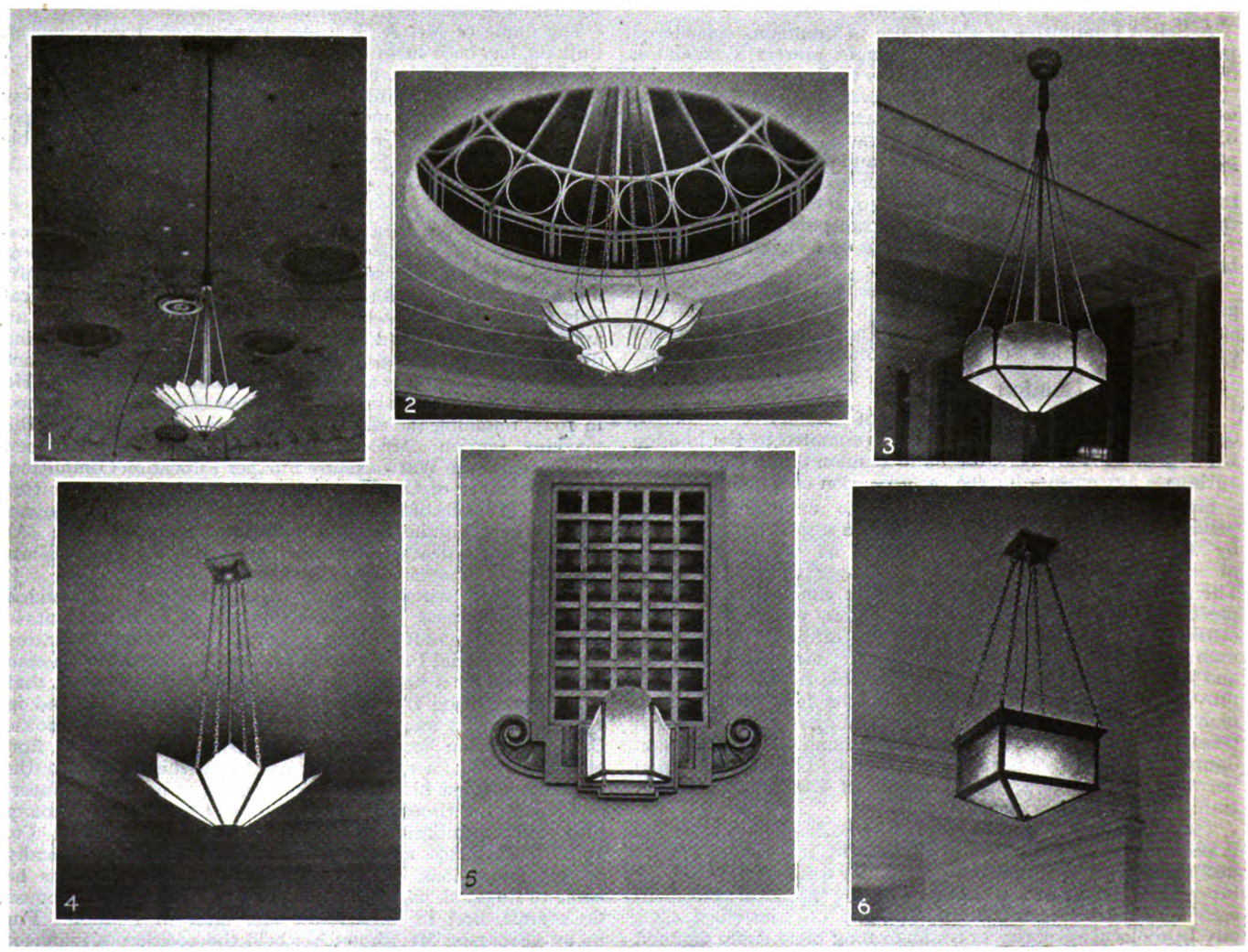
The main ceiling, promenoir and under balcony of the concert hall are illuminated with handsome glass fittings of simple and dignified design which are in perfect harmony with the decorative treatment of the auditorium. In the centre of the domed ceiling is a gilded sun burst, and from the centre of this is suspended a four-tier glass fitting of 8 ft. diameter, designed on plan to form a multiple-pointed star. The colour of the diamond raindrop glass panels is graded from white at the top to pale, medium and deep amber at the bottom. Four smaller two-tier fittings, each of 4 ft., dia. surround the coloured pendant, and under the balcony and around the promenoir single-tier fittings, smaller in proportion to their positions, complete the installation.

The main lighting feature in the large tea room and dance hall is a fine 6 ft. dia. pendant suspended from the centre of the dome. It is glazed with bent panels of diamond raindrop glass in pale and medium amber, finishing at the bottom with deep amber flat glass panels. The remainder of the fittings vary in diameter from 4 ft. to 2 ft., and are glazed with flat glass panels to match.

The Lucullus Room has a very effective lighting scheme, though it is of the simplest character. As the ceiling is low, it is planned with a shaped beam surround, relieved with a guilloche ornament. Small ceiling plates and galleries, carrying some forty-four 6 in. Superflux globes, half screened horizontally, with green and white opal covers, are fixed in the centre of the ornaments at about 2 ft. 6 in. spacing intervals. The repetition of these unpretentious units has a pleasing effect.

In the first class restaurant are installed pendants suspended from ceiling panels on silk covered rods and cord suspension. These fittings are hexagonal in shape, 4 ft. in diameter, glazed with pale and medium amber-tinted glass panels. Around the walls demi-coupé brackets to match are fixed in a number of shaped panels, giving a pleasing decorative effect to the wall surfaces which are panelled with mirror glass. The fittings in the second class restaurant are somewhat similar.

The entrance vestibules, staircases and lounges are equipped with handsome fittings of varying design, all worthy of special description, did space permit. The foregoing remarks, however, suffice to give an outline of the decorative lighting installation, the whole of which was manufactured and supplied by the General Electric Co., Ltd., and installed by Messrs, Aish and Co., of Bournemouth, under the instructions and supervision of the architects, Messrs. Home and Knight.



ILLUSTRATING the lighting fittings in the Bournemouth Pavilion, showing: (1) *one of the concert hall pendants;* (2) *the dance hall and central bowl pendant;* (3) *one of the units in the second class restaurant;* (4) *a promenoir light unit in the concert hall;* (5) *a wall fitting in the first class restaurant, and* (6) *a corridor unit in the dance hall.*

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SPECIAL COMMITTEES.

Commissioners Appoint Committees to Consider Assisted Wiring, and Other Schemes.

THE Electricity Commissioners have appointed Mr. Ll. B. Atkinson, representing the C.M.A.; Mr. H. Bentham, representing the Provincial Electric Supply Association; Mr. S. E. Britton, representing the I.M.E.A.; Mr. D. N. Dunlop, representing the B.E.A.M.A.; Mr. J. T. H. Legge, representing the Incorporated Association of Electric Power Companies; Mr. H. Marryat, representing the E.C.A.; and Lieut.-Col. W. A. Vignoles, representing the E.D.A., to be a Committee, with Mr. E. W. Dickinson as secretary, to consider what steps could be taken to ensure that facilities for assisted wiring and for the hire and/or the hire-purchase of apparatus are made available, wherever needed, to prospective consumers of electricity in rural and other areas of supply, and to make proposals for a practical financial scheme for the purpose.

The Commissioners have also appointed Mr. H. Bentham, representing the Provincial Electric Supply Association; Mr. A. C. Cramb, representing the I.M.E.A.; Mr. J. T. H. Legge, representing the Incorporated Association of Electric Power Companies; Mr. F. W. Purse, representing the London and Home Counties Joint Electricity Authority; and Lieut.-Col. W. A. Vignoles, the Electrical Development Association, to be a Committee, with Mr. C. E. Allan as secretary, to consider the various kinds of charges and tariffs offered by authorised undertakers in connection with the supply of electricity for lighting, domestic, office and power purposes, and to make definite proposals whereby a greater measure of uniformity in respect of charges and tariffs could be brought about in the Electricity Supply Industry.

ELECTRICAL WOMEN.

Members of the Association at the Ideal Home Exhibition.

A LARGE party of members of the Electrical Association for Women, including many groups from the provinces, visited on March 13th the Ideal Home Exhibition, which concludes at Olympia, London, to-morrow (Saturday), as guests of the British Thomson-Houston Co., Ltd., and the Hotpoint Electric Appliance Co., Ltd.

Demonstrations were given of various electric lighting, heating, cooking, refrigeration, and labour-saving appliances, and it was evident that the ladies were as much interested in the theoretical and constructional details as in the many domestic advantages offered by the equipment. In the "Bedrooms through the Ages," the lighting effects in which were planned by B.T.-H. lighting engineers, the party saw numerous examples of electric light adapted to meet the requirements of almost any surroundings. The "Mazdalux" electric fountain in the centre of the ground floor aroused considerable enthusiasm.

After luncheon, which was served in the Pillar Hall Café, the visitors adjourned to "His Master's Voice" Hall of Music kindly lent for the occasion by the Gramophone Co. Mr. F. W. Leevers, on behalf of the British Thomson-Houston Co., and the Hotpoint Electric Appliance Co., gave an interesting talk on the steadily growing appreciation of the advantages of electricity in the home, referring specially to the value of coloured lighting, the introduction of electrical refrigeration, improvements in electric cookers, and washing machines, etc.

Miss Haslett, Director of the Association, thanked the hosts for their kindness in arranging the visit and Mrs. Beale, the newly-elected president of the Birmingham Branch, seconded.

Mr. Fenwick, of the Gramophone Co., gave an interesting talk on modern gramophone-radio apparatus,

The visitors, numbering over 300, included among the provincial groups of the Association, members of the recently-formed mid-Gloucestershire Branch.

On March 18th the members of the Manchester and Salford District Branch of the Association paid a visit to the Hyde Road Depot of the Manchester Tramway Department.

ERRATUM.

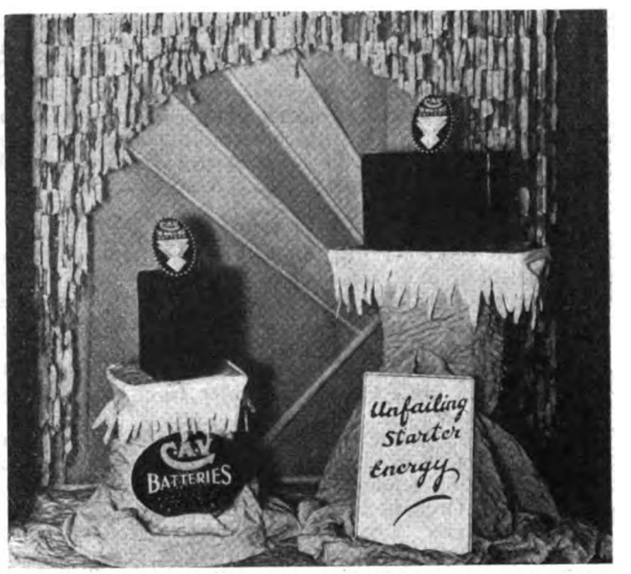
In the description of the new "A.C." microammeter of Ferranti, Ltd., which appeared in our issue of March 1st, pages 267 and 268, the range of the instrument was given as 750 mA. This should, of course, read 750 microamperes, the letter m having been printed instead of μ.

BUSINESS ITEMS.

MESSRS. BOUGHEY AND POWELL have opened new electrical showrooms at 18–24, Baldwin Street, Bristol.

Mr. WILLIAM TAYLOR, electrician, has opened premises at Millstone Yard, Peel Street, Barnsley.

The registered offices of the LORIVAL MANUFACTURING Co. (1921), LTD, have been removed to the company's Norwood Works, Southall, Middlesex.



The special car battery window display of C. A. Vandervell and Co., Ltd., which is available to the trade.

The telephone exchange and number of the CITY ELECTRICAL Co., Emerald Street, Theobalds Road, London, W.C., have been changed to Holborn 9722.

The PIGGOTT ELECTRICAL Co., LTD., and affiliated companies have removed to Salisbury Square House (Dorset Street entrance), Fleet Street, London, E.C.4.

An electrical exhibition, organised by the WESTERN ELECTRICITY SUPPLY Co., LTD., and held in the Town Hall, Bradford-on-Avon, on March 7th and 8th, was devoted chiefly to home lighting and small domestic appliances.

The ALTON BATTERY Co., LTD., Alton, Hants, has appointed Mr. Joseph Rea, of York Buildings, 32, Ann Street, Belfast, as agent for Alton stationary batteries, for Ulster and Donegal.

An order of more than usual interest has been received by the HART ACCUMULATOR Co., LTD., Marshgate Lane, Stratford, London, E.15, for a battery of 64 "JTPL" type cells, on behalf of the King of Hejaz.

MESSRS. EVANS AND WHEELER, electrical engineers, of 77, Market Street, and 22, Argyle Street, Birkenhead, have dissolved partnership. Mr. Stuart Evans will continue the business and Mr. Gordon Wheeler retires.

Of the exhibitors at the Printing Exhibition, which opens at Olympia, London, on April 11th, seventeen include examples of Brookhirst switchgear on their stands. BROOKHIRST SWITCHGEAR, LTD., Northgate Works, Chester, will themselves be showing on Stand 2, Section V.

The buyer for a firm with a chain of shops throughout London and the provinces, is desirous of getting in touch with makers of electrical scrubbing appliances small enough to be used in a shop. The editor will be pleased to pass on the names of firms interested.

The MARCONIPHONE Co., LTD., 210-212, Tottenham Court Road, London, W.1, announces that, in addition to the lectures entitled "The Screen Grid Valve" and "Valves and Circuits for A.C. Mains," there is now a third on "Public Address Amplification," illustrated by approximately twenty slides.

A repeat order for "Kathanode" traction batteries has been received by the D.P. BATTERY Co., LTD., Bakewell, from Brisbane. The order was placed through the company's Australian agents, T. K. STEANES AND SON, and is for batteries for use on road-craft trucks. The British Post Office authorities are now carrying out experiments with seven 15 cwt. "Victor" vans in London, and one 30 cwt. and two 25 cwt. "Electromobile" vans in Leeds, these have also been fitted with "Kathanode" traction batteries.

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BUSINESS OPENINGS.

Latest Particulars of Electrical Engineering and Wiring Installation Contracts for which Tenders are being Invited at Home and Abroad.

WE give below the latest particulars of contracts for which tenders are invited. The closing date is given, when available.

DAVENTRY GUARDIANS.—Electrical installation at Institution. Particulars from the Clerk.

WEST SUSSEX COUNTY MENTAL HOSPITAL, March 22nd.—Twelve months' supply of electric lighting sundries. Forms of tender, etc., from the Clerk and Steward, at the Hospital, Graylingwell, Chichester.

EAST HAM CORPORATION, March 23rd.—Supply of about 5 750 yards of 0·075 in., six-core, split-conductor, paper insulated, lead covered and double steel wire armoured 6 600 V (alternatively 11 000 V) cable, to B.E.S.A. specification.

Annual Stores Contracts.

HARROGATE CORPORATION, March 23rd.—Twelve months' supply of cables, joint boxes, joint box compound, service meters, service cut-outs, and transformers. Specifications, etc., from Mr. N. McLean, borough electrical engineer, 33, Swan Road, Harrogate.

HARROGATE CORPORATION, March 23rd.—One year's supply of meter boards, etc. Forms of tender from the Borough Electrical Engineer.

NEATH RURAL DISTRICT COUNCIL, March 23rd.—Supply of sundries in connection with Dulais Valley electric lighting scheme. Form of tender, etc., from Mr. D. M. Davies, Council Offices, Orchard Street, Neath.

BETHNAL GREEN (LONDON) BOROUGH COUNCIL, March 25th.—Electric lighting installation in seven blocks of tenement buildings. Specification, etc., from Mr. David J. Keep. town clerk, Town Hall, Cambridge Road, E.2 ; deposit £2 2s.

EDINBURGH CORPORATION, March 25th.—Supply of materials to the electricity department for 12 months, including cables, conduits, fuses and fuse boards, electrical material, electricity meters, meter boards, etc. Specification from the Engineer and Manager, Dewar Place Edinburgh.

FARNWORTH URBAN DISTRICT COUNCIL, March 25th.—Supply of l.t. cables. Specifications, etc., from Mr. A. J. Hutchinson, Electricity Dept., Albert Road, Farnworth, Lancs.

GLOUCESTER CORPORATION, March 25th.—Supply and erection of two 1 000 kW motor generators, for conversion of 11 000 V 50 cycle a.c. to 460/500 V d.c. Specification, etc., from the City Electrical Engineer, Commercial Road, Gloucester.

ILFORD CORPORATION, March 25th.—Supply of paper insulated cables. Specification, etc., from the Borough Electrical Engineer, Electricity Works, Ley Street, Ilford.

KNOTTINGLEY URBAN DISTRICT COUNCIL, March 25th.—Electric light wiring of 48 proposed houses in Weeland Road and Womersley Road, Knottingley. Specifications, etc., from the Surveyor, Town Hall, Knottingley.

MANCHESTER CORPORATION, March 25th.—Heavy a.c. equipment, cables and lighting, at Hyde Road Tramway Car Works extensions. Specification, etc., from the City Architect, Town Hall, Manchester ; deposit £1 1s.

STIRLING CORPORATION, March 25th.—Electrical work in connection with the erection of sixteen houses at Burnside Street, Stirling. Specification (No. 8) from the Burgh Engineer ; deposit £1.

BETHNAL GREEN (LONDON) GUARDIANS, March 26th.—Installation of electric fans in parts of Institution, Waterloo Road, E.2, and of Hospital, Cambridge Road, E.2. Specifications, etc., from the Clerk, Administrative Offices, Bishop's Road, Bethnal Green, E.2. ; deposit £1.

ISLINGTON (LONDON) BOROUGH COUNCIL, March 26th.—Supply of new lead battery, for Edison refuse collecting vehicle. Further information from the Cleansing Department, Liverpool Road, N.1.

BLACKPOOL CORPORATION, March 27th.—Two electrically-driven sewage pumps. Specification, etc., from the Borough Engineer.

OLDHAM CORPORATION, March 27th.—Electric light installation in 200 houses on Limeside housing estate. Specifications from the Borough Engineer.

LEEDS CORPORATION, March 28th.—Supply and fixing of Ruston and Hornsby crude oil engine, and re-fixing, on a fresh site, of remainder of electric lighting plant and machinery driven thereby, at Gateforth Sanatorium. Specification from the Medical Officer of Health, 12, Market Buildings, Vicar Lane, Leeds.

BROOK MOTORS, LTD., March 29th.—Electric lighting work in connection with extensions to Empress Works, St. Thomas's Road, Huddersfield. Plans, etc., can be seen at the offices of Mr. J. Arnley, 55, New Street, Huddersfield.

GLASGOW CORPORATION, March 29th.—Supply of poles, bases and cables, for street lighting. Specifications from the Inspector of Lighting, 20, Trongate, Glasgow.

RHONDDA URBAN DISTRICT COUNCIL, March 30th.—Supply of house service, a.c., ordinary and prepayment meters, cable joint boxes, compound, cut-outs, etc., for one year. Specifications, etc., from the Electrical Engineer, Electricity Works Porth, Glam.

ROSSLYNLEE ASYLUM, March 30th.—Six months' supply of electrical fittings, etc. Forms of tender from Mr. C. L. Addison-Smith, 19, Heriot Row, Edinburgh.

MANCHESTER CORPORATION, April 3rd.—Supply and placing in position at Oldham Road " B " sub-station of one 8 000 kVA forced air-cooled transformer, 32 000/6 600 V, three-phase, 50-period. Specification (No. 232) and form of tender from Mr. H. C. Lamb, Electricity Department, Town Hall, Manchester ; deposit £1 1s.

WEST MIDLANDS JOINT ELECTRICITY AUTHORITY, April 5th.—Supply and erection of three single-phase, 4 000 kVA transformers, to form a 12 000 kVA three-phase bank, at the Authority's West Bromwich generating station. Specification, etc., from Mr. E. F. Hetherington, chief engineer and manager, Phœnix Buildings, Dudley Road, Wolverhampton ; deposit £2 2s.

GREAT WESTERN RAILWAY, April 9th.—Supply of electrical wires and cables (list 20), telegraph ironwork (list 21), and wire-iron and steel for telegraph work, etc. (list 28). Forms of tender can be obtained from the Stores Superintendent, Swindon.

CENTRAL ELECTRICITY BOARD, April 15th.—Supply and erection of 33 000 V overhead transmission lines, in connection with the North-West England and North Wales Electricity Scheme. Specification (No. N.W.E.-S.L.2) from Mr. R. H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2. ; deposit £2 2s.

WEST RIDING EDUCATION COMMITTEE, April 17th.—Electric light installation at Edlinton New Middle and Elementary Schools and caretaker's house. Specifications, etc., until April 10th, from the Education Officer, County Hall, Wakefield.

CENTRAL ELECTRICITY BOARD, April 22nd.—Supply and erection of 33 000 V and lower voltage transformers. Specification (No. N.W.E.-S.T.2) and form of tender from Mr. Richard H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2 ; deposit, £2 2s.

CENTRAL ELECTRICITY BOARD, April 29th.—Supply and erection of electricity meters, in connection with the Central Scotland Electricity Scheme. Specification (No. CS-SS 14) and form of tender from Mr. Richard H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2 ; deposit £2 2s.

Overseas.

UNLESS otherwise stated, particulars of overseas contracts are to be had from the Department of Overseas Trade (Room 52), 35, Old Queen Street, Westminster, London, S.W.1. *Note.—An asterisk denotes that local representation is, in practice, essential.*

ANTWERP MUNICIPALITY, March 22nd.—Supply of electric cable and accessories. (Reference B.X. 5 124.)

INDIAN STORES DEPARTMENT, NEW DELHI, March 26th.—Supply of oil engine generator set (order No. N./9 439). (Reference B.X. 5 157.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, March 26th.—Switchboard cords. (Reference B.X. 5 067.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, March 26th.—Supply of telephones and dials (schedule C. 401). (Reference B.X. 5 023.)

SOCIETE NATIONALE DES CHEMINS DE FER VICINAUX, BRUSSELS, March 27th.—Supply of tramcars and trailers. (Reference A.X. 7 639.)

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EGYPTIAN MINISTRY OF THE INTERIOR, March 27th.—Supply and installation of electric lighting system, for the town of Fashn. (Reference B.X. 5 037.)

PORT ELIZABETH MUNICIPALITY, March 28th.—Disconnecting boxes, oil and link switches, trifurcating boxes and electricity meters. (Reference B.X. 5 146.)

PORT ELIZABETH MUNICIPALITY, March 28th.—Supply of 33 000 V cable (specification No. 18). (Reference B.X. 5 147.)

PORT ELIZABETH MUNICIPALITY, March 28th.—Supply of transformers. (Reference B.X. 5 148.)

SOUTH AFRICAN POSTS AND TELEGRAPHS, March 28th.—Supply of telephone switchboard boards. (Tender No. 148), (Reference B.X. 5 048.)

DUBLIN BOROUGH COMMISSIONERS, March 29th.—Installation of motors, starters, starting switches, etc., at City Abattoir. Specifications from Mr. F. McArdle, architect, 29, Rosemary Street, Belfast; deposit £3 3s.

KAILAN MINING ADMINISTRATION, March 30th.—Supply and erection at Shanghai of two 300 kW turbo-generators. (Reference B.X. 5 714.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, April 2nd.—Supply of jumper rings and terminal strips (schedule C 405). (Reference B.X. 5 066.)

INDIAN STORES DEPARTMENT, April 3rd.—Supply of paper insulated cables, for 660 V and 6 600 V, respectively, with joint boxes and joint compound (order No. N. 9 530). (Reference B.X. 5 164.)

INDIAN STORES DEPARTMENT, April 3rd.—Supply of 30 kW steam engine driven generator set (order No. N. 9 538). (Reference B.X. 5 167.)

ARGENTINE MINISTRY OF PUBLIC WORKS, April 4th.—Supply of Diesel electric Titan crane. (Reference A.X. 7 583.)

VICTORIAN RAILWAY COMMISSION, April 5th.—Supply of rectifiers and storage batteries, for power signalling purposes (contract No. 42 549). (Reference B.X. 5 166.)

VICTORIAN ELECTRICITY COMMISSION, April 8th.—Galvanised steel transmission line towers (specification 29/13.). (Reference A.X. 7 401.)

VICTORIAN ELECTRICITY COMMISSION, April 8th.—Supply of 22 000 V transformers (specification No. 29/17). (Reference B.X. 5 101.)

DUBLIN BOROUGH COMMISSIONERS, April 9th.—Supply and erection of electrically driven pumping plant on site adjacent to service reservoir at Stillorgan, co. Dublin. Specification, etc., from the City Treasurer; deposit £1.

NEW ZEALAND PUBLIC WORKS DEPARTMENT, April 9th.—Supply of induction voltage regulators, for Lake Coleridge scheme (section 215). (Reference B.X. 5 018.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, April 15th.—Conductor cords (No. P. and T., 151/1 319). (Reference B.X. 5 098.)

INDIAN STORES DEPARTMENT, April 16th.—Supply and erection of one 5-ton overhead electric three-motor gantry crane (order No. N. 9 536.) (Reference A.X. 7 652.)

INDIAN STORES DEPARTMENT, April 16th.—Supply and erection of one 5-ton electric telpher (mono rail), with track (order No. N. 9 537). Reference A.X. 7 653.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, April 17th.—Supply of copper earthplates (specification 133). (Reference A.X. 7 556.)

UMTALI MUNICIPALITY, April 18th.—Supply of line sundries, switchgear and transformers, in connection with extensions of electricity undertaking. (Reference B.X. 5 142.)

UMTALI MUNICIPALITY, April 18th.—Supply of 1 000 kW turbo-alternators, spray cooling plant, switchgear and crane (contract B). (Reference B.X. 5 145.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, April 25th.—Supply of three electrically-driven wheel lathes (tender No. 1 410). (Reference A.X. 7 621.)

VICTORIAN ELECTRICITY COMMISSION, April 29th.—Supply of two or three steam turbo generator sets, with condensers, etc., for Yallourn power station extension (specification 29/7). (Reference B.X. 5 062.)

VICTORIAN ELECTRICITY COMMISSION, April 29th.—Supply of two swing hammer mills with electric motors, for brown coal (specification 29/9). (Reference A.X. 7 434.)

EGYPTIAN MINISTRY OF PUBLIC WORKS, May 15th.—Supply and erection at Government Printing Office, Cairo, of 120 kW d.c. Diesel electric generating set, with foundations, artesian well, electrically-driven water cooling pump, etc. Forms of tender, etc. (10s. 6d.), from Chief Inspecting Engineer, 41, Tothill Street, London, S.W.1.

VICTORIAN RAILWAY COMMISSION, May 15th.—Supply of one geared three phase electric winding engine (contract No. C.M. 778). (Reference A.X. 760.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, May 16th.—Supply and installation of electric signalling apparatus at Johannesburg. (Reference B.X. 5 165.)

TANGANYIKA GOVERNMENT, June 1st.—Concession for utilisation of Pangani River Falls for the development of electric power. Copies of the draft concession may be obtained from the Crown Agents for the Colonies, 4, Millbank, London, S.W.1.

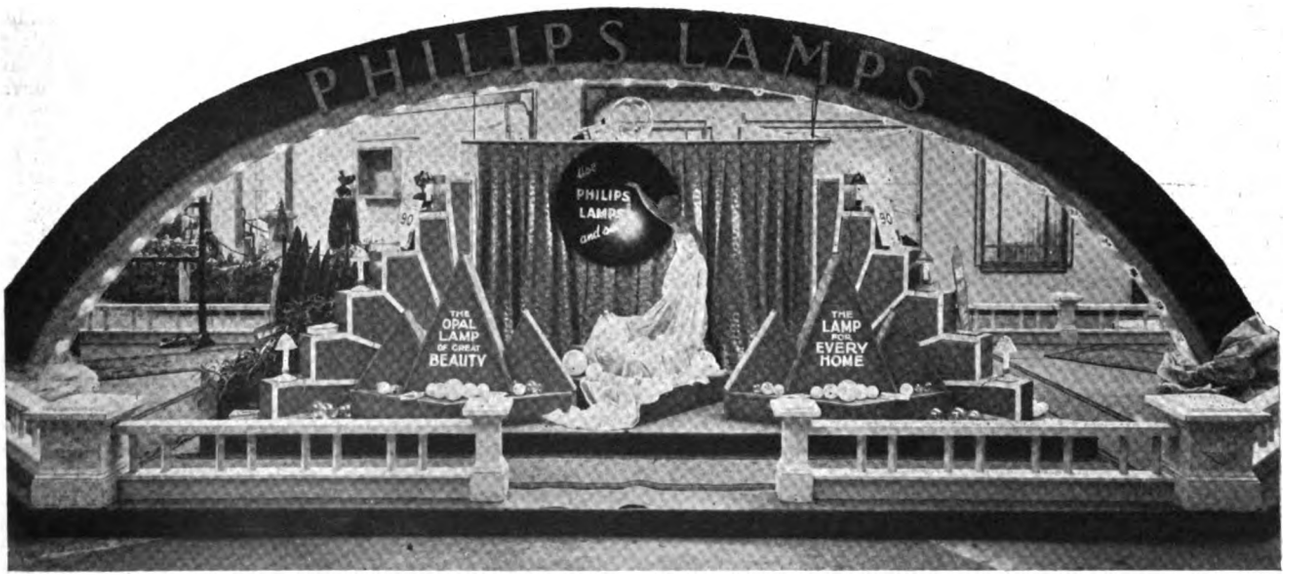
STATE ELECTRICITY WORKS, MONTEVIDEO, July 8th.—Construction and equipment of 50 000 kW power station.

Tenders Accepted.

CORNFORTH PARISH COUNCIL.—Cleveland and Durham County Electric Power Co., public electric lighting.

ELLAND URBAN DISTRICT COUNCIL.—H. C. Stringer, electrical and other works in 45 scullery houses.

SOUTHEND CORPORATION.—Jackson and Co., electric lighting installation at Intermediate School, £497.



THE stand of Philips Lamps, Ltd., at the Ideal Home Exhibition at Olympia, London. The exhibition, which contains many items of electrical interest, concludes to-morrow, Saturday.

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HALIFAX CORPORATION.—H. Brennand, electricians' work in six lock-up shops in Ovenden Road, Halifax.

PORTSMOUTH CORPORATION.—W. J. Lenton, electric light installation at Milton Cemetery lodge, £46 5s. 9d.

EASTBOURNE CORPORATION.—Braine and Parris, wiring under assisted wiring scheme, 16s. 6d. per point.

CHELTENHAM CORPORATION.—Sharpe and Fisher, Ltd. supply of electric light fittings. (Recommended).

POPLAR (LONDON) BOROUGH COUNCIL.—Green Economiser Co., renewal of economiser plant, £1 086. (Recommended.)

BRIDLINGTON.—W. Carr, electricians' and plumbers' work in new residence on Sands Green estate, for Mrs. J. G. Gant.

LIVERPOOL CORPORATION.—C. E. Price, electric lighting installation at Old Swan washhouse, £59. (Recommended.)

Small House Lighting.

EASTBOURNE CORPORATION.—Braine and Parris, electric lighting installation in 250 small houses, 16s. 6d. per point.

SEAHAM HARBOUR URBAN DISTRICT COUNCIL.—Harrison Bros., wiring 40 houses on Carr House estate, £188 6s. 10d.

CLECKHEATON CO-OPERATIVE SOCIETY.—F. W. Birkett and Sons, electrical work for new business premises in Cheapside.

OLDBURY EDUCATION COMMITTEE.—H. Roberts, electrical installation at Bristnall Hall Lane Elementary School, £225.

BOLTON CORPORATION.—Forest City Electric Co., Ltd., installation of automatic traffic signals at Wheatsheaf corner.

CHELTENHAM EDUCATION COMMITTEE.—W. H. Tandy, electric light installation at the Dunalley Street School, £54.

CARLISLE CORPORATION.—A. G. Bullen and Co. and W. Batey and Sons, electric light installations in Council houses.

OFFICE PREMISES, ST. SWITHIN'S SQUARE, LINCOLN.—Kirk Wilson, Ltd., complete electric lighting and heating installation.

PORTADOWN URBAN DISTRICT COUNCIL.—Portadown Electric Co., Ltd., electric light installation at Central Market, £144.

WATFORD GUARDIANS.—Ellis and Ward, Ltd., installing electric light installation at casual, mental, and infirm wards, £568.

OLDHAM EDUCATION COMMITTEE.—J. P. Hall, Ltd., two rotary converters, for electricity laboratory of Technical College.

YORK EDUCATION COMMITTEE.—Corporation Electricity Committee, electric light installation at technical institute, £490 5s.

FARNBOROUGH URBAN DISTRICT COUNCIL.—A. E. G. Electric Co., Ltd., Hogan and Wardrop and C. C. Garrard, supply of l.t. cables.

EARBY URBAN DISTRICT COUNCIL.—A. Dodgson and Son, electric wiring of Council offices and adjoining house, £69 15s. 6d.

GUILDFORD CORPORATION.—Craigpark Cable Co., Ltd., supply of all-lead, covered, vulcanised indiarubber and flexible cord cables.

WEYMOUTH CORPORATION.—Worthington Simpson, Ltd., materials for new vertical spindle motor at Radipole pump house, £158.

GLASGOW CORPORATION.—Fullerton, Hodgart and Barclay, Ltd., supply of ten cable groove rings for subway power station, £418.

WORCESTER CORPORATION.—Abell and Smith re-wiring market hall and Butcher's market and providing electric fittings, £120.

ERITH U.D.C.—R. W. Downer, wiring baths for electric light, £53 10s., plus £3 5s. for wiring and connecting four special lamps.

AMPTHILL GUARDIANS.—Bedfordshire Electrical Installation Co., installation of electric heating apparatus in board-room and offices, £72.

METROPOLITAN ASYLUMS BOARD.—H. Lewis and Co., electric light installation at Southwark casual ward, £105. (Recommended.)

MAIDENHEAD CORPORATION.—Hackbridge Electric Construction Co., Ltd., two 100 kVA transformers, £122 each. (Recommended.)

GLASGOW CORPORATION.—Haddow and Co., Ltd., electrical installation at Shettleston and Tollcross baths, £970 15s. 2d. (Recommended.)

EALING CORPORATION.—R. E. Smart and Co., supply and erection of electrical sewage pumping machinery at Northern Sewage Works, £440.

BINGLEY URBAN DISTRICT COUNCIL.—E. Hey, electricians' work in connection with erection of three blocks of eight houses at Cottingley.

FIFE EDUCATION COMMITTEE.—Soave and Littlejohn, electricians' work in connection with additions to St. Marie's R.C. School, Kirkcaldy, £25.

NEWBURY CORPORATION.—Hathorn, Davey and Co., Ltd., 135 B.H.P. electric motor, with 10 in. horizontal pump, for drainage pumping plant, £899 5s.

GLASGOW CORPORATION.—A. and P. Steven, Ltd., provision of passenger lift at Glasgow Cross buildings, instead of recommended tender of Waygood-Otis, Ltd.

SUNDERLAND CORPORATION.—Forest City Electric Co., Ltd., and Barber and Colman, Ltd., installation of automatic traffic signals at various points, £320 (estimated).

RAMSGATE CORPORATION.—J. Carman, cable and electrical equipment, for use by the Sands and Entertainments Committee, £132 13s. 1d.; electric lamps, £74 12s. 2d.

GRAVESEND CORPORATION.—British Thomson-Houston Co., Ltd., supply of switchgear, £233 13s.; Bruce Peebles and Co., Ltd., supply of transformer, £136. (Both recommended.)

METROPOLITAN WATER BOARD.—W. T. Henley's Telegraph Works Co., Ltd., supply of 750 yards of h.d. bare copper wire and 500 yards of h.d. double braided copper wire, £90 9s. 1d., less 2½%.

SHOREDITCH (LONDON) BOROUGH COUNCIL.—Hewittic Electric Co., Ltd., supply of mercury arc rectifier automatic converting equipment, at Evelyn Street sub-station, £9 643. (Recommended.)

NORTHAMPTON CORPORATION.—Northampton Electric Light and Power Co., Ltd., supply of current for lighting two traffic control signal installations for 24 hours daily, £15 4s. 2d. per control per annum.

WESTMINSTER GUARDIANS.—Bellis and Morcom, Ltd., installation of generating plant at St. Stephen's Hospital, £1 347; General Electric Co., Ltd., alteration of existing switchboards, £171.

ESSEX COUNTY COUNCIL.—Christy Bros. and Co., Ltd., work in connection with electrical installation at new sanatorium, Black Notley, £1 879 1s.; E. C. Porter, supply of 10 H.P. electric motor, £55.

STAINES GUARDIANS.—Cooksey and Son, wiring, etc., in connection with lighting of portion of Infirmary, and also Girls' Home, £261; Staines and Egham Electricity Co., transformer, cable, etc., £67.

PLYMOUTH CORPORATION.—Chloride Electrical Storage Co., Ltd., supply of two batteries for electric vehicles, £212 5s. 6d. each; Harland Engineering Co., provision of feed pump at Prince Rock power station, £291 7s.

HULL CORPORATION.—Automatic Telephone Manufacturing Co., Ltd., table telephones and bell sets, £402 3s. 9d.; F. Smith and Co., bronze wire, £330 10s. 6d.; W. F. Dennis and Co., cable, £124 15s.; and inside wire, £96 8s. 3d. (All recommended.)

KETTERING URBAN DISTRICT COUNCIL.—Ferranti, Ltd., 50 kVA transformer, £51; Brush Electrical Engineering Co., Ltd., 250 kVA transformer, £170; Crompton Parkinson, Ltd., 350 kVA transformer, £185; Union Cable Co., Ltd., h.t. and l.t. cables, £1 194.

DURHAM COUNTY EDUCATION COMMITTEE.—Simm and Richardson, electric light installation at Usworth Colliery School, £289 10s.; and electric light installation at Seaham Harbour Council School, £167; Falconar, Cross and Co., Ltd., installation at Brandon Colliery School, £370.

BIRKENHEAD CORPORATION.—W. T. Glover and Co., Ltd., 2 000 yards, 0·15 sq. in. l.t. 4-core cable, £1 240; and 1 000 yards 0·0225 sq. in. l.t. 4-core cable, £194; Hackbridge Cable Co., Ltd., 1 000 yards 0·2 sq. in. l.t. 4-core cable, £774; and 4 000 yards 0·1 sq. in. l.t. 4-core cable, £1 940.

Lighting of Baths and Washhouses.

LIVERPOOL CORPORATION.—Lambton and Hobster, alterations to pendant lights at Queen's Drive, Lister Drive, Picton Road and Garston baths: R. Jones and Co., electric light installation at Old Swan washhouse, £49, and new heated frame at Bowring Park, £297. (All recommended.)

WESTMINSTER CITY COUNCIL.—Coleby and Co., electric light installation at Buckingham Palace Road baths, £105. (Recommended.) Also tendered:—Buchanan and Curwen, £119; Gaillard, Robinson and Co., £122; W. J. Furse and Co., Ltd., £144; Speedy and Eynon, £145; H. E. Keen and Co., Ltd., £159.

HULL CORPORATION.—A. Shaw and Sons, electric lighting installation at Francis Askew school extension, £999 18s.; Schall and Son, Ltd., X-ray apparatus, £617 6s. 8d.; and apparatus for light treatment and electrical therapy, £231 19s. 4d.; Spencer Heath and George, Ltd., apparatus for orthopædic treatment, at East Hull clinic, £34 10s. 3d.

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WORK IN PROSPECT.

ANDOVER.—School (120 places), for Hants Education Committee. Particulars from the county architect, Mr. A. L. Roberts, The Castle, Winchester.

BEESTON.—Offices and factories for Boots, Ltd., Nottingham.

BOURNE.—Houses (32), for the Urban Council. Particulars from the contractor, Mr. T. A. Scotney.

CHESTERFIELD.—School, Boythorpe, for the Borough Education Committee. Particulars from the Education Architect.

DORCHESTER.—Houses (12), for the Rural Council. Particulars from the contractors, W. J. Cooper and Son, Bridport.

HATFIELD.—Houses (12), for the Rural Council. Particulars from the contractors, Shadbolt and Nash.

KINGSTON-ON-THAMES.—Cinema theatre, Bridge Approach, for Mr. H. E. Cohen.—Rebuilding Row Barge Inn for Hodgson's Kingston Brewery Co.

LEEDS.—Physics Department, for the Council of Leeds University. Particulars from the architects, Lanchester, Lucas and Lodge, 19, Bedford Square, London, W.C.

LEYTON.—Senior school (400 places), for the Borough Education Committee. Particulars from the architect, Mr. John H. Jacques, 61, West Ham Lane, Stratford, E.

NORTHAMPTON.—Extensions, bus garage, for the Town Council. Particulars from the borough engineer, Mr. Alfred Fidler.

ONGAR.—Housing scheme (44), for the Rural Council. Particulars from the Surveyor.

OXFORD.—Parish hall, to cost £3 500, for St. Michael's Parish. Particulars from the Incumbent.

SOUTHWICK (SUSSEX).—Housing scheme to cost £18 620, for the Urban Council. Particulars from the Surveyor.

STALYBRIDGE.—Extensions, West Hill and Central schools, to cost £14 000, for the Borough Education Committee. Particulars from the Clerk.

STOCKPORT.—Extensions, Stepping Hill Hospital, to cost £10 000, for the Board of Guardians. Particulars from the architects, Peirce and Son.

TORQUAY.—Hotel and shops, Victoria Parade, for A. Haarer and Son.—Extensions, Palm Court Hotel, Abbey Crescent, including 86 bedrooms, restaurant, etc., for Mr. Purkis.—School to cost £14 798, Barton, for the Borough Education Committee. Particulars from the contractor, Mr. H. Cruse.

INDIVIDUALIST LUNCHEON.

Important Pronouncement on Two and Three Party Political Systems.

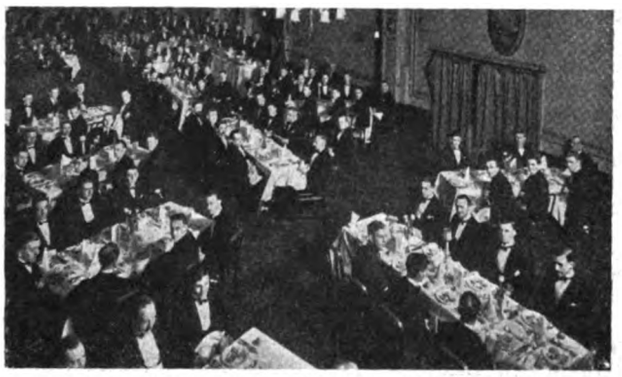
PRESIDING at the 23rd Individualist Bookshop luncheon at the Hotel Cecil, London, on Tuesday, Lord Hugh Cecil, M.P., said that he was an individualist because the individual was the unity of all moral and intellectual decision, and as such, he wanted to keep the State within the limits that were necessary within the social life of the community.

Sir Ernest Benn, the chief speaker, said that individualists were outside party politics, and were not likely to be enthusiastic members of any political party. They formed a considerable part of that pendulum that was needed to keep any party from swinging to extremes. They could be proud of the fact that during the three or four years of their existence they had exercised considerable influence on political thought. The country was faced with the question of the safety of democracy. He was a convinced democrat. He was alarmed to notice that not only in Italy but in other countries there was a definite challenge to the principle of democracy and all that it meant. Another question was the maintenance of the two party system. Thirty million voters were, he thought, capable of thinking intelligently in terms of two dimensions, but were not yet sufficiently advanced in political education to think in three dimensions. British government and British public life were based on the two party idea. The confidence and stability on which commerce and industry depended was only possible in a political situation governed by the two party system. Confidence and stability were the only real cures for unemployment. The work of the business man was to form his own judgment of the political prospects of the moment, and to proceed to act upon it. With two parties this was possible, but with a multi-political party such judgment was not easily formed.

Other speakers were Mr. Archibald Crawford, Sir Charles Marston, and Lord Lamington.

THE SOCIAL SIDE.

THE staff of the London Power Company met for dinner at the Connaught Rooms, London, on March 8th, the chairman of the company, Mr. W. F. Fladgate, presiding, supported by Mr. W. A. Pearman, general manager, and Dr. S. L. Pearce, engineer-in-chief. The attendance of over 200 comprised



Group taken at the sixth annual dinner of the Automatic Telephone Manufacturing Co., Ltd.

nearly the whole of the staff. After the loyal toast, the health of the chairman was proposed by Dr. Pearce, and in doing so he drew attention to the prominent part which Mr. Fladgate had taken in securing co-ordination for the electricity companies in London ever since his connection with the industry in 1890. Musical and comedy entertainment was provided.

The sixth annual staff dinner of the Automatic Telephone Manufacturing Co., Ltd., Strowger Works, Liverpool, was held on March 8th, in the Banqueting Hall of the Exchange Hotel. The attendance was the highest on record, some 170 members and guests being present. Sir Alexander Roger, chairman of the company, presided, and was supported by Mr. G. W. Moore, director and manager. The toast—"The Company"—proposed by Mr. C. Hitchen, was responded to by the chairman, whilst "Guests" were toasted by Mr. G. R. Maitland, Mr. E. A. Ward responding on behalf of the visitors. Other speakers during the evening were Mr. H. E. Powell-Jones, of the Telephone Development Association, and Mr. G. W. Moore.

I.E.E. SUMMER MEETING.

Preliminary Details of the Programme—Special Railway Concessions.

AT the invitation of the Société Française des Electriciens, the Summer Meeting of the Institution of Electrical Engineers this year will be held in France. A brief outline of the programme is to the effect that on June 11th the party will leave for Paris, lunching either at the Calais or Boulogne Maritime station or on the train between Calais (or Boulogne) and Paris. June 12th, 13th, 14th and 15th will be devoted to visits to various power stations, the wireless station at Sainte-Assise, the Carnot central automatic telephone exchange, etc., and excursions to Versailles, Malmaison, Chantilly and Sevres.

On the evening of Wednesday, June 12th, there will be a banquet (evening dress) given by the Société Française des Electriciens. On Sunday, June 16th, the party will leave Paris for Bordeaux, with a stop at Eguzon to inspect the dam and the hydro-electric station of the Paris-Orléans Railway. Lunch and dinner will be served on the train. On Monday, June 17th, members will leave Bordeaux for Pau, where in the evening they will be entertained at dinner (morning dress) by the South-Western Local Centre of the Société Française des Electriciens. Tuesday, June 18th, will be spent in visiting places of interest near Pau, including the Houra works and Eaux-Bonnes, the party proceeding to Lourdes in the afternoon. Excursions from Lourdes to works at Soulom and Gavarnie will be arranged for Wednesday, June 19th. On Thursday, June 20th, the party will leave Lourdes for Toulouse in the afternoon, spending Friday, June 21st, in an excursion to the old city of Carcassonne, returning to Toulouse in the evening. On Saturday, June 22nd, the party will leave Toulouse for Paris, arriving there about 10 p.m.

The approximate cost of the Paris portion of the meeting will be from £12 to £19 10s. per head (depending on class of hotel and route) and that of the whole trip (Paris and the Pyrenees) from £21 to £28 10s., which will include all transport, hotels and meals (except luncheons and dinners in Paris, and wines).

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ELECTRICITY SUPPLY.

Bedford Scheme for Rural Supplies—Swansea Assisted Wiring Scheme—Additional Lines between Preston and Blackpool—Improvement of Portsmouth Sea Front Lighting—Fulham's Meter Charges—Hire-Purchase Wiring at Portsmouth.

THE Electricity Commissioners have declined to authorise the borrowing of £23 000 by Porthcawl U.D.C.

Eston Electricity Committee is considering the question of extending electric lighting to Low Lackenby district.

Whitehaven T.C. has received sanction to a loan of £263 for new electricity mains for public lighting at Seacliffe.

The Twickenham and Teddington Electric Supply Co. is carrying out mains extensions in Park Road, Hampton Hill.

Omagh U.D.C. has decided to consult an expert with regard to a proposal to promote an electricity supply scheme for the town.

A scheme has been approved by Bedford T.C. for supplying electricity in rural areas, at an estimated outlay of £100 000. The project covers 31 parishes.

Swansea Electricity Committee is to make application to the Electricity Commissioners for sanction to borrow £2 000 for an assisted wiring scheme.

Weymouth Electricity Committee has obtained sanction from the R.D.C. to the erection of overhead lines to afford a supply of electricity to Overcombe.

Hackney (London) Borough Council is applying to London County Council for loans of £16 438 for mains and £6 965 for transformers and switchgear.

The Central Electricity Board has acceded to the request of Cockermouth R.D.C. to erect the transmission line between Threlkeld and Egremont on a route which avoids the Whinlatter Pass.

Winchester T.C. has decided to carry out cable extensions for improving the supply to the lower end of High Street and to St. Giles' Hill and surrounding district, at an estimated cost of £4 865.

Under the East Notts Electricity Special Order (1928) it is proposed to extend the Supply (as regards Basford rural district) to Burton Joyce, Calverton, Gotham, Lambley and Woodborough.

Llanfrechfa Lower Council takes exception to the South Wales Electric Power Co.'s stipulation of a minimum revenue of £500 as a condition of its undertaking to equip the district for electricity distribution.

Ealing Electricity Supply Committee is to erect two transformer stations at Queen Anne's Gardens and Kingsbridge Avenue; and the Metropolitan Electric Supply Co. is to erect a transformer in Tennyson Road.

Okehampton T.C. has refused an application made by Mr. W. G. Heath, of Plymouth, for the consent of the Council to a Special Order authorising him to supply electricity for public and private purposes within the borough.

A protest has been sent to the Ministry of Home Affairs against the proposal to provide Belleek Pottery with electric power from the river Erne, on the ground that the health of the town would be endangered if the water supply were cut off.

Rochford R.D.C. has decided to offer no objection to the scheme of the County of London Electric Supply Co., for the supply of electricity to Hockley, Hadleigh, Canewdon, Rayleigh, South Benfleet, Great Wakering, Thundersley, Rochford, and Eastwood.

Blackpool Corporation has received permission to borrow £13 000 for underground mains, £6 500 for overhead mains and £20 500 for transformers and switchgear, in connection with the installation of additional h.t. transmission lines from Preston to Blackpool.

Gravesend Electricity Committee is seeking sanction to borrow £3 165 for providing eight 200 kVA transformers, five kiosks and e.h.t. switchgear. Cables are to be extended between El Teb sub-station, Cross Lane distributor and the Echo section pillar, at a cost of £780.

In connection with the scheme to supply electricity to the outlying portions of the borough of Bridgwater and to Bridgwater rural district, the T.C. has consented to the erection of steel tower overhead lines by the Bridgwater and District Electric Supply and Traction Co.

It is understood that, on the suggestion of the district auditor, St. Pancras (London) B.C. has decided to insert a clause in contracts for coal supplies required for the electricity undertaking providing for variation of prices in accordance with any fluctuation in railway freightage rates during the periods of the contracts.

Lowestoft Electricity Committee recommends that application be made to the Electricity Commissioners for sanction to a loan of £14 500 for main and distribution cables to supply energy to premises in the parish of Kessingland. The Committee is to apply to the Commissioners for sanction to a loan of £5 000 for the purchase of meters.

Chelmsford Electricity Committee has discussed the question of the present charges for electricity, and the future development and improvement of the supply in the borough. The Committee has instructed the Town Clerk to submit a general report upon the position, and upon the question of the desirability of acquisition of the electricity undertaking by the council.

Portsmouth Electricity Committee has considered the question of improving the public lighting along the sea front, and the Engineer and Manager has submitted a drawing showing an improved fitting, suitable for the present lamp standards, the cost of installation of which for the whole of the sea front lights would be £1000. The Committee has adopted the scheme.

Llantarnam Council is awaiting the official consent of the Electricity Commissioners before going on with the scheme for private and public lighting in the district. The Council will apply to the Commissioners for sanction to borrow £17 500 for carrying on the scheme, with £650 for public lighting. Tenders amounting to £12 630 for carrying out the work have been provisionally accepted.

Hackney (London) Electricity Committee recommends that Messrs. May and Hawes be appointed consulting engineers in connection with the proposed extension of the generating plant at the generating station, under the South-East England Electricity Scheme, at a fee of 1% upon the capital expenditure on plant, subject to a maximum of £3 500, such fee to include travelling and other expenses.

A scheme has been adopted by Lewes T.C. for extending the public electric lighting, under a ten years' contract with the Lewes and District Electric Supply Co., Ltd. Under the new arrangement the consumption will be increased from 64 000 to approximately 125 000 kWh per annum, and the company will bear the whole capital cost, with the maintenance and renewal of lamps and fittings.

It is estimated that the maximum demand of the supply to Worthing, which it is proposed should be provided by Brighton and supplied through the medium of the Central Electricity Board, will rise from 700 kW in 1929-30 to 1 900 kW in 1932-33, and that the demand of Haywards Heath (to be supplied in a similar way) is estimated at 100 kW. Mr. John Christie, borough electrical engineer of Brighton, recommends that 2 000 kW should be inserted in the agreement with the Central Electricity Board, and the Town Clerk has been instructed to complete the agreement with the Board on this basis.

Portsmouth Electricity Committee recommends that wiring of dwelling-houses in the city, upon the hire-purchase principle, be undertaken by the Corporation upon the following conditions:—The cost to be refunded to the Corporation by the consumer by a payment of 10% of such cost upon his signing the agreement, and payment of the remainder by equal quarterly instalments over a period of five years, with interest at 6% per annum upon the amount outstanding; the scheme to be limited to private houses in the city, and within 60 feet of existing mains, and not to apply to houses in the course of erection; the first lamp and shade to be provided by the Corporation for each point wired.

Fulham (London) Electricity Committee reports that it has been represented that the payment of meter rent by small consumers of electricity for power purposes entails a hardship upon them. A total discontinuance of the rent for power meters would involve a loss to the undertaking of about £1 150 per annum, and the Committee does not consider that it would be advisable to discontinue meter charges entirely. It recommends that the present charge of 2s. 6d. per quarter for meter rent for power purposes be discontinued where the minimum quarterly consumption is not less than 60 kWh, and that where the quarterly consumption falls short of 60 kWh a charge be made equivalent to the difference between the value of the current consumed and the charge for 60 kWh.

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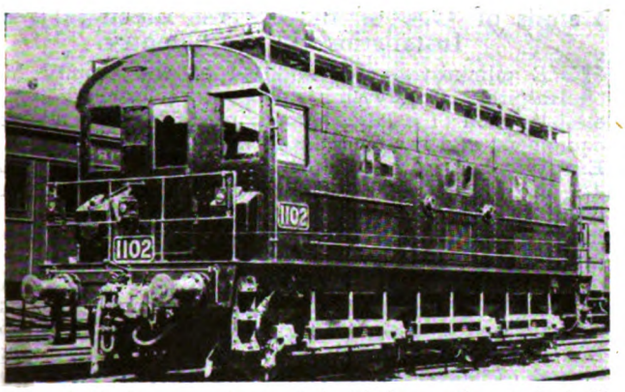
ELECTRICAL NEWS OF THE WEEK IN PICTURES.

Among the exhibits at the recent exhibition of modern industrial art, in New York, is the "fountain" illustrated above. The design is suggestive of a garden statue, and, by means of interrupted lighting of the tubes, the effect of a playing fountain is produced.

A French electrical device which, when fitted to a railway line will, it is claimed, indicate, within reasonable limits, the distance of an approaching or receding train.

Mr. Antony Simon, whose death on March 8th is referred to on page 353. He was for many years manager of Continental Sales for the Metropolitan-Vickers Electrical Co., Ltd. He was also a director of several subsidiary companies operating on the Continent.



One of the seven new types of electric locomotives to be built by the Victorian Railways Department for goods and shunting purposes. The Victorian Railway Commissioners, convinced of the increased speed of electric loco's., have adopted them wherever possible.

The pier entrance of the new Bournemouth Pavilion, which was opened on Tuesday. It will be remembered that Bournemouth is the scene of this year's E.C.A. Conference, to be held from June 26th to 28th. A description of the Pavilion is given on page 354.

Group of members of the Electrical Association for Women, with Mrs. Wilfrid Ashley, president, in the centre, after inspecting the all-electric kitchen on the restaurant car attached to the "Flying Scotsman." The inspection was made at King's Cross (London) Station, and a very comprehensive demonstration was given by the chef.

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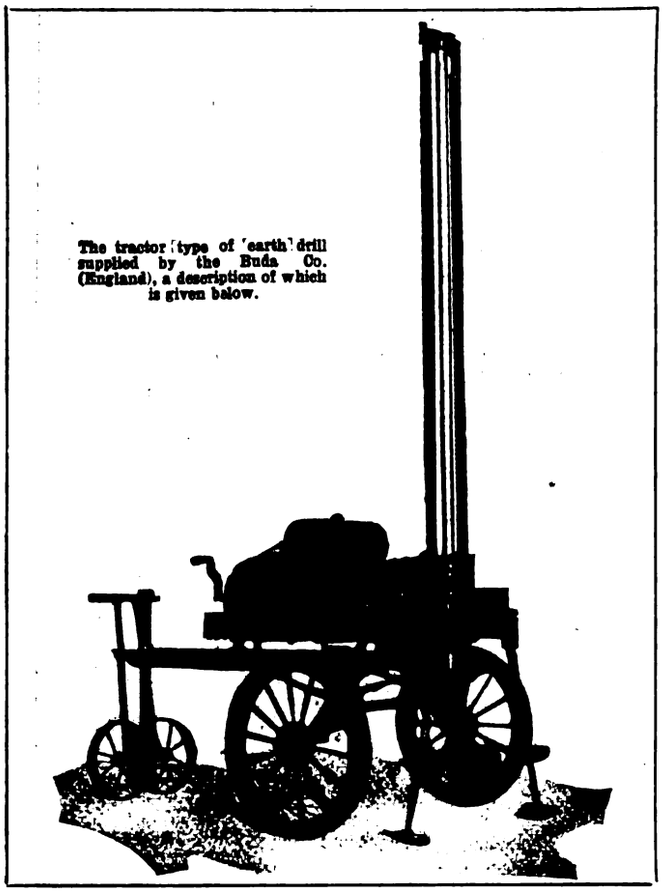
EARTH DRILLING.

Equipment for the Erection of Poles for Overhead Power Transmission.

THE Buda-Hubron earth drill by the Buda Co. (England), of 75, Evershot Road, London, N.4, is designed for digging holes for telegraph, telephone, power, and other poles to a depth of 10 feet or less with diameters of 13, 17, 19, 22, and 24 in. It is also adaptable for drilling blast holes and anchor holes, special equipments being supplied for these purposes.



The tractor type of 'earth' drill supplied by the Buda Co. (England), a description of which is given below.

It will dig 1½ in. diameter blast holes to depths of 15 ft., and 6 in. diameter anchor holes to 15 ft. The drills for holes for telegraph and power poles are formed of a single cast steel helix, polished on the top, and provided with a hinged shutter. Removable manganese steel cutters are provided for bolting on to the lower side of the helix. These cutters are of different types to take care of varying soil conditions, and, being separate from the helix, can be removed for re-sharpening and renewal. The helix is bolted to the bottom of the spindle, which, when engaged with the clutch, forces the helix down into the earth. The latter, dug up by the cutters, is forced up through a hinged shutter, so as to leave the portion being drilled clear of loose earth, thus permitting economy in power. When about 2 ft. of earth has collected above the helix, the drive clutch is disengaged and the drill raised to the surface by the engaging of the lifting clutch. The drive clutch is then again engaged, and the earth dispersed from the top of the helix, the hinged shutter and drill preventing any return of the earth into the hole. The drill will dig in clay, hard pan and shale, stones up to 4 in. diameter easily passing through the hinged shutter. The speed of drilling depends upon the character of the ground, but in heavy clay a 20 in. diameter hole can, we are advised, be drilled 6 ft. deep in three minutes, while on blast hole work in solid shale it will dig on an average 140 to 180 ft. per day.

The machine is supplied in three different styles, the trailer type is mounted on two wide steel tyred wheels 4 ft. in diameter, or 3 in. solid rubber tyred wheels can be furnished if preferred. The axles are mounted on roller bearings and being mounted on elliptic springs, the machine can be easily towed. It can be used for drilling holes on rough or uneven ground, as the tongue is adjustable and the desired angle can be secured by changing the position of the tongue post. The weight of the machine is approximately 1 850 lb., and due to this comparative lightness the machine is mounted on springs, which move upward when the drill strikes an obstruction. In addition, the cone friction clutch, connecting the engine to the main shaft, will slip when necessary. Hyatt roller bearings are used on the main drive shaft and all drive gears are enclosed and run in oil.

Another type of machine, supplied for mounting on a motor lorry, is much the same as the trailer type, but, instead of being mounted on wheels, is mounted on a sub-frame for bolting to the platform of the truck or lorry. This sub-frame is designed so that the drill and spindle may be tilted fore and aft to an angle of 25° and 12° to either side. A third type of machine comprises the earth drill equipment mounted on the front of a Fordson tractor on an extension frame, the equipment including a pole hoisting boom, boom winch, hoisting winch, and the necessary operating mechanism. The wheel base of this unit is 108 in., and its power is taken from the tractor engine by means of a belt. The tractor is equipped with special wheels which have rubber tyres with steel extensions, so that the machine can be used for both highway and cross-country work. In soft going, chains can be thrown round the wheels, which are of the open type. The winch supplied is of the worm type with reverse gear, so that power has to be used to lower the load. The winch will handle a two-ton load on a single line. The derrick is made up of jointed sections of heavy steel tubes, the standard being in two sections, each 14 ft. in length, though an additional 10 ft. section can be supplied if wanted. This derrick with extensions is capable of handling 75 ft. poles. It can also be used for loading poles and handling transformers and other equipment.

ELECTRICAL BAKING.

Details of One of the Largest Electrical Baking Installations in the Country.

THE administrative committee of the County Mental Hospital at Prestwich has adopted a scheme involving the electrification of a large amount of its bakery and kitchen equipment, and has placed with the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., a contract for the apparatus required. The installation will be one of the largest of its kind in the country, its service being to cater for patients and staff totalling, in all, about 1 200 people. The equipment to be supplied includes two electric baking ovens of a size to bake 400 lb. of bread each at a time. They will be of the Metrovick "Conveyor" type, in which the bread or confectionery to be baked is loaded on a number of trays which are carried round the oven by a motor-driven conveyor mechanism during the process of baking, so that the whole batch is evenly baked. The ovens will be equipped with an automatic temperature control device, so that on being switched on they are brought up to any desired temperature and maintained at that temperature without any attention, an arrangement which, besides being convenient, also saves spoilage which might be caused by over-heating. The installation will also include a kitchen range, three roasting ovens, a fish fryer, hot closets and carving tables, all of large size and electrically heated, and also a number of large steam-heated boiling and steaming pans and other kitchen utensils. These items will be supplied by MOORWOODS, LTD., of Sheffield, on a sub-contract.

Each of the baking ovens of this type has a rating of 50 kW, twelve elements being incorporated. Automatic and hand control is provided. Mounted on the inner framework is a chain conveyor of the type used in travelling ovens to which a number of baking trays are fixed permanently, and upon which the goods to be baked are placed either directly or on sheets. During baking, the conveyor is driven by a small electric motor, and travels slowly round the oven at such a speed that every article in the oven passes the door once each minute. The motor is mounted externally and started and stopped by a small switch mounted just below the oven door. The conveyor can be moved round by hand if desired.

NEW TYPE TURBO-ALTERNATOR.

We have received from METROPOLITAN-VICKERS ELECTRICAL CO., LTD., of Trafford Park, Manchester, a copy of leaflet 452/1 describing a new type of steam turbo-generator which, it is claimed, possesses many advantages for the ordinary industrial power requirements up to about 4 000 kW. It is further claimed that the initial costs of installing the plant are reduced, while economies and ease of operation of plants of these sizes are improved. A full description of the plant was given in THE ELECTRICIAN of October 12th, 1928.

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TRADE PUBLICATIONS.

A CATALOGUE of "Clix" products has been sent to us by LECTRO LINX, LTD., 254, Vauxhall Bridge Road, London, S.W.1.

List No. 23/29, dealing with electrical supplies, has been published by FORSE WHOLESALE, LTD., Traffic Street, Nottingham.

Folder E8, dealing with cooker control units, has been published by J. H. TUCKER AND CO., LTD., King's Road, Tyseley, Birmingham.

Two- and three-pin sockets and plugs are the subject of Folder A4, by J. H. TUCKER AND CO., LTD., King's Road, Tyseley, Birmingham.

List No. 48, by VENNER TIME SWITCHES, LTD., 45, Horseferry Road, London, S.W.1, deals with solar dials, their construction and use.

A special publication dealing with electric furnaces has been received from the ELECTRIC FURNACES CO., LTD., 17, Victoria Street, London, S.W.1.

"Elect" cooking and heating appliances are the subject of a special counter showcard issued by THE ELECTRIC HEATING CO., of George Street, Croydon.

PHILIPS LAMPS, LTD., 145, Charing Cross Road, London, W.C.2, have issued a new folder concerning the "Phililite" fittings described in our last issue.

List D.C./58 illustrates and describes the No. 46 table type cooking cabinet of the JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, London, S.W.1.

The 1929 edition of the booklet, "Renold Stock Chain Drives," has been received from HANS RENOLD, LTD., Burnage Works, Didsbury, Manchester.

The SAXONIA ELECTRICAL WIRE CO., LTD., Roan Works, Greenwich, S.E.10, has published a new reference and conversion table relative to wires and cables.

The PARSONS OIL ENGINE CO., LTD., Town Quay Works, Southampton, has issued catalogue No. 98, describing the company's 10/20 H.P. engine, a new product.

Leaflet L 4933, by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, is descriptive of "Geeko" lighting and starting accumulators.

Leaflet No. 200, describing electrically-driven air compressors and pumps, has been issued by ARNOLD GOODWIN AND SONS, LTD., Southwark Bridge, London, S.E.1.

A special window bill in connection with the type C.2 loud speaker has been issued by the BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, London, W.C.2.

A new edition of the Glassware catalogue has been released by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2. The reference is Section F (3).

The MIDLAND ELECTRIC MANUFACTURING CO., LTD., Barford Street, Birmingham, has issued a new leaflet devoted to the description of d.p. main switches and 2-way d.p. fuseboard units.

Catalogue Section No. 27-2, dealing with outdoor type, motor-operated induction regulators, has been sent to us by SWITCHGEAR AND COWANS, LTD., Elsinore Road, Old Trafford, Manchester.

The A.E.G. ELECTRIC CO., LTD., 131, Victoria Street, London, S.W.1, has published list X 1 105 E, dealing with domestic electric appliances; and list X 1 108 E, describing the company's electric fires.

The BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, London, W.C.2, has issued leaflet L.466, dealing with the company's electric freezing unit, and L.463, dealing with lighting fittings.

The BRITISH THOMSON-HOUSTON CO., LTD., has also published L.462, dealing with the company's new electric refrigerator, described in our issue of March 1st. L.465, giving sizes and prices, has been issued.

The REGENT LAMPSHADE CO., Imperial Works, 16, Brighton Terrace, London, S.W.9, has published a new catalogue illustrating and describing a newly introduced range of vellum shades coloured on both sides of the material.

Leaflet No. X220, dealing with totally enclosed ironclad industrial oil switches, types M.1, 650 V, and M.3, 650 and 3 000 V, has been published by J. G. STATTER AND CO., of Queen Anne Chambers, Westminster, London, S.W.1.

The A.C.E.C., 56, Victoria Street, London, S.W.1, has sent us a new publication, produced by the cable department, by way of showing in illustrated form the facilities available at the company's works. In order that the publication should be of the greatest possible use, the descriptions under each photograph are given in five languages.

WINDOW LIGHTING.

Interesting Scheme Introduced Into One of London's Popular Windows.

THE difficulties of colour lighting a shop window display are generally more manifest than the advantages, and although this is perhaps because a true appreciation of colour as an asset is not fully understood, there seem to be few

A window which has been fitted with a special lighting system for illuminating furniture displays.

installations which have been devised for satisfactory and easy working by the display manager. Not only should the system be flexible, but it should offer the simplest method of colour changing. It should make it possible to effect a change upon the same merchandise without the necessity of undressing or disturbing the window. Moreover, it should be understood that all lighting should be used to accentuate the colours or shapes of goods and should not be employed to produce false effects. With this object in view it is soon evident that a basis of white light—for good illumination—is necessary, and colours, although subsidiary, should be present in adequate strength.

The window of the new Drage extension in High Holborn, London, is arranged with such a system by the THOMAS J. DIGBY ILLUMINATING ENGINEERING CO., LTD., of 12, Gerrard Street, London, W.1, for the special illumination of furniture. The main lighting is derived from standard overhead battens and small floor lanterns equipped with stainless steel reflectors, and switched in sections. In passing it may be mentioned that although the foot candle power is high, actual experiment, for some time before the work was scheduled, prescribed the energy necessary to overcome the tremendous front reflections in the window. Masked behind the interior pelmets is a series of colour battens constructed for the most part in a novel manner. Light cast aluminium lamp housings are spaced at 18 in. intervals within a system of brass rails. Rolling on the rails is an arrangement of glass screens, four separate colours to each lantern, each section of batten having thin steel lines for remote control *behind* the window. The housings, although small, are capable of accommodating lamps ranging from 100 W to 500 W, and each has above the lamp a bell mouth communicating with a common ventilator exhaust system whereby the overheated air is drawn away immediately. The efficiency of this method is such that after prolonged burning it is still possible to place the hand comfortably on the lanterns.

WIRELESS RECEIVER DESIGNS.

We have received from FERRANTI, LTD., Hollinwood, Lancs, a number of wiring diagrams for the home constructor, the details of which are H.T. Supply Unit No. 1, for use on 200/250 V, 40/70 cycle mains, with a total output of 200 V, 100 mA; similar units with stated outputs of 200 V 80 mA, 160 V 50 mA and 200 V, 80 mA. Other wiring diagrams are for a two-valve set for local stations and 5 XX, and D920, which describes how to operate a "Melody Maker" receiver from a.c. mains by means of a Ferranti mains unit. A three-valve set for long-distance work is also published in diagrammatic form. The charts are free to the trade and public upon request.

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COMPANY NEWS.

Big Rise in Price of C.E.C. Shares—Northampton Company's Successful Year—London Electric Supply Corporation's Increased Revenue—New Petrol Electric 'Buses—Directors' Reports and Dividend Announcements.

THERE has been considerable buying of General Electric shares during the past few days, and as compared with a week ago the price quotation, at 63s. 9d., shows a rise of 8s. 9d. County of London Supply shares have also more than regained last week's drop, and are 1s. 6d. to the good at 53s. 6d. Westminster and Yorkshire Power shares have weakened. Underground Electric Rlys. ordinary shs. have regained 1s. Marconi International Marine shs. have been sold, and have dropped 5s. to below 64s.; Marconi's Wireless shs. are slightly better, and Eastern Telegraph stk. has recovered. Equipment shares have been variable.

Last Annl. Divd.	Description.	This Week.	Last Week.	1926 to 1928. Highest	Lowest
%	**Electricity Supply.**				
(*d*)	Brompton & Kensington Ord. ..	27/-	27/-	35/6	23/9
4	Central Elec. Sup. 4% Deb. ..	93	93	95½	88½
(*a*)	Charing Cross Elec. Ord. (£1) ..	26/-	26/-	51/-	24/3
	,, ,, 4½% C.P. (£1)	17/6	17/6	18/3	16/6
(*e*) 4½	Chelsea Elec. Sup. Ord.	27/-	27/-	45/3	24/-
10	City of Lond. Elec. L'ting Ord. ..	31/10½	31/10½	52/10½	26/-
6	,, ,, ,, ,, 6% C.P.	23/-	23/-	24/3	21/6
7½	County Lon. Elec. Sup. Ord. ..	53/6	49/-	68/6	25/9
6	,, ,, ,, 6% C.P. ..	23/-	23/-	24/-	21/3
(*g*)	Kensington & K'bridge Ord. (£1)	27/-	27/-	27/6	23/9
(*b*)	Lon. Elec. Sup. Ord. (£1).. ..	27/6	27/6	37/6	23/-
1/9½	Metro. Elec. Sup. Ord.	42/6	42/6	53/-	24/9
4½	,, ,, 4½% C.P. ..	17/6	17/6	18/3	16/3
7½	N'castle & Dis. Elec. Ltg. Ord. ..	28/1½	28/1½	31/9	17/6
1/2½	N'castle-upon-Tyne Elec.Sup.Ord.	25/-	25/-	30/3	19/3
6	N. Metro. Elec. 6% C.P.	23/-	23/-	23/9	20/10
6	Notting Hill 6% C.P. (£10) ..	10½	10½	11½	9½
(*e*)	St. James & P.M. Ord. (£1) ..	27/6	27/6	28/6	23/6
1/4½	Shrops.Worcs.&Staffs. Power B.Ord.	37/6	37/6	37/6	21/4
1/9½	W'minster Elec. Sup.Ord. (£1) ..	26/-	20/6	52/9	24/-
4½	,, ,, 4½% C.P. (£1)	17/6	17/6	17/10½	16/7½
8	Yorks. Elec. Power Ord.	34/6	35/6	38/9	24/6
6	,, ,, ,, 6% C.P. ..	24/-	24/-	26/9	20/7
	Railways and Tramways.				
8	Brit. Elec. Trac. Pfd.Ord. Stk ..	128	128	152	117
6	,, ,, ,, 6% Pf. Stk.	128½	128½	133	103½
4	Cent. Lon. Ry. Ord. Stk. (asstd.)	72	72	72	54
4	,, ,, ,, 4% Deb.	80	80	83	77½
4	City & S. Lon. 4% Perp. Deb. ..	79½	80	81	76½
5	Lon. Elec. Rly. Cons. Ord. Stk. ..	73½	73½	75½	42½
4	,, ,, ,, ,, 4% Pf. Stk.	73	73	77	68
4	,, ,, ,, ,, 4% Deb. ..	80	80	83	76½
5	Lon. & Sub. Trac. A. Deb. ..	97½	97½	97½	74
4	Lon. Un. Trams, 1st Deb. ..	61	61	63	39
4½	Met. Elec. Trams, 4½% Deb. ..	70	70	73½	62
5	,, ,, ,, 5% Deb. ..	69½	69½	70½	65½
3½	Met. Rly. Cons. Ord. Stk. ..	60	60	81	54½
3½	,, ,, ,, 3½% Pf. Stk. ..	63	63	67	60½
3½	,, ,, ,, 3½% Deb. ..	70	70	73½	67½
5	Met. Dis. Rly. Ord. Stk.	76½	76½	77½	52½
4½	,, ,, ,, 4½% 1st Pref. ..	80½	80½	84	74½
6	,, ,, ,, 6% Perp. Deb. ..	116½	116½	118½	110
4	S. Met. Elec. Trams, 4% Deb. ..	70	70	70	64½
5	Uudergrouud Electric Rlys. Ord.	24/6	23/6	28/2	11/-
—	Yorks. (W.R.) Trams, Ord. ..	5/-	5/-	16/-	3/-
4½	,, ,, ,, 1st. Deb. ..	59	59	78	60
	Electrical Manufacturing.				
7	Brit. Elec. Transformer 7% C.P...	15/-	15/-	19/10	4/6
15	Brit. Insulated Cables Ord. ..	93/9	95/-	86/3	56/-
6	,, ,, ,, 6% C.P. ..	22/6	22/6	23/10	21/-
7	British Thomson-Houston Pref. ..	23/9	23/9	24/9	19/7
7	,, ,, ,, 7% Deb.	104½	104½	109½	102½
10	Brush Electrical Ord.	27/6	27/6	30/9	24/-
15	Callender's Cable Ord.	87/6	86/3	91/3	66/-
6½	,, ,, 6½% C.P. ..	25/-	25/-	25/9	22/-
7½	,, ,, 7½% B. Pref. ..	27/6	27/6	28/3	25/-
8	Crompton-Parkinson 8% Cum. Pf.	25/7½	25/7½	27/-	14/-
6	,, ,, 6% Cum. 2nd Pf.	18/-	18/6	19/6	9/7
7½	Edison Swan Elec. 1st Pref. ..	25/7½	25/7½	13/-	7/4½
5	,, ,, ,, 1st Deb.Stk.	86½	86½	92	81½
7½	Elec. Construction Ord.	20/-	20/-	32/6	23/6
7	,, ,, 7% C.P. ..	22/6	22/6	22/9	21/-
—	English Elec. Ord.	7/6	8/1½	15/9	5/-
6	,, ,, 6% C.P. ..	9/4½	9/4½	18/9	7/-
7	Ericsson Telephones 7% Pref. ..	20/-	18/9	22/7½	17/6
35	Ever Ready (Gt. Britain) Ord. ..	21/6	22/6	92/3	18/1
6	Ferranti 6% Pref.	18/-	18/-	19/4½	16/9
7	,, 7% 2nd Pref.	21/3	21/3	19/3	13/9
10	General Elec. Ord.	63/9	55/-	46/6	26/6
‡25	W. T. Henley's Ord.	120/-	120/-	120/-	69/3
12½	Johnson & Phillips Ord.	38/9	38/9	67/11	34/-
7½	Lon. Elec. Wire. & Smith's Pref ..	23/9	23/9	25/-	22/3
7½	Siemens Bros. & Co. Ord. ..	27/6	26/3	36/6	24/9
10	Telegraph Const. Ord. (£12) ..	25½	25½	30½	20
	Telegraph.				
3½	Anglo-Am. Tele. Ord. Stk. ..	61½	61½	63½	56½
10	Eastern Ord. Stk.	262	255	273	135
3½	,, 3½% Pref. Stk.	68½	68½	70½	59
4	,, 4% Deb.	79½	79½	81½	74
10	Eastern Extension Ord. (£10) ..	20½	25½	27½	14
22	Gt. Northern Telegraph (£10) ..	32½	32½	43½	26
10	Indo-European (£25)	55½	55½	48½	30
20	Marconi's Wireless T. Ord. ..	81/3	80/-	84/4	12/-
12½	,, Int. Mar.	63/9	68/9	90/-	16/6
10	Western Tel. Ord. (£1)	26½	25½	27½	12½

(*a*) 19 7/16d. per share. (*b*) £8 8s. 6·66d. per cent. (*c*) 1s. 6·949d. per share.
(*d*) 1s. 8·706d. per share. (*e*) 1s. 9·3d. (*g*) 1s. 7·223d.
‡Including 1s. bonus.

HADFIELDS, LTD.—Div. of 2½%, less tax, proposed for year 1928, agst. 5% for 1927.

GLOBE TELEGRAPH AND TRUST CO., LTD.—Intm. div. of 5s. per sh., net, will be payable on March 28.

EASTERN EXTENSION, AUSTRALASIA AND CHINA TELEGRAPH CO., LTD.—Fin. div. for 1928 of 5s. p. sh., payable tax free, on Apl. 15.

CHELSEA ELECTRICITY SUPPLY CO., LTD.—Fin. div. of 11·3d. p. sh. on ord. shs. is announced, makg, standard div. for year.

EASTERN TELEGRAPH CO., LTD.—Div. at rate of 3½% p. a., less tax, on pref. stk. for qrtr. endg. March 31, div. of 2½% on ord. stk., tax free, for qrtr. ended December 31, 1928, will be payable on April 15.

HENDON ELECTRIC SUPPLY CO., LTD.—Net surplus for 1928, £39 811. Fin. div. 2s. p. sh., tax free, makg. 15%. To repairs and renewals, £8 293; to gen. res., £4 728; income tax acc., £5,900. Fwd., £9 628.

COUNTY OF DURHAM ELECTRICAL POWER DISTRIBUTION CO., LTD.—Pft. for 1928, £59 299, agst. £44,966, plus £887 brt. in. Int. on deb. stk., loans, etc., £26 862. Ord. div. 6%, subject to tax (same as last year). Fwd. £1 224.

TEES POWER STATION CO., LTD.—Pft. for 1928, £122 231, agst. £85 672. Int. on debs. and advances required, £63 213, agst. £27 774. Div. 6%, subject to tax, agst. 5%. Fwd. £750 (agst. £1 311 for 1927, after placg. £10 000 to res.).

MERSEY POWER CO.—Working pft. for 1928, £100 869, plus £36 420 brt. in. To loans redemptn., £20 000, int., £41 072. Div. 5% on ord. shs.; to depreciatn., £30 000 fwd., £17 080. Sales of electy. increased by nearly 6 000 000 kWh.

LANCASHIRE DYNAMO AND MOTOR CO., LTD.—Pft. for 1928 £21 002, plus £5 350 brt. in. Div. on pref. shs., 5½%, less tax, includg. intm. div. paid to June last. Ord. div. 5% for year, less tax. To res. for directors' fees, £700, to res. acct., £5 000. Fwd., £7 800.

AMERICAN CABLE AND RADIO MERGER RUMOURS.—Mr. J. G. Harbord, president of the Radio Corporation, announces that there are no negotiations completed or pending towards a merger or consolidation of any kind between the Radio Corporation and the Western Union Telegraph Co.

NEWCASTLE AND DISTRICT ELECTRIC LIGHTING CO., LTD.—Pft. for 1928, £72 809, plus £15 658 brt. in. Int. on debs. and loans, £17 933, to deb. and leasehold redemptn. funds, £4 970; depreciatn., £22 000; to gen. res., £10 000; div. at rate of 7½%, less tax, for year £18 000; fwd., £15 564.

AUTOMATIC TELEPHONE MFG. CO., LTD.—Pft. for 1928, £123 670 (after charging depreciatn. £50 000), plus £81 755 brt. in. Directors' fees, £2 442; to gen. res., £35 000; pref. div., £12 000; intm. div. on ord. shs. (3¾%), £18 750. Directors recommend further div. of 6¼% on ord. shs., makg. 10%, less tax, for year, and a bonus of 2½%, less tax, Fwd., £93 483.

NEWCASTLE-UPON-TYNE ELECTRIC SUPPLY CO., LTD.—Pft. for 1928, £819 456, agst. £783 493. Int. on deb. stks., loans, etc., absorbed £204 670, agst. £221 465; to res. for special depreciatn. and contingencies, other than equalisatn. of divs., £150 000 (same as last year), to res. for plant renewals, etc., £60 500. After paying divs. on 7% and 5% pref. shs., fin. div. of 3½% on ord. shs. is recommended, makg. 6% for year, subject to tax. Fwd., £80 653, agst. £43 206.

GENERAL ELECTRIC CO., LTD.—It was officially announced on March 16 that the offer for sale of 1 500 000 British £1 ord. shs. had been postponed. The committee representg. American shhldrs. asked that the sale should be deferred pendg. negotiatns., and Sir Hugo Hirst agreed to the adoptn. of this course. Sir Hugo stated that the Board's financial advisers had elaborated a plan which in the directors' opinion safeguarded the objects which they had in view, and which he defined at the shhldr's. mtg. on March 13. Sir Hugo having suggested that a representative should negotiate on behalf of American interests, the American committee cabled on Monday that its two representatives, Mr. T. L. Chadbourne and Mr. H. B. Swope, would sail for England in the *Aquitania* on March 23, or the first vessel available. In acknowledging this, Sir Hugo said the Board was on the point of completing proposals on lines which they felt would meet all reasonable criticism levelled agst. its first proposals and which might

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avoid the necessity of the representatives taking the journey across. In a subsequent cable, members of the committee of United States shhldrs. stated that they would not name someone in London to be in touch with the co., as no member of the committee was there, and added that Sir Hugo, personally, had not vouchsafed to them any indication of changes intended to be made in the proposals passed by the mtg. on March 13th.

Company Meetings.

LIVERPOOL OVERHEAD RAILWAY CO.—Ald. M. H. Maxwell, presiding at the meeting on March 13th, said the net income for 1928 was £22 284, compared with £14 758 in 1927, and the passengers carried were 7 511 559, or 183 383 more than in 1927. Mr. C. H. Keet, a shareholder, said if the ordinary shareholder was to have any satisfaction it was necessary for the board to adopt a more enterprising policy. The proposal to pay the full year's dividend of 5% on the preference shares was criticised, but the motion for the adoption of the report was carried.

NORTHAMPTON ELECTRIC LIGHT AND POWER CO., LTD.—Mr. F. H. Thornton, presiding at the recent meeting, said in spite of the general prevalence of bad trade, they had a very successful year. During the year they obtained statutory powers to carry out the extensions, to which he alluded last year, in Northamptonshire and North Buckinghamshire. Their area consisted of some 1 000 square miles, and they were now supplying in all 80 towns and villages. During the year they had added 44 miles to their extra high tension mains, and 23 miles to their distributing mains, making a total of 188 miles of high tension mains and 132 miles of distributing mains. The board looked forward with confidence to the results of the extensions that would take effect during the present year. The meeting confirmed the dividends of 2½ % on the 5% cumulative preference shares, making 5% for the year and 5% on the old ordinary shares, making 9% for the year.

LONDON ELECTRIC SUPPLY CORPORATION, LTD.—The Earl of Bessborough, presiding at the meeting on March 13th, said in spite of reductions in prices of current, their revenue had grown from £693 926 in 1927 to £708 542 in 1928, and net profits were £181 206, compared with £127 594. Final dividends making 6% on the preference and 9% on the ordinary shares for the year were recommended. The benefits consumers received during 1926, 1927 and 1928, due to their being charged less than the standard price, amounted to approximately £300 000. The sale of their Deptford generating station to the London Power Co. was completed in March last. The Power Co.'s new station on an adjoining site, and the capacity of which would be ultimately about 200 000 kW, was expected to be in commission shortly. Their "all in" tariff, although it had only been in operation for a month, had been adopted by a large number of consumers. Their next step would be to open a showroom in their residential area. The report was adopted and the dividends were approved.

SCOTTISH POWER CO., LTD.—Mr. George Balfour, M.P., presiding at the meeting on March 13th, said the extensions to the steam generating stations at Bonnybridge and Arbroath had proceeded satisfactorily. The Arbroath extensions were carried through in two stages, and the first generating set has been on load for several months. The combined generating plant installed would then amount to a total of 32 500 kW. In addition, there are, of course, the smaller units of generating plant at Montrose, Brechin, Crieff and Kingussie, which were gradually being superseded as bulk supplies were afforded by the Grampians Co. A start was made on the construction of the hydro-electric works of the Grampians Co. at Rannoch during the early part of the year and the works were proceeding so as to be completed for supply by the end of next year. From the hydro-electric station a 132 000 V line would be carried to Abernethy, south-east of Perth, for connecting into the main transmission lines of the Central Electricity Board. The report and the dividend at the rate of 8% per annum on the ordinary shares were approved.

TILLING-STEVENS MOTORS, LTD.—Mr. H. E. Carter, presiding at the recent meeting, said they had completed the manufacture of eight new and entirely up-to-date petrol-electric chassis for test in service, and some of these would be running upon the London streets as soon as the bodies were erected upon them. The chassis had already been passed by Scotland Yard, and there only remained the passing of the final vehicle complete with the body. From their own tests and from the running of a similar engine and dynamo for over 20 000 miles in Wolverhampton, they had every reason to believe that the results would give satisfaction. They had also given close attention to petrol-electric commercial vehicles, and had now in production standardised engines of two types, of different sizes and power, suitable for both passenger and goods vehicles, either of which could be supplied gear-driven or electrically propelled. He thought they were the only company in this country able to offer customers both types and to advise them as to which was the more economical and satisfactory for their particular conditions.

CHISWICK ELECTRIC SUPPLY CORPORATION, LTD.—Mr. Harry Kahn, presiding at the general meeting, said the number of consumers had reached 6 283, an increase of 480, and the total revenue £85 949, or £5 484 higher than last year, while total profits at £52 430 showed an improvement of £7 254. Both at Chiswick and Aberystwyth their rates would cost considerably more, as their assessments had been practically doubled. At Chiswick, on the basis of the new assessment, at the present scale the rates alone would work out at ¾d. per kWh. The Press and public were apt to overlook items like this, as also interest and depreciation on capital sunk in machinery and mains, when agitating against the so-called exorbitant prices charged for current. The net

IN the above illustration are seen 638 members of the B.T-H. (Rugby) Ex-Service Association which, besides running various social events for the benefit of members, is now turning its attention also to helping local charitable institutions having no direct connection with the B.T-H. The Association has enrolled over a thousand members—about one-sixth of the employees of the main works of the company.

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result was that, with the balance brought forward, there was £35 653 10s. 4d. available for distribution, of which £11 250 had been absorbed by the interim dividend of 7½% actual paid on July 23rd, 1928. This left £24 403 10s. 4d., which the directors recommended be appropriated as follows: In payment of final dividend of 8½% actual, £12,750; refund to consumers for 1928, £9 000; carry forward, £2 653 10s. 4d.

ENGLISH ELECTRIC CO., LTD.—Mr. W. L. Hichens, presiding at the meeting on Monday, said whereas there was a loss of £134 450 in 1927, and provision had to be made for exceptional losses, in 1928 there were no exceptional losses, and the loss for the year was reduced by over £100 000 to £33 600. The trading profit for 1927 was £66 000 better than in 1926. He hoped that if prices did not fall below the present low level, and if the same volume of orders were secured as during the past year, the company would continue on the up grade. There had been an increase in the value of British export trade in electrical machinery, due to the high level of efficiency it had attained. The English Electric Co. had secured an important share in this foreign business. Of the orders secured through the Power and Traction Finance Co., the 45 000 kW power station near Athens would probably be in operation in June, and considerable progress had been made with the 65 000 kW station near Budapest. The Power and Traction Finance Co. had other schemes under consideration, notably two hydro-electric schemes in Scotland. The position of the company had been materially strengthened. The report and accounts were adopted.

KENSINGTON AND KNIGHTSBRIDGE ELECTRIC LIGHTING CO., LTD.—At the meeting on March 14th, Col. R. E. Crompton, chairman, said they were working on their policy of providing mains suitable for the new standardised system of alternating current distribution, which required that they provide suitable static transforming sub-stations. This would entail further capital expenditure. The item "purchase of current" had risen from £57 945 in 1927 to £66 522, due to an additional one and a quarter million units purchased. Their net profit for 1928 amounted to £33 569, compared with £43 868 in 1927. Their future prospects were very good. Judging from their returns during the first few weeks of this year it is evident that another substantial advance in output and in additional connections might be expected. Their showrooms had been successful in attracting the attention of consumers and they were there able to demonstrate to them the latest and most economical methods of using electrical appliances for all purposes. The business of providing electric cooking apparatus had increased and was likely to still further increase. Customers using electric cooking seemed to be satisfied with the results from the economical point of view. The report was adopted.

SOUTHERN RAILWAY CO.—Brig.-Gen. Everard Baring, presiding at the meeting on March 6th, said capital expenditure on the electrification of suburban lines in 1928 was £115 000. This item would have been larger if they had charged to capital the expenditure incurred in providing the electrical equipment of the line that would replace the overhead system. On the previous Sunday they inaugurated the last stage of the two extensive schemes of electrification. The first scheme was completed in July, 1926, and the second scheme was opened last year. Up to the present time they had electrified 270 route miles and 748 track miles, over 13% of their total track mileage. They had recently authorised the electrification of the line from Wimbledon to West Croydon via Mitcham, six and a quarter miles, and the line from Twickenham to Windsor, about 13 miles. The Wimbledon and Sutton Railway, which would be completed this year, would also be electrified. By the end of this year they would have abolished the single-phase, overhead system on the former L.B. and S.C. section, and have substituted the d.c. system. After allowing interest upon the whole of the expenditure and bringing to debit the whole of the costs, there was a very considerable profit which had gone a long way in helping to pay the dividends on the deferred stock.

MATHER AND PLATT, LTD.—Mr. L. E. Mather, presiding at the recent meeting, said profit showed a slight increase. The amount available for distribution was sufficient, the board considered, to recommend the same dividend and bonus as for the previous six years, and still to leave a reasonable carry forward. They continued to improve their workshop plant at Newton Heath and Salford with labour-saving machinery without displacing labour. Their research department and designers had been busy on development work during the last year or two with increasingly good results. Electrically, they had further developed the standardisation of their dynamos and motors, resulting in increased sales. Their geared generators and converting plant had also been in demand, so that their total output of electrical machines for 1928, as regards numbers sold, manufactred, and held, constituted a record in the history of the company. The outlook at home seemed somewhat brighter. Their French company continued to show a good profit, in spite of considerable competition. Their German company reported more favourably than for some time past. India continued to provide them with many inquiries, and an improvement had already been noticeable from China. Japan continues a good customer, in spite of the increasing tendency to manufacture as much as possible.

New Companies.

EMERY AND CO., LTD.—Cap., £500. Electrical, lighting, wireless and general engineers, etc. Solicitors: Sproston and Son, Newcastle-under-Lyme.

HEALING RAYS, LTD.—Cap., £300. Medical and general electricians, radiologists, etc. Reg. office: Arkwright House, Parsonage Gardens, Manchester.

EIRCO (WHOLESALE), LTD.—Cap., £100. Electrical engineers, manufacturers of electrical equipments, dealers in wireless, etc. Reg. office: Kingscourt, Wellington Place, Belfast.

LEAVERS' (HENLEY), LTD.—Cap., £4 000. To acquire business of motor engineer and repairer, wireless and electrical engineer, carried on by W. E. Leaver at 2, Reading Road, Henley.

RAY THERAPY INSTITUTES, LTD.—Cap., £2 000. Proprietors of electrical and sun ray treatment establishments, etc. Solicitors: Woolfe and Woolfe, 13A, Old Burlington Street, London, W.1.

POWER CENTRE CO., LTD.—Cap., £1 500. To acquire business of switchboard manufacturers and electrical and mechanical engineers now carried on at 15, Park Lane, Liverpool, as "The Power Centre Co."

CLARENDON PRESSING AND WELDING CO., LTD. Cap., £3 000. Manufacturers of and dealers in motor vehicles, electrical engineers, etc. Reg. office: Clarendon Works, Clarendon Street, Coventry.

PERTRIX, LTD.—Cap., £10 000. Electricians, electrical and mechanical engineers and contractors, suppliers of electricity, and manufacturers of and dealers in electric batteries. Reg. office: 120, Tottenham Court Road, W.1.

COLLEYS (1929), LTD.—Cap., £10 000. To manufacture telegraph coils and inventions in connection therewith, to adopt agreement with Exchange Telegraph Co., Ltd., etc. Reg. office is at 3–6, Marine Street, Bermondsey, London, S.E.

METAL AND CHEMICAL PRICES.

TUESDAY, March 19th.

		Price.	Inc.	Dec.
Copper—				
Best Selected ..	per ton	£99 nominal	£11 10 0	—
Electro Wirebars	,,	£99 10 0	£8 0 0	—
H.C. Wires, basis	per lb.	1s. 1¼d.	⅛d.	—
Sheet	,,	1s. 0 11/16d.	¼d.	—
Phosphor Bronze—				—
Wire (Telephone) basis	per lb.	1s. 4¼d.	⅛d.	—
Brass 60/40—				—
Rod, basis ..	per lb.	9d.	—	—
Sheet ,, ..	,,	11¼d.	¼d.	—
Wire ,, ..	,,	11¼d.	¼d.	—
Pig Iron—				
Cleveland Warrants	per ton	£3 9 6	—	—
Galvanised Steel Wire, basis 8.S.W.G. ..	,,	£14 15 0	—	—
Lead Pig—		Not Quoted		
English	per ton	Nominal £31	£6 0 0	—
Foreign or Colonial	,,	£29 15 0	£6 5 0	—
Tin—				
Ingot	per ton	£223 2 6	£2 15 0	—
Wire, basis ..	per lb.	2s. 11d.	¼d.	—
Aluminium Ingots	per ton	£95 0 0	—	—
Spelter	,,	£29 0 0	£2 15 0	—
Mercury	per bottle	£22 5 0	—	—

Sulphur—Flowers, Ton £12 0 0 *Sulphuric Acid*—
,, Roll ,, £10 10 0 (Pyrites, 168°) Ton £6 15 0
Copper Sulphate ,, £25 to £25 10 0 *Sodium Chlorate* per lb. 2¾d.
Boric Acid (Crystals),, £30 0 0 *Sodium Bichromate* per lb. 3¼d.
Rubber—Para fine, 1s. 1¼d.; plantation, 1st latex, 11 7/16d.

∴ The metal prices are supplied by British Insulated Cables Ltd.

THE LEAD MARKET.

A setback at the beginning of last week was, according to James Forster and Co., carried further on Tuesday, March lead touching £23 5s. and forward £23 11s. 3d. From this point a recovery set in, and assisted by further buying, prices rose 15s. per ton, the tone at the close being firm.

Closing prices on March 15th were £24 1s. 3d. for March, £24 2s. 6d. for April, £24 5s. for May, and £24 6s. 3d. for June, 8s. 9d. to 10s. per ton higher on the week.

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COMMERCIAL INFORMATION.

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debt. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

ABBOTT AND CO., South Devon House, Plympton, wireless dealers. £15 0s. 5d. February 7th.

CARR, William, 8, Front Street, Chester Moor, electrical engineer. £20 4s. 8d. January 30th.

DEVEREUX, LTD., 1B, Yukon Road, Balham, electrical engineers. £36 7s. 8d. February 7th.

ELECTRICAL SHOWROOM, Croft Terrace, Torquay Road. Paignton, electrical engineers. £20 3s. 8d. September 26th.

HUDSON, Mr. R. C., 1, Bridge Road, Chatburn, radio engineer, £22 6s. 6d. February 5th.

SOUTHALL, Mr. S., 29, High Street, Welshpool, electrical engineer. £11 5s. 5d. January 28th.

VICTORIA WIRELESS AND GRAMOPHONE STORES, 47, Morton Street, S.W., wireless and gramophone dealers. £39 2s. 7d. February 4th.

Deeds of Arrangement.

PATTEN, Charles Edward, trading as COVENTRY RADIO EQUIPMENTS, 61, Clay Lane, Coventry, electrical outfitter. Dated March 11th, filed March 14th. Trustee, H. J. Kirby, 26, Trinity Churchyard, Coventry, accountant. Liabilities unsecured, £555; assets, less secured claims, £490.

SMITH, Stanley Carlos, 10, Facade, Devonshire Road, and 108, Devonshire Road, Forest Hill, wireless dealer. Dated March 7th, filed March 14th. Trustee, W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C., accountant. Liabilities unsecured, £1 024; assets, less secured claims, £500.

Receivership.

IZZARD BROTHERS, LTD.—W. B. Pearson, Corporate Accountant, of 5, John Street, Bedford Row, W.C.1, was appointed receiver and manager on February 28th, 1929, under powers contained in certain debentures dated December 22nd, 1925.

Private Meetings, etc.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

ELECTRICAL APPLIANCES (BLACKPOOL), LTD.—This company, whose debenture holders have appointed a receiver, was formed in March, 1920, with an authorised capital of £5 000, increased in October, 1920, to £7 500 in £1 shares, of which 6 500 shares have been issued, all for cash. According to the latest return filed, the directors were William Outhwaite, George Outhwaite, R. T. Waite and W. T. Rawcliffe, with 1 400 shares each; and H. F. Shanshaw, holding 700 shares. There was one other shareholder, a chartered accountant, holding 200 shares,. William Outhwaite, on behalf of the debenture holders, appointed the receiver.

London Gazette, etc.

Bankruptcy Information.

HALL, Sidney (trading as E. GREEN AND CO.), 13, Caledonian Road, Leeds, and 30, Leighton Lane, Leeds, electric lamp dealer, First meeting, March 25th, 11 a.m., Official Receiver's Office, 24, Lower Bond Street, Leeds. Public examination, April 9th, 10.30 a.m., County Court House, Albion Place, Leeds.

Notice of Dividend.

JONES, Edward Denis, Royal Sportsman Hotel, Portmadoc, Carnavon, electrical engineer. First dividend, 1s. per £, payable April 5th. Official Receiver's Office, St. Peter's Churchyard, The Cross, Chester.

Notices of Intended Dividends.

SHARPE, Henry Clifford, 4, Gordon Terrace, Dorchester, wireless engineer. Last day for receiving proofs, March 30th. Trustee, T. Barton, City Chambers, Catherine Street, Salisbury, official receiver.

WILSHAW, George Marshall, and SHARPE, George, trading as WILSHAW AND SHARPE, 320, Padiham Road, Burnley, electrical dealers. Last day for receiving proofs, March 29th. Trustee, J. W. Carter, District Bank Chambers, Blackburn, official receiver.

Partnerships Dissolved.

GREER, SON AND DIGGINS, electrical and automobile engineers and contractors, 99, Canal Crescent, Perth, by mutual consent, on January 21st, 1929, by the retiral of James Crofton Diggins one of the partners. Under the firm name of GREER AND SON the business will continue to be carried on at the same address by Leonard Allan Greer and Leonard Allan Greer, Junior, who will pay all debts due by, and collect all debts due to, the dissolved firm.

JACKSON (H. A.) AND CO. (Jane Anderson SINGLETON, formerly Jane Anderson Jackson, and Robert RAMSDEN), manufacturing electrical engineers and merchants of electrical goods, Caxton Hall, Chapel Street, Salford, by effluxion of time as from December 31st, 1928. Debts received and paid by R. Ramsden, by whom the business will be carried on.

MANCHESTER MAGNETO CO. (Harry Varley BARKER and Percy Stanley CLARK, magneto repairers, 51, Hardman Street, Manchester, by mutual consent as from March 1st, 1929. Debts received and paid by H. V. Barker, who will continue the business.

Bankruptcy Proceedings.

COUNTY ELECTRICAL AND WIRELESS STORES, LTD., Garrick Yard, St. Martin's Lane, London, W.C. The statutory meetings in the compulsory liquidation of this company were held last week at the Board of Trade Offices, 33, Carey Street, W.C. The Official Receiver said the company was registered as a private one in July, 1923, with a nominal capital of £1 000, subsequently increased to £7 000. The issued capital was £1 000, all of which was issued for cash and fully paid up. Shortly after its inception, the company was appointed agents to retail "Burndept" products in the East Kent Area, and business was first started in July, 1923, at premises at Deal. Subsequently branches were opened at Folkestone, Bournemouth, Gloucester, and Hythe. Although in the first few months of the company's trading it restricted its sales to Burndept products, it gradually traded in other makes of wireless sets, and at Deal some business was done in house electric light wiring. By February, 1927, the company had become indebted to Burndept Wireless, Ltd. (a company formed in March, 1925, to take over the business of Burndept, Ltd., then in voluntary liquidation) to the extent of £6 998 in respect of moneys advanced and goods supplied. On February 17th, 1927, a debenture constituting a floating charge upon the whole of the assets of the company was created and issued to Burndept Wireless, Ltd., as security for the indebtedness. In June, 1927, Burndept Wireless, Ltd., agreed to accept a sum of £1,250 in full discharge of the company's indebtedness; an overdraft to this limit was obtained from the company's bankers, and the Burndept debt was paid off and the debenture was satisfied. Afterwards the company purchased the bulk of its supplies from another firm. The results of the company's trading from its inception to the date of the winding-up order (5 years and 6½ months) were as follows:—Sales, £36 499; gross profit, £7 130; overhead expenses, £18 326; net loss £10 691. It therefore cost £18 326 to make a gross profit of £7 130. Towards the end of 1928, the company became very badly hampered for want of working capital, but no means were found of providing this, and, in consequence, there was a marked falling off in the amount of the company's business. The liabilities of the company at the date of the winding-up, were approximately £4 319, and the assets were valued at £614. The Official Receiver had given up possession of the various premises occupied by the company. At the date of the winding-up, the directors were Messrs. H. S. Prince, A. W. Hambling, and J. H. Monins.

LONGE, John Martin, late of Queen's Gardens, Lancaster Gate, London, W. The affairs of this debtor, formerly interested in the lamp and electrical lamp industries, who was adjudged a bankrupt in May, 1926, with ranking liabilities estimated at £8 866, came before Mr. Registrar Francke in the London Bankruptcy Court on March 15th on the hearing of his application for an order of discharge. The Official Receiver said that, according to the report of the trustee in bankruptcy, there was a total realisation from the estate of £190, and it was estimated that a dividend of 3d. in the £ would be paid. In July, 1920, the debtor began business in partnership with two other persons as electrical lamp manufacturers in Woodchester Street, Harrow Road, W., where they traded under the style of the Eclat Electric Lamp Co. He was only a sleeping partner and estimated that he had sustained a loss of £7 000. In January, 1923, the debtor bought the Spencer Lamp Works, Spencer Hill Road, Wimbledon, for £8 000, of which £2 000 was paid in cash, £6 000 remaining on mortgage. The purchase price included the Standard Lamp Works, and he carried on those undertakings under management until July, 1923, when they were taken over by a company called the Eclat Electric Manufacturing Co., Ltd., which he registered. He became a director, and a year later obtained for the company of loan of £11 000 from bankers against securities worth £9 000 and against the guarantee for £3 000 of the petitioning creditor. Early in 1925 the first debenture holder appointed a receiver, and the second debentures had produced nothing. Towards the end of 1925, in order to discharge the loan of £11 000, his securities were sold and the petitioning creditor was called on to pay a certain amount under his guarantee. The debtor had failed to fulfil his own guarantee to the petitioner and the proceedings in bankruptcy ensued. In September, 1923, he had registered and become a director of the Eclat Electrical Accessories (Paddington) Co., Ltd., but this company also proved unsuccessful and a receiver had been appointed, the company at the date of his failure being moribund. The debtor attributed his insolvency to liability under guarantee to the petitioning creditor and to the failure of two of the companies. The discharge was granted subject to the nominal suspension of four weeks.

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PATENT RECORD.

The following information is prepared from the Illustrated Official Journal (Patents) by permission of the Controller of H.M. Stationery Office. Printed copies of full Patent Specifications, when accepted, may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at 1s. each.

Specifications Accepted.

305 330 PRITCHETT AND GOLD and E.P.S. Co., LTD., and C. R. D. PRITCHETT. Gas vents for electric accumulators. (16/12/27.)
305 332 J. A. CRABTREE. Fixed contacts for electric tumbler switches. (17/12/27.)
305 335 H. E. BUCKLEN. Battery charging systems and control relays and circuits for use in such systems. (19/12/27.)
305 345 T. YAMANOUCHI. T-shaped joint for electric cables. (29/12/27.)
305 348 A. MCKELLAR. Electric globe holders. (31/12/27.)
282 838 INTERNATIONAL GENERAL ELECTRIC CO., INC. Selcetive relays, particularly for electric protective systems. (31/12/26.)
305 354 CONSULTING AND RADIO SERVICE, LTD., and N. TURNER. Carrier arms for electrical pick-up devices for sound-producing machines. (10/1/28.)
287 079 ASSOCIATED TELEPHONE AND TELEGRAPH CO. Telephone systems. (14/3/27.)
305 356 D. R. DAVIES and METROPOLITAN-VICKERS ELECTRICAL CO., LTD. Electrical switchgear. (12/1/28.)
284 285 H. J. KUCHENMEISTER. Means for regulating the strength of sound in photo-electric reproduction from sound films. (27/1/27.)
284 356 ELEKTROMEKANO AKTIESELSKABET. Detection of variations in the frequency of high-frequency oscillations. (28/1/27.)
305 388 E. F. RUSS. Induction furnace. (2/3/28.)
305 393 W. FRENSDORFF and DEUTSCHE SCHIFF- UND MASCHINENBAU AKT.-GES Electric supply and distribution systems. (9/3/28.)
296 397 SIEMENS AND HALSKE AKT.-GES. Arrangement for the automatic regulation of the efficiency of transmission systems, particularly of high-frequency transmission systems. (31/8/27.)
292 942 J. SOUSEDIK. Single and multi-phase commutator motors. (27/6/27.)
305 420 G. RICHARDSON. Heat-operated electric switch. (3/5/28.)
290 226 INTERNATIONAL GENERAL ELECTRIC CO., INC. Electric drives for paper machines. (10/5/27.)
303 823 A. POUCHAIN. Negative electrode for zinc electric accumulators. (10/1/28.)
303 824 A. POUCHAIN. Lead electrode for electric accumulators. (10/1/28.)
291 376 P. F. HELLERMAN. Grip for electric cables. (31/5/27.)
305 428 F. WHIPP and WHIPP AND BOURNE, LTD. Electric fuses. (8/6/28.)
305 429 M. TROUTON and WIRELESS MUSIC, LTD. Electrically operated vibratory devices such as are used in the recording or reproduction of sound. (30/1/28.)
294 982 METROPOLITAN-VICKERS ELECTRICAL CO., LTD. Vacuum pumping apparatus. (3/8/27.)
301 014 FALK, STADELMANN AND CO., LTD. Filaments for electric incandescent lamps. (23/11/27.)
295 281 BRITISH THOMSON-HOUSTON CO., LTD. Joining of sheet metal by electric welding. (8/8/27.)
296 678 MARCONI'S WIRELESS TELEGRAPH CO., LTD. Radio and the like receivers. (1/9/27.)
305 447 S. T. QUILLIAM. Boxes or containers of mechanism for electrically operating tramway or railway points, switches, and the like. (11/10/28.)
300 902 F. CONRAD. Electric clocks. (17/3/27.)
275 264 MAATSCHAPPIJ TOT VERVAARDIGING VAN SNIJMACHINES VOLGENS VAN BERKEL'S PATENT. Alternating current motors. (30/7/26.)
283 490 R. BOSCH AKT.-GES. Electric storage batteries. (11/1/27.)
305 600 H. F. ELLIOTT. Tuning system for electric circuits carrying high-frequency currents. (6/8/27.)
305 680 J. BACSA. Alkaline accumulators. (8/8/27.)
305 683 M. Y. A. SERRUYS. Manufacture of inductance coils and the like. (9/8/27.)
305 508 P. R. COURSEY and DUBILIER CONDENSER CO. (1925), LTD. Means for the production of high frequency currents. (30/8/27.)
305 687 BRITISH THOMSON-HOUSTON CO., LTD., H. S. PETCH and F. J. LANE. Electric protective arrangements. (8/10/27.)
305 283 J. B. TAUNTON. Lamp-holders for electric lamps. (25/7/28.)
305 600 HOTPOINT ELECTRIC APPLIANCE CO., LTD., and W. J. SIMS. Electric heating devices. (1/11/27.)
305 691 STANDARD TELEPHONES AND CABLES, LTD. (L. POLINKOWSKY). Telephone systems. (2/11/27.)
305 515 E. W. JODREY. Manufacture of electrical condensers and materials therefor. (3/11/27.)
281 249 PATENT-TREUHAND GES. FUR ELEKTRISCHE GLUHLAMPEN. Method of producing a ceramic compound which is moulded by casting in a hot state. (26/11/26.)
305 612 J. STONE AND CO., LTD., and A. A. MEAD. Dynamo electric machines. (8/11/27.)
305 618 AUTOMATIC TELEPHONE MANUFACTURING CO., LTD., and W. O. PASSMORE. Telephone systems. (8/11/27.)
305 696 A. REYROLLE AND CO., LTD., and B. H. LEESON. Electric protective systems. (9/11/27.)
305 702 J. H. NICHOLS. Electric inductance coils. (9/11/27.)
305 703 G. A. MATHIEU. Radio and the like high frequency receiving systems. (9/11/27.)
305 708 BRITISH THOMSON-HOUSTON CO., LTD., and H. S. PETCH. Electric protective devices. (10/11/27.)
280 576 ASSOCIATED TELEPHONE AND TELEGRAPH CO. Telephone systems. (10/11/26.)
305 496 BRITISH THOMSON-HOUSTON CO., LTD., and C. J. MORTON. Lamps for motor vehicles. (14/11/27.)
305 688 W. E. BEATTY (BELL TELEPHONE LABORATORIES, INC.). Apparatus for applying material to cores, particularly applicable to the insulation of cable conductors. (14/11/27.)
305 730 A. GRAHAM AND CO., LTD., and W. J. RICKETS. Telephonic systems. (17/11/27.)
305 731 SIEMENS BROS. AND CO., LTD., and D. A. CHRISTIAN. Telephone systems. (17/11/27.)
305 733 T. L. ECKERSLEY. Aerial systems for wireless signalling. (16/11/27.)

Applications for Patents.

January 28th.

2 875 F. NEWTON. Electric motors for driving spinning cans. (13/6/28.)
2 900 NORDDEUTSCHE KABELWERKE A.G. and V. PLANER. Insulation of cable joints. (28/1/28, Germany.)
2 911 OLDHAM AND SON, LTD. Electrical couplings, etc.
2 916 H. S. PRINCE. Accumulators.
2 920 RADIOVISOR PARENT, LTD. Remote reading compasses, etc.
2 924 SIEMENS and HALSKE, A.G. Power-supply apparatus for thermionic valves, etc. (27/1/28, Germany.)
2 899 A. ZOPP. Devices for winding coils of wire in layers. (28/1/28, Austria.)

January 29th.

3 051, 3 052 T. ALLISON. Telephone instruments.
3 044 J. BERTHENOD. Battery ignition systems. (17/3/28, France.)
2 952 R. BOSCH AKT.-GES. Electrically driven hair cutting machines, etc. (14/2/28, Germany.)
2 953 R. BOSCH AKT.-GES. Insulated conductors, etc. (27/2/28, Germany.)
3 001 BRITISH THOMSON-HOUSTON CO., LTD., and F. H. CLOUGH. Electric protective systems.
3 002 BRITISH THOMSON-HOUSTON CO., LTD., and F. H. CLOUGH. Telemetric systems.
3 003 BRITISH THOMSON-HOUSTON CO., LTD. Cable terminals.
3 041 P. C. DOIGNON. Regulators for telegraphic apparatus.
2 985 C. H. HORWOOD. Electric self-starters for engines.
3 004 INTERNATIONAL GENERAL ELECTRIC CO., INC. (ALLGEMEINE ELEKTRICITATS GES.). Housing, etc., for electrical apparatus.
3 028 RADIOVISION CORPORATION. Photographic recording by electric discharge.
3 033 H. J. ROUND. Radio, etc., amplifiers.
3 023 SIEMENS-SCHUCKERTWERKE A.G. Production of electrical connection of high conductivity. (1/2/28, Germany.)
2 950 H. N. SKERRETT (FULD AND CO., TELEPHONE UND TELEGRAPHENWERKE A.G.). Microphones.
2 961 W. S. WARREN. Telephone number indicator.
3 006 W. H. WHATMOUGH. Electrical condensers.
2 962 A. C. WYNNE. Electric couplings.

January 30th.

3 173 AUTOMATIC TELEPHONE MANUFACTURING CO., LTD., C. E. BEALE, and R TAYLOR. Telephone apparatus.
3 202 K. BRENSING and O. GOTTESMANN. Electrolytic processes.
3 076 W. COOPER, P. SYKES, and SYKES AND DYSON, LTD. Electric fuses.
3 077 W. COOPER, P. SYKES, and SYKES AND DYSON, LTD. Distribution of current.
3 157 F. C. CURTIS and CURTIS MANUFACTURING CO., LTD. Resistances, etc.
3 118 S. GILCHRIST. Cut-out devices.
3 214 K. N. ELECTRICAL PRODUCTS, LTD., and J. W. MILLER. Vibrating sound producing and recording apparatus.
3 143 G. C. and P. A. LUNDBERG, A. P. LUNDBERG AND SONS, LTD., and G. PEGG Switches.
3 114 J. MCCALLUM. Insulating coverings for metal-sheathed cables, etc.
3 106 PARK MOTOR CO., LTD., and W. F. WOODHAMS. Electrical amplifiers.
3 161 F. PINK. Copying telegraphs.
3 203 RADIOVISOR PARENT, LTD., and F. C. WHALEN. Means of measurement of small variations of illumination.
3 142 C. RUZICKA. Light sensitive cells.
3 149 SIEMENS-SCHUCKERTWERKE A.G. Fastening heating rods in electric furnaces, etc. (4/2/28, Germany.)
3 179 SIEMENS-SCHUCKERTWERKE A.G. Submarine cables.

January 31st.

3 338 J. L. BAIRD and TELEVISION, LTD. Television apparatus, etc.
3 273 J. H. E. BAKER, AND STANDARD TELEPHONES AND CABLES, LTD. Switching arrangements for telephone systems.
3 274 J. H. E. BAKER, L. B. HAIGH, and STANDARD TELEPHONES AND CABLES, LTD Telephone systems.
3 345 BRITISH THOMSON-HOUSTON CO., LTD. Electrical distribution systems. (31/1/28, U.S.)
3 277 A. C. BROWN. Vibration relays for electric lighting, etc., circuits.
3 350 G. H. BUCKLE. Automatic ignition control.
3 310 FERRANTI, LTD., S. Z. DE FERRANTI, and J. H. WHIBLEY. Static transformers.
3 336 E. FORETAY. Electric gramophone. (31/1/28, Switzerland.)
3 280 GENERAL ELECTRIC CO., LTD., and R. GUMM. Manufacture of electric heating apparatus.
3 282 F. P. LAMPARD and C. ROBINSON. Method of suppressing echo effects in telephone circuits.
3 244 C. R. MATTHEWS and S. S. WRIGHTSON. Insulation of railway, etc., rails.

COMING EVENTS.

Friday, March 22nd.

ENGINEERING AND SCIENTIFIC CLUB, WOLVERHAMPTON.—Paper on "The History of the Foundry Industry in the Midlands," by Mr. J. H. Wood.

INSTITUTION OF ELECTRICAL ENGINEERS (SOUTH MIDLAND STUDENTS' SECTION).—Grand Hotel, Birmingham. Joint meeting with Civil and Mechanical Engineers.

PHYSICAL SOCIETY.—Imperial College of Science, Imperial Institute Road, South Kensington. Annual general meeting. Presidential address by Dr. W. H. Eccles, F.R.S. 5 *p.m.*

INSTITUTION OF ELECTRICAL ENGINEERS (NORTH-EASTERN CENTRE, STUDENTS' SECTION).—Armstrong College, Newcastle-upon-Tyne. Lecture by Mr. E. S. Evans. 7.15 *p.m.*

ROYAL INSTITUTION.—21, Albemarle Street, London. Lecture by Sir Ernest Rutherford, F.R.S., on "Penetrating Radiations." 9 *p.m.*

Saturday, March 23rd.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle Street, London, W.1. Paper on "Molecular Motions in Rarefied Gases," by Sir E. Rutherford, F.R.S.

PAISLEY ASSOCIATION OF ELECTRICAL ENGINEERS.—Visit to Messrs. The Clyde Valley Electrical Power Company's hydro-electric power station at Bonnington, Falls of Clyde. 3 *p.m.*

ASSOCIATION OF MINING ELECTRICAL ENGINEERS.—South Wales Institute of Engineers, Park Place, Cardiff. Paper by Mr. C. L. James on "Power Factor: Its Cause and Effect." 6 *p.m.*

Monday, March 25th.

ELECTRICAL CONTRACTORS' ASSOCIATION (EALING SUB-BRANCH).—Ordinary meeting.

INSTITUTION OF ELECTRICAL ENGINEERS (NORTH-EASTERN CENTRE).—Paper by Sir Charles A. Parsons and Mr. J. Rosen on "Direct Generation of a.c. at High Voltages."

INSTITUTION OF ELECTRICAL ENGINEERS (SOUTH MIDLAND CENTRE).—Paper on "The Construction of the Grid Transmission System in Great Britain," by Messrs. Johnstone and C. W. Marshall.

ELECTRICAL CONTRACTORS' ASSOCIATION (EALING SUB-BRANCH).—Ordinary meeting.

INSTITUTION OF ELECTRICAL ENGINEERS (SCOTTISH CENTRE, STUDENTS' SECTION).—Heriot-Watt College, Edinburgh. Paper by Mr. R. C. Henniker on "Static Transformer Testing." 7.15 *p.m.*

Tuesday, March 26th.

ELECTRICAL CONTRACTORS' ASSOCIATION (CHESTERFIELD SUB-BRANCH).—Falcon Cafe. Ordinary Meeting.

ELECTRICAL POWER ENGINEERS' ASSOCIATION (LONDON LOCAL GROUP).—Paper on "Foundations," by Mr. J. C. Hughes.

INSTITUTION OF ELECTRICAL ENGINEERS (SOUTH MIDLANDS, STUDENTS' SECTION).—Visit to works of the Midland Electric Manufacturing Co., Ltd.

POLYTECHNIC SCHOOL OF ELECTRICAL ENGINEERING.—307-309, Regent Street, London, W.1. Lecture (VIII (course of eight lectures) by Mr. E. S. Ritter, on "Picture Telegraphy."

ELECTRICAL CONTRACTORS' ASSOCIATION (CHESTERFIELD SUB-BRANCH).—Falcon Cafe, Chesterfield. Ordinary meeting.

INSTITUTION OF ELECTRICAL ENGINEERS (NORTH MIDLAND CENTRE).—Paper by Mr. B. L. Goodlet on "The Testing of Porcelain Insulators. 7 *p.m.*

INSTITUTION OF ELECTRICAL ENGINEERS (NORTH-WESTERN CENTRE, STUDENTS' SECTION).—Engineers' Club, Albert Square, Manchester. Paper on "High Tension d.c. Transmission," by Mr. F. Roberts. 7.15 *p.m.*

Wednesday, March 27th.

ELECTRICAL CONTRACTORS' ASSOCIATION (CROYDON SUB-BRANCH).—Ordinary meeting.

ELECTRICAL CONTRACTORS' ASSOCIATION (BELFAST BRANCH).—5, Bedford Street, Belfast. Ordinary meeting. 3.30 *p.m.*

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THE ELECTRICIAN

Established 1861. The Oldest Weekly Illustrated Journal of

Electrical Engineering, Industry, Science and Finance.

Bouverie House, 154, Fleet Street, London, E.C.4. Telegrams: "Benbrotric, Fleet, London." Telephone: City 0244 (Ten lines).

[Closed on Saturdays in accordance with the "Five-Day Week" plan adopted by Benn Brothers, Ltd., and its associated organisations.]

No. 2652. [No. 13. Vol. CII.] Friday, March 29, 1929. Annual Subscription, 25s. Overseas, 30s.

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EASTER HOLIDAYS.

The editorial, publishing and advertising offices of "The Electrician" will be closed for the Easter holidays from 6 p.m. on Thursday, March 28th, to 9 a.m. on Tuesday, April 2nd.

Current Topics.

Spring Trade.

ALTHOUGH the electrical industry is less dependent upon the seasons for its trade than many, it can take advantage of some seasonal tendencies to expand business at certain times in the year. It should be unaffected by the slackness of the "holiday" season and should use other seasons to increase the normal sales peaks. The application of this notion to the campaign activities of the E.D.A. is already proving its utility. We therefore make no apology for producing this week a special Spring Trade Number. We can point to no new fashions; there are no special Spring-time colours for flexibles or new shapes for lamps—though price changes are the subject of strong rumour—but we can and do point out that this is the most propitious time of the year for the manifestation of special selling activity in regard to domestic electrical appliances. At no other time of the year is there such a keen general desire for refurnishing the home. Our job is to make it known that electricity can be of help to all in furthering those laudable aspirations. Even if we ourselves are no longer victims of the annual upheaval of Spring cleaning the remembrance of our sufferings in the unenlightened past should have sufficient poignancy to imbue us with the missionary's zeal for converts. The surprisingly small percentage of electricity consumers possessing electric suction cleaners suggests, however, that we have not tried very hard to pass on the good news that Spring cleaning is an anachronism in the Electrical Age. Every lighting consumer is a prospective buyer of a suction cleaner. Too many of us have allowed ourselves to be frightened off this fruitful field by the notorious activities of the house-to-house canvassers, but there are openings to-day for the sale of thousands of cleaners, and they can be sold fairly easily, and without any of the stunt salesmanship adopted by the "commission only" type of salesman.

The approach of lighter evenings hardly seems to suggest public interest in lighting fittings, but the bright sunny days draw attention to shabby specimens, and suggest replacement by something which may be decorative by day as well as by night. Again the advent of warmer weather makes the keenest coal-fire adherents reluctant to light the fire just for an hour or two in the evening. This reluctance can be overcome in many cases by the offer of one of the smaller types of electric fire. And so we may go on through the range of domestic aids—not forgetting refrigerators and fans—all potentially good sellers in the Spring. There are yet possibilities in the domestic field just now. Let us take them while we may.

Capital for Telephone Development

IN casting about for profitable commercial schemes tending to reduce unemployment, successive Governments have been singularly blind to the claims of the telephone industry. Technically, the telephone system of this country is altogether admirable, but on the business side the curbing effect of the Treasury has been the major anti-progressive factor. Despite the existence of an almost unlimited field for profitable expansion of the service, it has been left to an association of British manufacturers of telephone plant and accessories—the Telephone Development Association—to take on the necessary work of development. Their work during the last four and a half years has clearly indicated the potentialities of a long-sighted programme of development, and it has also indicated, as Sir ALEXANDER ROGER pointed out, in his speech at Monday's annual meeting of the Association, that progress is definitely held up through lack of capital for investment in badly needed extensions. Although the present Government programme envisages an investment in this direction of £10 000 000 a year until 1931, the T.D.A. emphatically holds the view that this is not nearly enough, and that something more than £100 000 000 could profitably be invested during the next seven years. It is, as Sir ALEXANDER said, a negative of international effort for us to rest content with a situation in which facilities exist for the spoken word to be transported from San Francisco to the Atlantic coast of America, thence by wireless—soon by submarine cable—to these islands, only to find on arrival here that only just over 3½ per cent. of our population have the necessary telephone in their home or office to receive it.

A Deserving Appeal.

IN connection with the centenary commemoration this year of the establishment of King's College, University of London, an appeal is being made for £350 000 to meet requirements for buildings and endowments. The College is now, with the approval of the Senate, acquiring a 200 years' lease of an area of nearly 5 000 sq. ft. above the

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Aldwych station, and plans have been prepared for the erection on this area of a new building to accommodate several departments which are now inadequately housed. The attention of our readers is drawn to the special arrangements which are being made to secure endowments for the Chair of Physics, now occupied by Prof. E. V. APPLETON, F.R.S., and the Chair of Electrical Engineering which, since the untimely death of Prof. J. HOPKINSON, F.R.S., in 1898, has been held by Prof. ERNEST WILSON. The discoveries and inventions which have been made in the laboratories of the College, the promise of new developments contained in the original investigations which are now being carried on, and the continuous supply of personnel trained in these two departments, are of immense value to the electrical and allied industries, and it is hoped that the firms to whose benefit the College contributes in so many ways will generously help to place the two chairs in the position of dignity and financial security which their importance deserves. During the past hundred years the departments of physics and electrical engineering in King's College have rendered valuable services to the electrical and allied industries, and to-day the two departments are regularly supplying trained workers to meet the demands of modern industry. In addition to their work of teaching, all members of the staff are actively engaged in the prosecution of research. For example, in the Wheatstone Laboratories, under the general supervision of Prof. O. W. RICHARDSON and Prof. E. V. APPLETON, work is proceeding on wireless wave propagation, investigations on soft X-rays, and generation of electrical oscillations by gas discharges; while similar investigations are being carried on in the Siemens Electrical Laboratory, under Prof. WILSON.

American Views on British Electrical Industry.

To see ourselves as others see us is one of the processes which, when applied to the electrical industry, are always of interest. From a recent "Commerce Report" of American origin we learn of the electrical industry in England that "shipments both on industrial and public supply account have barely kept level with the totals of 1927." . . . For almost a year exports have, according to the same report, declined steadily, but, we are pleased to note, the movement has come to an end. On export account, therefore, the outlook is given as "still hopeful" and "there may be sufficient turnover to keep the factories employed without yielding any real surplus for the financing of important contracts in the future." These views on the position of the British electrical industry are based on one of the B.E.A.M.A. trade reports, which is sufficient reason for pointing out the harm which the broadcasting of pessimistic reports may sometimes cause. If America believes the electrical industry of this country to be barely keeping its head above water, there must be others with similar views. These remarks are all the more remarkable when it is remembered that the total value of American electrical exports from January to November of last year (the latest available) amounted to £20 000 000 against the British total of £16 895 185 for the same period, figures which show that the condition of the American electrical industry cannot, after all, be very different from that of our own.

The B.E.A.M.A. Report.

IN contrast with some of the publications of its Economic and Statistical Department, the annual report of the council of the British Electrical and Allied Manufacturers' Association for the year 1928 takes a more hopeful view of the trade situation. It points out that, while the trade depression of last year naturally affected the electrical industry, electrical production in 1928 was in advance of that of 1927, and that, while at one time Britain had lost ground in international competition, the electrical orders secured towards the end of the year were calculated to restore the state of balance existing in 1927. An unsatisfactory feature of the export situation was the smaller volume of orders placed by the Dominions, with the possible exception of India, but an improvement is expected in the current year. On the other hand, in neutral markets, such as Europe and South America, the British position was improved, and there are indications that, during 1929, the extension of the curve of progress will be upwards.

Talking Films.

THE announcement on Monday by Mr. WINFIELD SHEEHAN, vice-president and production manager of the Fox Films Corporation, that his company will never make another silent motion picture but will produce only dialogue and musical pictures, is not without interest to the electrical industry. The "movies" have for a long time absorbed a considerable amount of electrical equipment in the way of lighting apparatus, and now that the "talkie" is becoming established even greater opportunities are at hand. From the electrical point of view the talking film possesses the advantage that not only is all the lighting equipment of the silent picture necessary to its production but extensive sound recording and reproducing apparatus is also necessary. So important does this side of the film industry appear to be that last week no fewer than eight companies signed an agreement with the A.E.G. and Siemens and Halske providing for the exchange of over 500 patents for the manufacture of talking films. Films of this type so far exhibited in this country have been of American origin, the reproducing apparatus being of Western Electric manufacture, and, though the majority of the halls where the films are shown were designed without regard to acoustics, the results have, on the whole, been remarkably good. At this stage of development each film is hired with the reproducing equipment, but doubtless in time such apparatus will be as much a permanent fitting of every cinema as is the projector itself. The manufacture of sound reproducing apparatus is for the most part in the hands of the big wireless manufacturing firms, many of whom have merged with gramophone organisations. The latter are also well versed in the electrical recording of sound on their own account, and with the Radio Corporation of America and the Victor Talking Machine Co., and the Marconiphone Co. and the Gramophone Co. all pursuing the same objective, it is fairly safe to say that the talking end of the "talkie" is well on its way to perfection. The gramophone industry long ago attracted many radio engineers to its laboratories, and, unless we are very much mistaken, other men of the electrical calling will find their way to Elstree and Hollywood, to put the talking film on the same technical plane as the gramophone.

A Fool-Proof Charger Wanted.

THE increasing use of home chargers for wireless accumulators makes the necessity for fool-proof designs all the more important. The majority of the a.c. rectifier types on the market incorporate a 2-electrode valve with automatic resistance balance for 2, 4 or 6 V accumulators, thus requiring of the user no more technical skill than is necessary to connect up the positive and negative output leads to the battery, and to plug the device into the supply circuit. On the face of things, this arrangement looks fool-proof so long as the polarities of the output circuit are observed. We thought so, too, but a case has come to our knowledge where the wall plug accommodating the charger was wanted for a bowl fire, with the result that the charger plug was removed and the fire plugged in circuit. This, too, appears simple enough, but, with the output of the charger still connected across the accumulator, the latter was shorted for several hours. This simple case once more points to the necessity for manufacturers to make domestic electrical appliances in such a way that every oversight due to the ignorance of the user is anticipated, failing which definite instructions should be given with each apparatus sold. In the case of industrial equipment every precaution is taken to prevent error by ignorance. Why, then, should the domestic user of electrical appliances be assumed to be *au fait* with the shortcomings of such things as chargers? Further, why should not the apparatus be made really fool-proof?

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MORE ELECTRICAL PENETRATIONS.

A "Muck-Shifter's" Unconventional Views on Electricity for Civil Engineers and Public Works Construction—Opportunities for Electrical Industry.

By WARWICK HOLMES.

IT was a lean and bronzed friend returned from Nile irrigation and dam construction who first made me think of further electrifying heavy outdoor engineering operations. He was an open-air civil engineer—a type beloved of certain novelists. Modesty made him describe himself as a "muck-shifter"; for the purpose of this story we will call him by the more euphonious title of Mark Shuter.

Before showing the various and many directions in which electrification of contractors and civil engineers' constructions can expedite work and reduce costs, certain fundamentals about these primal branches of engineering have to be faced. Why are public works contractors so often discovered with steam-driven cranes, dredgers and pile drivers? Why are their burdens navvy-borne; the timbering for excavations sawn with sweat and muscle? Why are hands literally at the pumps; why compressors oil-engine driven; why does the wheel-barrow persist?

Shuter, who had more time for contemplation in open spaces than journalists and power station engineers who cramp their brains thinking of the next edition or the agenda for Monday's meeting, had asked himself these questions. His reply involved fundamental considerations. "Before we can think of words like civilisation, city, industry, or electricity supply we must be able to see harbours, docks, roads and water works," said Shuter. All of those things in a new country come before an electricity supply. It may be assumed generally that the builder of bridges and tunnels, the drainers of watersheds, those who dam and sap, blast and bore—in a word the big Mark Shuters of the world—have been accustomed to think and act without much electric power entering into their calculations or their works. As a result the spade has as yet only become a steam shovel; horseflesh hauls the rough burdens of brick and ballast; men, men, and more men, toil with lever and picks; they haul at chains, and are bent with buckets.

An electrically-driven air compressor for road drill operation. The connection to trolley wire should be noted.

"Here," said Shuter, "in these highly electrified islands of Great Britain there can be no excuse for un-electrical methods of performing great works: clearly, more creative salesmanship is wanted." More getting together is needed between civil and electrical engineers. Some time back I showed in THE ELECTRICIAN how the building industry could benefit by electricity behind hod, trowel, crane and every manner of smaller tool. I was told the article caused a "stir." Good. The unelectrified condition of the sheltered building industry, I insist, is nothing compared with the horse-flesh-coal-and-boiler state of the old generation of Mark Shuters.

Lest it might be thought that what I am saying is an exaggeration, regard, please, the works which are carried out either by or for "men-who-should-know-better." Take, for example, the making of roads. If new arterial roads are to be driven across country, there may be some excuse for using a preponderance of horseflesh and oil engines. There may, indeed, be considerable distances to be traversed to make cable connection to a supply; landowners of intervening property may be those perfect sportsmen who think of their partridges first, and lastly of their country's need for better communications. In Italy I remember watching, on a hot summer's day, road constructors on new works erecting temporary trolley wires. I marvelled. These were to be used for supply to narrow gauge electric locomotives for tip wagonhaulage. Electric motors connected to those extempore power services were eventually used for power-shovel working, for ballast grinding, for sieving, for concrete mixing and for compressor operation. An amateur cinematograph film which I made enthusiastically of the excavations of a recently completed London building shows the maximum electrification of contractor work, but petrol locomotives used for tip-wagon haulage. The pity of it.

Where road construction operations are contemplated within a city there seems no excuse whatever for ignoring the economic and convenience factors of electric power. That this development is already well "tooled-up," as they say in Coventry, is evident from the successful operations of an all-electric rail laying and roadway maintenance plant devised by the London United Tramways. A heartening description of this equipment forms the subject of a later paragraph.

Tardiness to adopt electric power for urban road construction is evidently due to the same difficulty as that faced by building contractors: namely, entreating a supply company to bring precious cables into a horrid site where no building as yet exists. In the case of road construction and repair operations, particularly where tramway system section and feeder pillars are to be found at regular intervals along the side walks, obtaining an electricity supply should surely be easy. Why not design section pillars with provision for some spare feeder circuits? These could be connected when required, by plugs and cab-tyre twin to the motors of mechanically operated road making plant. Meters would be provided within the feeder pillars so that contractor could be charged for the current consumed. In streets with no feeder or section pillars, why not meters and feeder sockets in the under-pavement inspection chambers generally used for housing junction and fuse boxes?

The idea is not without parallel in the provision of temporary water services for builders and contractors. By application to a local water authority, I assure you, a stand-pipe can be provided in an under-road hydrant-box near the site. Metered water is thus supplied and charged for. Why should similar facilities be denied the would-be user of electric energy? Where roads are maintained by direct labour under control of a city or borough civil engineer, and the electricity supply is a municipal undertaking, the expense of selling current should be virtually nil. Internal book-keeping between one department and another of the same borough is all that would be required. Very low rates for power would thus be possible.

Emergency night work would be a glad business by provision of temporary electric lighting. The latter would provide incomparably better illumination than acetylene flares. Hoarding and barrier lights—generally depressing oil things—could be electric and cheerful. Pitch and asphalt could be melted electrically. Think of the customary daylight coal-fired, smoke-belching peripatetic boiler—an eyesore and an olfactory affront. Why tolerate it?

A very bright spot in the use of electric power is the successful

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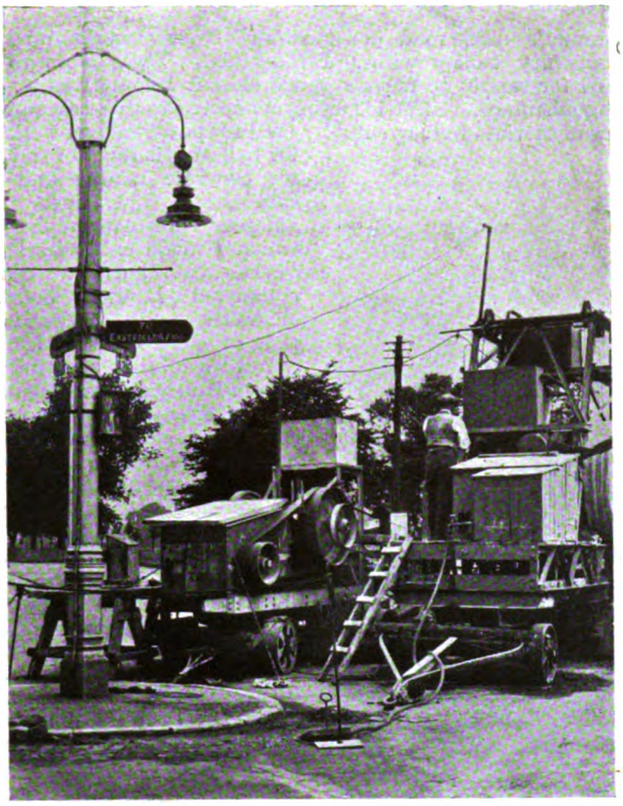
operation of an all-electric rail-laying and roadway maintenance plant devised by the London United Tramways. Some of the photographs which illustrate this article show a four-man pneumatic drill, and a composite plant which comprises ballast crusher, belt conveyor and concrete mixer.



A road making plant with electricity and water "on tap."

The latter plant is shown conducting various operations. We see stone crushing, and delivery of concrete from mixer to tip-wagon. All operations are electrical, except power for the latter, which is from a petrol engine. A battery driven truck would have pleased me better.

Laying Pipe Cables.

Among "the-men-who-ought-to-know-better" class are, of course, the supply companies themselves. It is no uncommon event, where new cables have to be drawn into ducts in a city, to see this performed entirely by unaided human beings. A few months ago in a town of 500 000 population, I witnessed no fewer than twelve men manning a cable and drum. The spectacle was more like a "turn" from a military tournament than a serious industrial operation. The rate of movement of the cable was about 1 foot per minute, so that the man power cost for drawing in 100 yards of cable was approximately £5 10s. In the face of this there must be a lot to be said for power-operated winches.

The Commonwealth Edison Co., in addition to a fleet of electric lorries of all sorts of shapes and capacities, have a number of special cable-laying vehicles. Like all the transport fleet of this undertaking, these are electric battery vehicles, but are specially equipped with electric motor-operated winches for hauling cables into ducts and subways. Battery trucks, which are used for towing two-wheeled lever-loading cable trailers in New York and Chicago, facilitate drum manoeuvring in city streets. But, then, in England it is the exception to find supply companies who believe in electric vehicles, so I suppose the hope for power-operated cable laying is very remote—and petrol dearer, too.

The Holborn explosion, apart from revealing undreamed-of antiquity and methodless pipe and cable-laying of public utility services, discloses universal antipathy to labour saving tools. Lighting in the cable trenches and sewer cuttings is by portable acetylene flares, and even by naphtha torches. Think of it in 1929! Beyond the use of pneumatic picks for concrete breaking, no power operated tools are used. The compressors are oil-engine-driven; hoists and lifting tackle are man-handled. There is not a temporary cable service in the whole of the devastation. The sight of a man sitting astride a 4 ft. water main reducing its length by 3 ft. assisted only by hammer and chisel, would be laughable were it not for the egregious time waste which the traffic diversion entails. If new lengths of cast iron water main *must* be cut on site, why not a portable carborundum wheel—high speed and electrically driven?

The Power Age.

For some years Shuter has collected from engineering papers cuttings relating to electrically-operated plant and tools for civil engineers. From the infrequent use of such appliances by civil engineers and contractors in England, one would say that great days are ahead. Electric welding has progressed so far in the United States that a year ago, on the line of the Boston and Maine Railway at Chicopee, Massachusetts, there was commenced an electric arc-welded, rivetless steel railway bridge. The latter is virtually a one-piece structure. Every joint has been welded solid and immovable. Forty tons of steel were saved by avoiding the conventional riveted design.

A French firm of contractors' engineers supply portable electrically-driven ballast grading machines. A Boston firm of cable makers specialise in cables for use "out where the going is rough," that is, for services to power shovels and quarry compressors. A Duisburg firm makes electric power shovels of 25-ton lifting capacity. The Arrol-Whitaker electric navvy from Glasgow is well known, also the same firm's rotary tunnelling machines adapted for electric drive.

A Leipzig firm recently completed an electrically-operated reservoir-excavating machine having an operating radius in one location of 260 yards. The capacities of the drag line buckets on this machine are 7 cu. yd. each. Machines like these can literally move mountains. If you want to bore vertical holes in the earth for pole erection there is an earth drill adapted for oil-engine or electric drive which will bore 6 ft. in 3 minutes. It can be purchased in London, and is very largely used in America. For overhead line erectors it should be "just the thing."

Building Docks and Harbours.

There are merchandisers of electrical energy, generally described by writers in electrical trade papers as "supply engineers," who think too little of the harbours and estuaries that are the big doorways to cities. In an effort to alleviate sudden rush of domestic electricity to the head, a N.E.L.A. bulletin writer once reminded readers that one medium-sized electric vehicle, such as a supply undertaking might use for local delivery purposes, provided a load exactly equivalent to that of seventeen hundred electric flat irons. There are some who are like that about their docks and harbours.

In shrimping for the load provided by electric haircurlers and shaving mugs, it is conceivable that energy merchandisers are missing the big fish—yes, the Mark Shuters—which nets cast in deeper waters would catch. New docks built in England require for their construction the same tools and plant as docks built anywhere else in the world. I recollect, nevertheless, being jealous of the electrical equipment of harbour contractors in Rotterdam, Hamburg and Copenhagen. A letter addressed to twenty large British civil engineering contractors.

An electric crusher, conveyor and mixer on road construction work.

when I began to think more about the subject of this article a few months ago, asked the question: "Is it your opinion that the further use of electric power would facilitate and cheapen the constructions of public works contractors?" The replies ranged from the type which misunderstood the question to bald statements of the "we are not interested"

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kind, and "requisitions for new plant are not due till the blank date, and should be addressed to our office at blank."

In contrast with steam-operated quaywall cranes, and excavators, pile drivers, pumps and locomotives, which are a common sight in hours spent on a pilot's tender, or familiar to one who scans from his ship the banks of British estuaries, many Continental and American harbours were built into a full tide of electrical energy behind pick and sledge. That they are operated electrically goes without saying. Lest I am misunderstood, please let it be said that most of the harbour authorities in Great Britain are very wise users of electrical energy.

Friends from San Francisco who last "fall" joined me in a midnight tour of certain important London dock improvements, were interested in extraction from the clay bed of 30 ft. steel piling with the aid of an American tool. All the cranes, of course, were steam driven, and some of the lighting was by acetylene flares. Picturesque, we called it.

Canals and Electricity.

Recent amalgamations of canal and inland waterway interests persuaded me that there is yet a chance to save these navigations and provide cheap transport for fuel, minerals and building material. Mark Shuter, to whom I referred the subject, believes in electrification of canals, and replacement of the towpath barge dobbin. Others, too, have dreamed of towpaths installed with permanent way, trolley wire and electric tractor, barge masters paying ton-mile towing rates to a navigation authority. The chains of locks, for example those near Devizes, inevitably imposed by land contour and gradient, incur heavy maintenance costs. They reduce grievously overall average speeds of canal-borne freights, so that hard-boiled men have leant back in their Berkeleys, and said: "Canals, Mr. Shuter, are for flat countries—Holland and so on."

That this is nonsense must be manifest to anyone who takes the trouble to graze an acquaintance with current German canal practice. Here, again, an opportunity; thousands of milowatts directed by an aggressive and creative energy merchandiser must come to the aid of the civil engineer. Forgive me, but electric and electro-hydraulic barge hoists of hundreds of tons capacity and many metres of lift are well established accomplishments in certain Continental canal systems. Thereby are obviated the con- and ob-struction of locks and incalculable water wastage.

Powers have been granted for the building of more tube railway systems; further suburban railway electrifications are on the drawing board. Let electrical engineers remember, too, the canals; let them add to the volume of opinion which temperately advocates inland water communication; let them, by urging the use of electrical energy in their reconstruction and operation, paint the first bright picture in a discreditable history of British inland waterways.

In an earlier paragraph I have shown how electrical energy may easily and profitably be put into the hands of the Mark Shuters. Charges of pessimism and destructive criticism—the latter necessary for ground levelling purposes—are no doubt being formulated. I hope later to be acquitted.

Rapid tube travel is the greatest possible compliment to an electric age. The progressive contractors, who built the South London tube extensions, equipped electrically the whole of the shaft sinkings on station sites. Air compressors for picks and riveters, pumps for drainage and grouting, drills, hoists and tip-wagons—all were electric. I nearly lost my eardrums in the air-lock looking at it. One contractor, a friend of Shuter's, even set the good example of using a 3-ton electric battery vehicle for clay and shale shifting from excavations to dump. But every time last year when I went to Piccadilly Circus new station and escalator excavations, I found miners digging clay laboriously with hand spades. Think of it.

That bacon-frying aroma which assails the nostrils in certain London catacombs arises from cooking by gas rings for booking clerk and porter staffs. Ugh! Tunnels and permanent way are examined at night by portable acetylene lamps; paraffin is deemed the ideal illuminant for the signal and safety lamps of guards and conductors.

How Supply Companies Could Help.

Here, then, are some constructive suggestions which we must put into action at once. Every wise merchant knows that the progress of great industries is accelerated or retarded according to whether the sales policy for distribution of its contributory and consumable products is aggressive or static. The provision on civil engineering works of a portable electric cabin and office, by the electric undertaking with power to sell is most reasonable. All sorts of sub-contractors—the piling companies, the dredger operators, the bridge builders and others—have their offices; not so the electricity suppliers who might easily be the most important of all sub-contractors. What is wanted is an efficient switch, metering and distribution cabin. On a large site like the Ford Dagenham site, for example, where mammoth piling and drainage operation are demanded, several portable electric distributing chambers would be required. If power were transmitted to them at high pressure, they would need to incorporate transforming equipment. That would be easy.

It must, of course, be conceded that the present partially standardised condition of supply characteristics is some obstacle in the way of full utilisation of electric motors by public works contractors. Mark Shuter's American experiences of advantages arising from voltage standardisation brought an avalanche to my ears. I stemmed it with a just account of what the Commissioners and Central Electricity Board had done and were doing.

Sales resistance to purchasing that new plant which full electrification demands, could be overcome by a hire service agreement operated by supply authorities, or sub-let to officially appointed electrical sub-contractors. Believe me, the large number of big civil engineering works which are in hand by public works contractors at the present time, and the total of contracts involving enormous expenditures during the next five years, justify a brave perspective from electrical development personnel. Let them think. Those contracts justify the statement that there are millions of kilowatts of unconnected power load waiting for the supply undertaking who will follow the line of reasoning I, and no doubt others, have pursued. Let them at least take the trouble to investigate; Shuter is *on* friend.

BOOK REVIEW.

Excavating Machinery as Represented by Power Shovels, Drag Lines and Grabbing Cranes. By W. BARNES, M.I.Mech.E. (London: Ernest Benn, Ltd.). Pp. xvi+247. 42s. net.

Although excavating machinery is a comparatively recent development, both the applications and types of apparatus coming under this heading have grown at a remarkable rate. This practical and well-illustrated treatise deals with power shovels, drag lines and grabbing cranes, and in addition to constructive and relative data the author supplies valuable hints and working information for the prospective user. While the first steam shovel appeared in this country in 1840, it was not until 1899 that the Osgood Co. built the first electrically-operated shovel which had two motors, one of 25 H.P. for hoisting and swinging, and one of 15 H.P. for racking. The next, with a 60 H.P. d.c. motor by Scott and Mountain, of Newcastle, was constructed by Ruston, Proctor and Co., in 1902, but after these pioneer efforts progress was exceedingly slow. In fact, up to about 1914 only about 20 machines in all had been constructed by the various makers. In recent types, the Austin and the British Thomson-Houston variable voltage systems, with their lower power and maintenance costs and their ability to dispense with hoisting brakes and clutches with the attendant air compressor, are regarded as offering great possibilities for the future. The new "Eddystat" controller, made by Electric Control, Ltd., also appears to offer distinct possibilities on a.c. excavators. The electric shovel is particularly favoured in copper and iron ore mining, and the author provides interesting details of working costs and output in comparison with steam apparatus. In the Utah Copper Mine during seven months of 1926, during which period nearly nine million cubic yards of excavation were involved, it was ascertained that on a.c. shovels there was an average consumption of 0·494 kWh per cu. yd. of material excavated, the consumption on d.c. being 0·397 kWh. The d.c. machines also had a slightly larger output at 1 846 cu. yds. per shift of 8 hours, compared with 1 766 cu. yds. In a general comparison of daily working costs of a certain sized drag line excavator, the electrical machine ties with the crude oil engine machine at 105s., the costs rising to 140s. for a coal-fired steam machine, 145s. for a petrol-engine machine, 173s. for a petrol-electric machine, and 223s. for an oil-fired steam machine. The book should prove indispensable to those having to do with excavating machinery.

W. L. C.

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MAILING LISTS BUILD BIGGER BUSINESS.

Classifications Allowing Various Appeals to be Sent to Different Classes of Electricity Consumers—How the Electrical Contractor Can Link Up with National Advertising and Reap Personal Benefit from it.

By W. A. GIBSON MARTIN.

IT is not a difficult matter for the electrical contractor to compile a mailing list of users of current. In some cases the Corporation or supply company will supply a list of firms and private individuals to whom current is supplied. In others, the use of electricity is so usual to-day that any list of residents in good class districts would consist of from 90 to 95% users of electricity. The value of the mailing list is not so much the number of live names which it contains, but the manner in which the list is kept, and the method of using it to bring in business.

The only efficient way of keeping a mailing list is to have a card devoted to each name, and to have the cards kept in strict alphabetical order irrespective of the class of user, or whether the user is a private person or a business organisation. There is only one exception to this rule, made purely for the sake of convenience: prospective customers may be kept in one file and customers in a second file, but this convenience may be sacrificed if the double index does not save time. This classification may be obtained in another way, still keeping to one index for the whole mailing list.

There are two main groups of users, and these again are each divided into two subsidiary classes. The classifications may be indicated by coloured cards, or by coloured tabs fixed to each card, or by having the cards notched or cut away as is done in the case of guide cards in a vertical file. The diagram reproduced indicates how colours may be used as the basis of classification. As an aid to memory, it will be seen that light colours are used for the cards to indicate prospective customers and dark colours to enable an operator to pick out all customers.

In choosing colours for the latter, care must be taken to obtain cards which will show up writing distinctly; there are some dark blue and dark red cards offered by stationers which are far from satisfactory in this respect, and as it is necessary to read names and addresses quickly and accurately, there must be a test made of different colours of cards, not only when an entry is made, but a week or so after. If the name and particulars show up clearly immediately after writing, and again after the lapse of a day or more, the colour will be quite satisfactory. If there is any doubt about a colour when tested in this way, it is safer to adopt another and a lighter colour, to make certain of efficiency in addressing letters and envelopes.

CLASSIFICATION OF MAILING LIST.

	PRIVATE.		COMMERCIAL.	
CLASS.	PROSPECTS.	CUSTOMERS.	PROSPECTS.	CUSTOMERS.
Light	White cards	Buff cards	Light Blue cards	Medium Blue cards
Power	Yellow cards	Orange cards	Pink cards	Red cards

When a prospect becomes a customer, a new card of the proper colour is made out and any details transferred to the new card.

Linking Up.

National advertising is a form of publicity which occupies a large part of every electrical manufacturer's programme to-day, and so there is no need to convince people about the advantages of electricity as a luminant and for power. But the progressive contractor and the wide-awake retailer want to link up their own services as electrical experts with the national advertising of the manufacturers. As most manufacturers now favour "wide distribution" of their goods, the electrical contractor no longer enjoys the privileged position of a sole agency in his district. Thus, taking for example Mazram lamps, the electrical contractor must prove to the mailing list, not how good Mazram lamps are, but exactly *why* the people on the mailing list should buy Mazram lamps from him, and not from one of the hundreds of other dealers who carry stocks. The national advertising campaigns will sell Mazram lamps, but the general phrase, "obtainable from all electricians," must be replaced by educating the customer to think "Mazram." "Oh, yes; Brown's Electrical Stores in High Street sell Mazram lamps." That can only be done by telling the customer about the service which Brown's Electrical Stores can offer, and that although Mazram lamps can be bought in many different stores, there is only Brown's Stores which backs up the sale of lamps with service.

The electrical contractor is fortunate in dealing with a product which is recognised as essential for all modern buildings, but about which the average man is ignorant. Even the simple matter of replacing a fuse wire is an affair of mystery to the vast majority of those who use electric light every day of their lives. Thousands of the new houses built recently have electric light, and when the slightest fault develops there is a hurried telephone call for the electrician, and the man's travelling time is double or treble the time taken to rectify the trouble. It is unfair to expect people to pay for four hours of a man's time when the job only took half an hour, yet it is quite obvious that just as the man has to be paid for four hours, so has the firm of electrical contractors.

A Booklet Suggestion.

If, however, the electrical contractor has a booklet prepared, telling in simple language the elementary facts about electricity supply, showing in a clear way the purpose of the fuse box and exactly how a fuse wire should be put in; and if a booklet is illustrated to make these simple points easily understood, and has a few lengths of fuse wire enclosed in a pocket in the back cover; if this is done, then the customer is offered a service which lifts Brown's Electrical Stores from the rut in which all other stores are located, and shows the customer exactly *why* he should buy Mazram lamps—and every other type of electrical requirement—from Brown's.

It is, of course, easy to generalise; it is easy to talk about preparing a booklet, and about the fact that there are many people who do not understand the simplest facts in connection with electricity. But even large firms have to consider rather carefully before they indulge in expensive schemes of broadcasting a booklet to perhaps 10 000 or more users of current. Such a procedure might or might not be a success, and in all probability it would be too large an undertaking to carry through efficiently. It is possible to use the booklet to much better advantage by sending a letter to the mailing list, explaining that a man has sometimes to travel five or six miles to put right a very simple fault, and that with the object of avoiding expense to customers a booklet has been prepared explaining in a non-technical way how to keep an electrical system in order; the booklet will be sent to those who reply, using the post card enclosed.

By this means, the profitable use of the booklet is assured, the electrical contractors find out exactly which prospects are genuinely interested in electrical matters, and the cards in the mailing list can be marked accordingly. Follow-up letters and leaflets can be sent to these people from time to time, while they offer a useful way of using the over-printed advertising matter supplied by manufacturers.

A firm in New York desires to secure exclusive agencies for the United States of British manufacturers of electrical household and heating appliances, electric labour-saving devices, electric tools, machines or patented specialities used in the electrical hardware or automobile industries, lamp shades, lighting fixtures, illuminating signs, radio specialities, etc. Further information can be obtained from the Department of Overseas Trade. (Reference No. 147.)

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ARCHITECTURAL LIGHTING.*

How Effects are Obtained—Modifying Conceptions of Space—Luminous Surfaces—Some Notable Examples—Collaboration with Architects.

By WALDO MAITLAND (E L.M.A. Lighting Service Bureau).

THE chief characteristic of architectural lighting is the fact that it is built into the fabric of the building, and forms an integral part of the architecture.

Isolated examples of built-in lighting, such as cornice lighting or illumination from skylights, have been designed during the last ten to 15 years, but it was not until comparatively recently that this movement received general stimulus subsequent to the Paris Exhibition in 1925, from which the basis of architectural lighting, as we know it, took form.

Architectural lighting, incorporating the lighting units in the structure of the building, may be obtained from (*a*) panels in the ceiling; (*b*) panels in walls; (*c*) lighted columns; (*d*) lighted lintels; (*e*) cornice lighting.

In some instances the lighting effects are obtained by reflection from opaque surfaces—i.e., indirect lighting, while in other instances the light is obtained through translucent material, providing either semi-indirect or a direct form of illumination. In the former, the effect is achieved by reflection from white or coloured surfaces, while in the latter the quality and colour of the translucent material is important. The indirect method, however, inevitably suffers from the lack of vitality associated with this form of lighting, and, in general when employed, requires supplementary lighting methods to give complete satisfaction.

There is one important feature of these architectural methods of lighting which considerably assists the furtherance of good lighting—namely, that high intensities of illumination can be provided from light sources within the field of view which are of comparatively low brightness, and, in the best examples, any semblance of glare is avoided.

Another phase in architectural lighting is the use of light to modify the conception of space, and to give a sense of separation between one room and another; for example, by lighting the surfaces within the field of view in one room to a greater brightness than those in the adjoining room. Of course, a similar result is frequently obtained by the careful choice of colour schemes in adjoining rooms. An excellent example of this effect of separation produced by coloured lighting is to be seen at the Mayfair Hotel in a reception room and adjoining ballroom.

Architectural lighting is as yet in a very early stage of development, and some of the examples which I propose discussing only incorporate a little of this architectural lighting effect; while in others the lighted or luminous surfaces play a vital rôle in the character of the interior or exterior design of the building.

Interior Lighting.

LIGHTED CAPITALS.—An interesting effect has been obtained in some instances by lighting the caps of columns, and this method may be applied to provide general lighting in the interior when the columns are sufficiently close together. To be successful from an architectural point of view, the columns themselves have to be very carefully designed. Such a method of lighting has been introduced in the Accounts Section of the Shoreditch Electricity Showrooms, where lamps are introduced in the glassware at the capitals of the columns and elsewhere.

LIGHTED COLUMNS.—The illuminated columns on the ground floor of the main Berlin Electricity Showrooms form an interesting feature at the head of the stairway leading to the floor below. Although the columns are luminous, their position does not suggest that they are intended for supporting loads, and, hence, contrary to many examples of lighted columns, they do not convey the appearance of weakness. Wide metal bands form capitals to the columns, and these in turn are supported by subsidiary vertical and horizontal strips. Auxiliary lighting is provided from the upper portion of the frieze and the cornices, giving a general even brightness to the ceiling.

In other examples columns are built up from units of moulded lighting glassware on either side of doorways. This is a feature which can be incorporated when the main fabric of the building is completed.

In the following examples the lighting has become an integral part of the architectural design, and it is evident that the modelling of the room has been influenced by consideration of architectural lighting.

For instance, in the first class dining saloon on the "Ile de France," direct lighting is provided from the ceiling by 164 symmetrically arranged portholes, each housing a 300 W lamp and covered with thick yellow tinted glass. The strong lines of the room are not in any way hindered by the lighting system, but are, if anything, emphasised by the repetition of the lighting units, which are well placed in the ceiling and walls. The electrical consumption is 5½ W per sq. ft., and the lighting effect is that of brilliant sunlight.

An Interesting Effect.

In the first-class lounge on the same liner, the central portion of the ceiling is composed of squares, egg-shaped in section, and a lamp is placed at the apex of each. An interesting effect has been produced in this room by the introduction of a light fawn carpet below the central part of the ceiling. The furniture, too, is light in colour, so that, when brightly lighted from the ceiling, this portion of the room stands out in contrast to the surrounding carpet and furniture, which is carried out in dark browns and greens. Indirect cornice lighting illuminates the remaining parts of the ceiling, which, since it is textured, gives a rich decorative effect.

The Bar Bergère in Paris is an interesting example of interior lighting where the columns, ceilings, and counter are rendered luminous. The luminous surfaces assist in giving an atmosphere of gaiety.

In another instance, the main illumination is obtained from a recessed ceiling, the lamps being housed in coves, a warm and pleasing effect being obtained by the introduction of coloured lamps on various circuits.

The lighting of the Bar Chiquito, Paris, shows other interesting architectural lighting features. It is lighted by a luminous ceiling which is framed by a strong luminous band obtained from lamps placed in reflectors, housed above the broad dark frame of the ceiling. A large ovolo moulding, containing lamps, at the base of the ceiling, lights up the lower portion of the textured sides, and the gradation of brightness on the textured portion emphasises the lines on sloping sides.

Similar lighting methods can be applied to domestic interiors, and some excellent examples of modern domestic lighting were to be seen in the exhibition rooms at Waring and Gillows' recent Modern Art Exhibition.

In all examples of architectural lighting better results are achieved when the "architectural lighting" is supplemented by lighting details such as applied fittings.

I have, up to now, been dealing with purely architectural lighting as applied to interiors, but if logical methods of applications are evolved there is no reason why the lighting of building exteriors should not become a natural thing in the future. Already many daring attempts have been made, with remarkable success. While the daylight appearance of an interior is important (although there are many instances where the interior is essentially designed for artificial lighting), this question becomes of still greater importance when considering exterior design, and the best schemes are those which serve the dual purpose.

Lighted Building Surfaces.

While the main consideration, from a commercial point of view, is obviously that of giving a shop front added power of attraction, there is no reason why the architect cannot obtain both commercial attractiveness and architectural soundness by careful arrangement of lighted surfaces on the façade. In some instances, selected surfaces of the building may be lighted up from lamps concealed on the face of the building, and in others luminous surfaces may be provided by lamps behind translucent materials, such as opal or frosted glass. The character of the ordinary shop front only remains visible as long as daylight lasts, but, as soon as night comes, its identity vanishes, and it is in maintaining this identity at all times that architectural lighting can be successfully employed.

Exterior architectural lighting can be obtained by illuminating horizontal bands, the façade of the building being pro-

* From a paper read before the Illuminating Engineering Society on March 19th.

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vided with white horizontal surfaces, each provided with a cornice to accommodate lamps on the upper side. The daylight architectural lines of the building are thus emphasised at night time.

Other façades of a different character are almost entirely composed of glass, and yet, in spite of this fact, the designs do not suggest that the glass is supporting the building. The interplay of vertical and horizontal lines can be made to give the design an interesting character, the lettering on the frieze being both decorative, and valuable from an advertising point of view.

A 625 kW Marquise.

The Galeries Lafayette, Paris [see THE ELECTRICIAN, March 30th, 1928, p. 351] represents a well-known example of marquise lighting, and is interesting from its magnitude and commercial value. The marquise, which is 500 ft. long, consists of a strong metallic frame to carry the glass, in the structural design of which great care was taken to permit easy access to lamps. The construction of such a large marquise presented a difficult problem. Most of the glass in the marquise is ribbed on one face, and designs are made by cutting these ribs in certain parts. Some portions of the glass are left clear, while others are rendered diffusing by sandblasting, or acid-etching, all of which gives variety and relief to the material. The marquise itself requires 800 lamps of 500 W each, while the outer edge, which defines its shapes, uses 1 500 lamps of 500 W each. There are, in all, 2 600 lamps, totalling 625 kW, and when it is borne in mind that the lighting circuits are arranged to give blending of colour it will be readily appreciated that the marquise appears at night time as a colossal jewel. The new marquise of Messrs. Selfridges is, perhaps, one of the best examples in this country of decorative exterior lighting of this kind.

The Lotus Shoe Co. in this country have recently embarked on a rebuilding programme, incorporating architectural façades to the shops of some of their more important agents, and that in Edinburgh is of special interest. The windows are lighted from reflectors placed above vertically hanging sheets of glass, and immediately above them a valance, consisting of decorative glass, is lighted by a number of small lamps, while, of equal importance, the lighting arrangement for the façia is neatly designed.

Messrs. Riddington's Tea Shop in Dover Street, London, is quite a recent example of the lighted shop front. White opal boxes, between which is placed patterned glass in colour, constitute the main features of the design. Behind the projection of the white strips at each end a diffusing glass box has been placed, which, after dark, gives a red light. This installation, unfortunately, lacks effectiveness at night, due to inadequate illumination, but the daylight appearance is good.

Simultaneously with the development of modern architectural lighting practice there has evolved a range of lighting fittings to accord with these modern conceptions. One might almost term these fittings as the necessary detail to architectural lighting. The design of these fittings is free and generally simple in character, the form of the fitting predominating. A further characteristic is the fact that there is a predominance of glass, and the tendency to employ a number of small lamps in the place of a few lamps of higher wattage, and frequently these fittings present quite an extensive luminous surface of low intrinsic brilliancy.

While the best results are only obtained when these fittings are used supplementary to the main architectural lighting, there are many instances where modern interiors are exclusively lighted by such means. When used, however, to supplement the illumination provided from truly architectural lighting, these auxiliary fittings are not necessarily intended to augment the general lighting of the room, but are provided with a view to obtaining luminous decoration. Consequently, the question of the luminous efficiency of the fitting is, therefore, frequently secondary in importance to the richness and decorative effect obtained.

Materials.

The translucent materials employed for architectural lighting vary from the more complete diffusing material, such as opal glass, to the less completely diffusing materials, such as acid-etched or sand-blasted glasses. In fact, as a result of this new movement, glass in the hands of artists has shown commendable results, and designers are employing innumerable glasses of different textures and degrees of diffusion to give interesting designs. In some instances, plate glass is used as the basis, and is decorated in various tones by all the known arts of etching or enamelling. In Germany, sheets of opal glass are being extensively employed to obtain architectural lighting effects, and its more complete diffusing properties enable it, in many instances, to give better results than can be obtained from sand-blasting and acid-etching. The process of enamelling glass is being perfected, and it is possible that enamelled glass will be extensively used in the future.

In France, in particular, pressed glassware is being used largely for lighting purposes. This glassware has been introduced in the forms of cubes, cornice units, picture rail units, lintel units, dentil units, column units, etc., and may be built up to serve many functions. For instance, the cubes may be built up in any desired shape, forming a ceiling fitting floor standard, or a single cube may be incorporated in a table standard or wall bracket.

Unfortunately, illuminating engineers are considerably handicapped in the development of modern forms of illumination, due to the lack of accurate data on the diffusing properties of their translucent materials. If some figure of merit for diffusion were available for the different materials it would be possible to prescribe rules for positioning of lamps, their spacing, and their distance from the translucent surface to obtain visually even brightness or, at least, a known diversity of brightness.

Lighting Demonstration Room.

With a view to giving architects and engineers facilities to study these new methods of lighting, the E.L.M.A. Lighting Service Bureau has inaugurated an architectural department. This department has already collected much important data on the lighting of public and domestic buildings, and has constructed a new lighting studio where some of the many aspects of architectural lighting are portrayed. In its conception the studio does not represent any particular interior, but is intended to show the effect of light in relation to space, and the importance of combining the lighting as an intimate element in the architecture, and to this end various systems of lighting have been incorporated. [A brief description of this studio was given in THE ELECTRICIAN of March 15th, 1929, page 318.]

In conclusion, I would suggest that in architectural lighting we have a logical way of introducing artificial light, and although there are many people who are sceptical about this new outlook I am convinced that, even with its limitations, it is a step in the right direction. Many critics of architectural lighting confine their criticism to the materials employed, but I feel that criticisms of this character do not in any way nullify the value of the principles involved. For instance, it is quite likely that moulded or sand-blasted glass may be superseded by opal or enamelled glass, but the general characteristics of architectural lighting in providing lighted surfaces of low intrinsic brilliancy is undoubtedly a rational solution to the problem of clothing electric light, and the methods employed have definitely architectural value.

The whole movement is as yet in its infancy, and its successful application is contingent upon the closest collaboration between the architect and the engineer.

Books Received.

"Road versus Rail." By Christopher T. Brunner. (London: Ernest Benn, Ltd.). Pp. 128. 2s. 6d. net.

"Aladdin, U.S.A." By Ernest Greenwood. (New York and London: Harper Bros.). Pp. xvii+265. $2.50.

"Practical Primary Cells." By A. Mortimer Codd. (London: Sir Isaac Pitman and Sons). Pp. viii+127. 5s. net.

"Electricity Applied to Mining." By H. Cotton. (London: Sir Isaac Pitman and Sons). Pp. xi+625. 35s. net.

The Journal of the Institution of Electrical Engineers. Vol. 67, No. 386. (London: E. and F. N. Spon.) 10s. 6d. net.

"Electric Drive Practice." By Gordon Fox. (London: McGraw-Hill Publishing Co.) Pp. viii+421. 17s. 6d. net.

"The Practical Electrician's Pocket Book, 1929." Edited by F. H. Robinson. (London: Odham's Press.) Pp. 520. 2s. 6d. net.

"Electrical Transmission and Distribution." Vols. III and IV. Edited by R. O. Kapp. (London: Sir Isaac Pitman and Sons.) 6s. net, each.

"Whittaker's Electrical Engineer's Pocket Book." Edited by Mr. R. E. Neale. (London: Sir Isaac Pitman and Sons.) Pp. xiii+775. 10s. 6d. net.

"The Choice of Electric Motors and Control Gear." By A. Kershaw. (London: Association of Engineering and Shipbuilding Draughtsmen.) 4s. net.

"Handwörterbuch des Elektrischen Fernmeldewesens." Parts 1 and 2. (Berlin: Julius Springer). Part I, Pp. vii+830. Part II, Pp. iv+903. 192 marks.

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ARCHITECTURAL LIGHTING.

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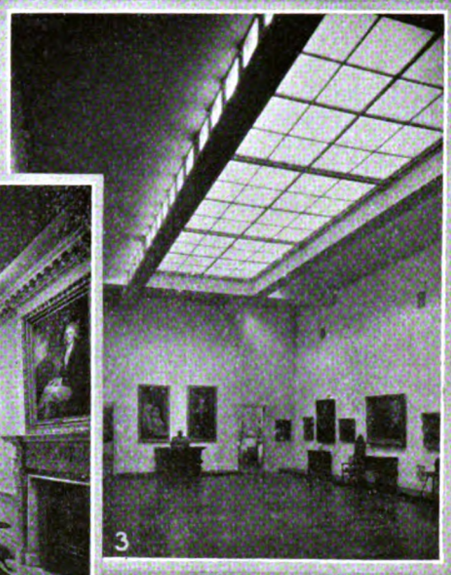
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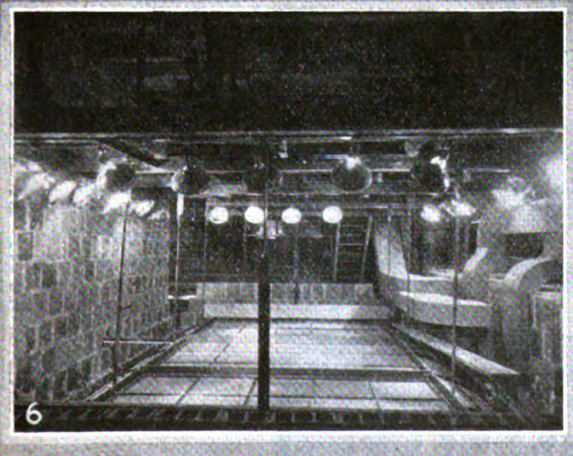
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THESE pictures, illustrative of architectural lighting in the Philadelphia Museum of Art, show :—(1) *Cove lighting in the Rotunda ;* (2) *A room with lighting through artificial windows and from ceiling cove projectors ;* (3) *a temporary gallery with artificial skylight and projectors arranged within the ceiling beams ;* (4) *a period room showing the emphasis which may be given to individual paintings by the lighting provided ;* (5) *main gallery illumination through artificial clerestory windows ;* (6) *arrangement of projectors over the artificial skylight in Fig.* 3 ; (7) *the projectors and housing for the artificial clerestory windows in Fig.* 5.

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SPRING-TIME WINDOW DISPLAYS.

Educating the Public on Positive Lines—The Spring-Time "Atmosphere"—Selling Rather than Showing—Individual Units versus the Crowded Window—Riveting Instead of Distributing People's Attention.

By A. EDWARD HAMMOND (Author of "Shopfitting and Display," and "Practical Aids to Retail Selling").

WITH the last E.D.A. Conference, "Organising for Increased Sales: Spring Cleaning Season, 1929," and the excellent paper read by Mr. H. W. Roberts fresh in their minds, electrical contractors will not surely need any further reminder of the importance of making their window displays not only as attractive as possible, but also that they must be imbued to the utmost extent with a spring-time "atmosphere."

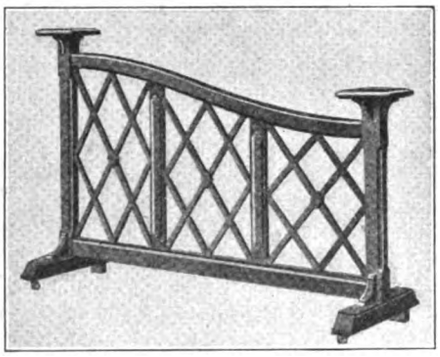


Fig. 1.—A useful display device for dividing a window into two sections.

In regard to the spring-cleaning appeal there are many angles of approach; but the main plank on which to build display schemes of the next few weeks is the positive assertion that modern electrical appliances eliminate the need for spring cleaning, with all its attendant disorganisation and worry. Alternatively, window displays might advantageously be carried out in conjunction with the message: "Use Electricity for Spring Cleaning this year, and thus avoid the necessity for Spring Cleaning Next Year." The inference drawn from this would be that with electrical appliances once installed, the possibilities of dust and dirt accumulating to such an extent as to justify an annual overhauling of the whole interior would be avoided.

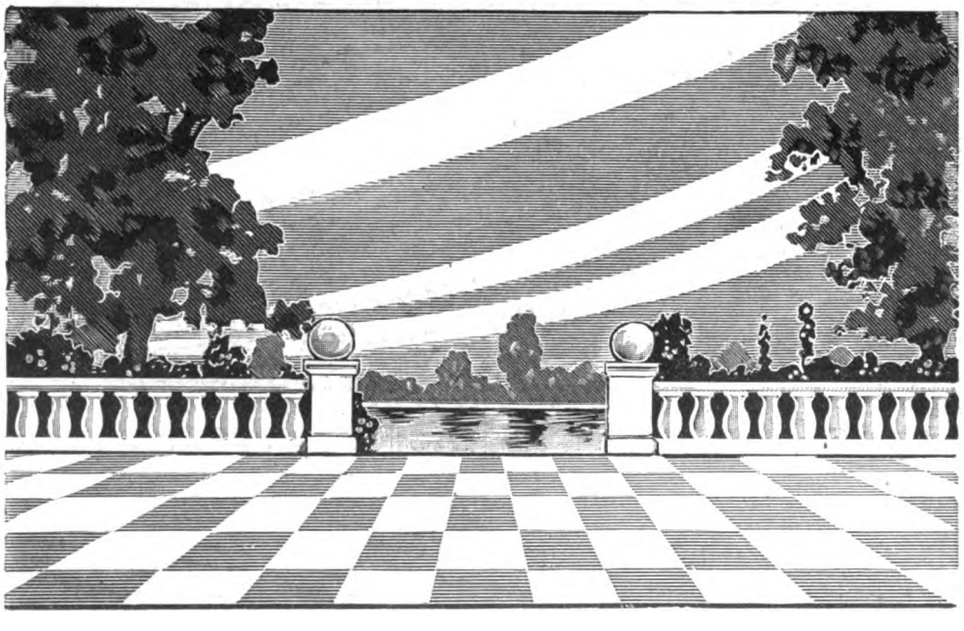
Mr. Roberts said in his lecture: "Spring Cleaning in an Electrical Age should be Non-Existent," but he thought that it would take two or three generations to kill this horrible annual upheaval. Well! It is in the hands of the contractors and the supply authorities, and, if they are content to leave it at that, the two or three generations will probably become two or three decades.

But why not a campaign to eliminate spring cleaning? It is not within my province here to suggest on what lines such a campaign should be run. It would obviously embrace all phases of selling, and one of the most powerful and effective educational forces would be the window display.

Neither contractors nor supply authorities yet realise the tremendous propaganda and direct selling potentialities of their windows. The window display still occupies an incidental place in the organisation of the business. The tendency is to regard it as a space which has got to be filled and made reasonably attractive, as well as being as representative as possible of the whole stock. That is an entirely wrong conception of the functions of the display window. It should certainly not be filled, and there is no earthly reason why any attempt should be made to show "something of everything." The only result is a confusion of the senses and desires of the passer-by, and a lessening of the possibilities of her making up her mind.

The average contractor evidently feels that he is not getting his money's worth out of his window if he does not use the display space to what he considers the best advantage, by arranging the electrical goods and fittings in such a manner that there is no "waste" space. The unit or group system has done a great deal in other retail shops towards breaking this habit of crowding the windows. Modernist display has achieved much more by making a proportion of the window dressers realise that unoccupied space is not necessarily wasted space. The open method of window dressing has now fortunately almost universally replaced the serried array of goods on shelves in rows, arranged to fill the window to capacity. It has even stopped some electrical contractors from *crowding* their windows, but it cannot truthfully be said to have prevented their *filling* them.

One of the aims of the contractor or the supply authority's window dresser in carrying out his displays should be to rivet the attention of the customer upon one line, for it is physically and mentally impossible to rivet attention upon a score or more of different classes of goods, no matter whether they are electrical or textile or tonsorial or gastronomical. On the contrary, the effect is to scatter it, or to distribute the window gazer's interest to such an extent that it dissolves, and the person concerned passes on unimpressed and unconvinced. If customers browse for any length of time over a shop window,



AN example of the scenic background, a most useful accessory for spring-time windows. Such display aids involve no work in preparation and are available in roll form on stout paper. The usual dimensions are 96 in. by 60 in.

After, say, a fortnight's use they can be rolled up and stored away quite easily until they are required again.

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they generally continue to browse on to the next window. There are many people about who are hardened window gazers, to whom the shop window is nothing more than a means of entertainment, and it is perhaps not sufficiently realised that *not* every window gazer is a potential customer.

It seems there is a danger to-day of the shop window becoming a means of free information and entertainment for the public at large. Perhaps it is a tendency that is overlooked by the average electrical contractor in arranging his displays, and it is highly probable that this tendency would be eradicated if he or his display man would concentrate more upon *selling* in his window and less upon *showing*.

The contractor knows, or should know, exactly the class of customer to whom he wishes to make an appeal, for even in mixed districts it should not be difficult to determine a window display policy by striking a happy medium in the exhibition of electrical fittings, with an occasional incidental introduction of a high quality item. If the window displays are confined to a very few lines of the type most likely to appeal to local residents, in conjunction with, say, a background of seasonable suggestiveness, instead of being crammed in an attempt to make them representative of stock, as well as demonstrative of the contractor's professional capacities, he would have less window gazers, but more customers. He would eventually teach people to browse inside his premises instead of on the pavement outside.

Window Dividers.

It occasionally happens that the electrical contractor has sufficient window space to justify its division into two sections so that seasonable lines can be shown on one side and general everyday selling accessories in the other portion of the window. This can best be effected by the use of a window divider of the type shown in Fig. 1. This is preferable to panelling across the centre of the window, which has the effect of darkening portions of the display and frequently necessitating increased use of light.

The window divider comes in useful, too, when it is desired to make two distinctly different appeals in the window, say, one for high-class electrical equipment and the other for medium grade lines. Another advantage of the divider is that it can be used as a temporary window fitting, and is easily removed if a larger demonstration-display necessitates the whole space in the window being given up to one show.

A suggestion for a background with a decided spring-time appeal is shown in Fig. 2. In conjunction with such a background, labour-saving electrical household equipment should be displayed, with a sales message couched on the following lines: "Why slave indoors when the joys and beauties of spring are calling you outside? Instal electrical equipment and eliminate household worries, and thus free yourself for the enjoyment of spring."

Reference has been made before to the value of these scenic backgrounds. The great point about them from the small contractor's point of view is that they involve no work in preparation. They are supplied in roll form on stout paper, size 96 by 60 in., and need not be scrapped after they have had a run of a week or so in the window, for they can be rolled up and stored for a time, and then brought out again in conjunction with an entirely different range of electrical supplies.

The possibilities of plywood, laminated panelling, fibreboard, and similar materials should not be overlooked by the electrical contractor. These materials may be obtained in suitable sizes for converting to window enclosures. One popular range is supplied in the following dimensions: $\frac{3}{16}$ in. (standard) 3 ft. and 4 ft. widths, and lengths of foot multiples of from 6 to 16 ft.; $\frac{1}{4}$ in. (extra thick) 3 ft. and 4 ft. widths, and in lengths of 2 ft. multiples from 6 to 16 ft. This material has a matt surface which will take any paint, and can easily be sawn or cut into any shape or design desired.

Some of the modernist display fittings obtainable to-day may be described as windows inside windows, for they enable individual items or small groups of articles to attract attention solely to themselves, and thus to eliminate the wandering, hesitant, half-interested attitudes of the person who pauses to examine the window, and to inspire instead a conscious and concentrated attention which results in interested and undistracted study of the lines displayed.

It is interesting to notice that the British Electrical Development Association favour this style of display fitting. The display layouts and materials with which they are willing to supply contractors are characterised by simplicity. These, comprising such display aids as cubes, triangular blocks, black crêpe paper, and "cut-outs," lend themselves admirably for use in conjunction with displays limited to only two or three electrical specialities.

In this connection it may be mentioned that there is one new display fitting which the electrical contractor will find is worth noting, for, being illuminated, it has a suggestiveness about it which adds to its practical value. This is in the form of a luminous block a few inches square, which can be used singly or in numbers to form a support for goods displayed, or can be used in constructional form as a background, or painted with any lettering to convey the message of the window.

A Personal Analogy.

Perhaps a personal analogy may help to bring home more clearly to the electrical contractor or supply authority's display or showroom manager, who is still doubtful of the wisdom of reducing the contents of his window to a minimum, the importance of producing a concentrated effect in his displays. Let him walk past a hoarding covered with posters, remembering that he is in the same relation to the poster advertiser as the people inspecting his own window are to him, and then see not only how many posters he can recall, but how many have aroused his special interest or created in him any desire for possession. The probability is that he will have a blurred impression of the whole, and not any clear details of any individual features.

Then let him walk past one of the isolated groups of posters erected by The Empire Marketing Board, or glance at a smaller more tastefully arranged hoarding containing, say, six posters (of which, unfortunately, there are all too few). He will find that individual points stand out much more clearly in his mind after inspecting the last-mentioned range of posters.

Perhaps an even better and more convincing experiment is for the electrical contractor to apply the test to other shop windows—to a footwear dealer's or furnisher's windows, for example—any trade entirely remote from electricity, but containing goods which appeal to him purely as a private citizen.

If the contractor notices, as a "man in the street," the types of windows which induce him to buy, or, at any rate, to enter a shop, simply and solely by their power in arousing his interest, he will almost invariably find that they are the ones in which his attention has been drawn to one article or to a small group of articles.

As a final test he might have a special line displayed for a given period as a main feature in a window containing not more than three or four other articles, and then displayed for the same period in a well-packed window. Let him notice which window sells the most of those lines, and also how far his general trade is adversely affected by the reduced display. He will almost certainly find that, far from having an adverse effect, it will have had the result of bringing a steadily increasing number of people into the showrooms and will have been productive of a more satisfactory figure on the sales side.

I am indebted to Messrs. Samuel Elliott and Sons, Ltd., for the loan of the first illustration, and to Messrs. Dudley and Co., Ltd., for the second illustration.

TUNGSTEN FILAMENT LAMPS.

Chief Features of the Revised British Standard Specification.

THE British Engineering Standards Association has recently issued a revision of the British Standard Specification for Tungsten Filament Electric Lamps.

The chief features of this revision are the reduction in the tolerances allowed on the light centre lengths, while for lamps up to 100 W, the light centre lengths themselves have been reduced. The overall length of the lamp and the maximum neck diameter, together with the distance from the contact plate of the cap at which the measurement of the neck diameter is to be made, are also given. The light output of lamps and efficiency are now given in terms of lumens only, excepting that, in addition to the lumens output, the nominal mean spherical candle power output is given.

A change has been made in regard to the rating of vacuum traction lamps (series burning), the amperes at rated voltage being now adopted as a standard in place of volts at rated current.

Copies of this specification (No. 161–1928), may be obtained from the Publications Department, British Engineering Standards Association, 28, Victoria Street, London, S.W.1 price 2s. 3d., post free.

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ELECTRICITY ON TYNESIDE.*

Pioneer Electrical Firms—The North-East Coast Exhibition—Bearing of Pulverised Fuel and Marine Electricity on Future Prosperity.

By R. E. ROBSON, M.I.E.E.

HALF a century will cover electrical development on Tyneside. In the '80's we had those pioneer electrical manufacturers, Holmes, with his "Castle" dynamo and the first quick-break switch; Scott and Mountain, who developed colliery electrification; Clarke Chapman, who have done so much towards applying electricity to ships' auxiliary gear, and then Parsons, who left the latter firm to revolutionise the generation of electricity and ship's propulsion. These firms, along with the Ediswan Lamp Works at Benwell, and the Sunbeam Works at Gateshead, employed amongst them a considerable number of men, and then again, there was the electrical department at Elswick Works in old Lord Armstrong's time, which was of considerable size and importance.

Where Tyneside Led.

In the past Tyneside, along with the north-east coast, has been in advance in electrical development of any other area in the country, perhaps in Europe. During the last decade we have seen electricity still advancing; those large works of Reyrolle's at Hebburn have extended and extended to meet the requirements of the finest control gear manufactured. Colliery winding, coal screening and many other applications of electricity have been adopted owing to cheap power being available, and great strides have taken place in domestic heating and cooking, as well as the wiring of many thousands of small houses on assisted wiring schemes. These undertakings have all been in advance of general practice, and have now become general.

Large capital has been laid out by the great electricity supply undertaking here in research work, experiments and trials, and heavy prices have been paid for specially designed material and apparatus for entirely new electrical departures. Much of the plant was bought at the top of the market when the demand for current was great, which saddles an older and enterprising undertaking with heavier capital charges than those concerns that are developing now, or have recently developed.

We on Tyneside are not going to see ourselves as busy electrically in the future, compared with other areas, as we have been; we are nearer saturation than in other places, and therefore have less scope for business. I say nearer saturation advisedly, because there are, in my mind, many developments still untouched electrically. We cannot hope for much extension in collieries, shipyards or engineering works, as few on Tyneside use any other power than electricity.

I am afraid that, even in rural electrification, there is little prospect of much development. Northumberland covers a large area, but most of it is sheep farms, and Durham is practically industrial. For rural electrification, we must get into fertile areas, where cultivation is very intensive.

At the present time, owing to the abnormal depression of trade in the district, the electrical industry is not normal, and will suffer for the time being. We have certain advantages at the present time; let us make the most of them, and get current-consuming devices adopted where they can be afforded, and perhaps even where they cannot be afforded, by the use of hire-purchase arrangements.

Tyneside must, for the next few years, leave no stone unturned to get business; it must induce everyone to use electricity for every purpose. Notwithstanding all our troubles and bad trade at the present time, we have put our backs to the wall, and have gone in for a great and extensive scheme, namely, that courageous enterprise, the North-East Coast Exhibition. This Exhibition will show to the public electricity in all its applications, and will let them see that it is vital to the community for health's sake, for cleanliness, for convenience, and that its use is necessary if our industries are to hold their own against competition.

The North-East Coast Exhibition should give the industry an impetus. Those who have not seen the interior cannot grasp the magnitude of the enterprise, and those who have the good of the electrical industry on Tyneside at heart must make it a success: failure would set us back for years, but there must be no failure.

What is going to be the position of electricity on the north-east coast in future? It seems to me that current will not be cheaper here than elsewhere. The cost of coal, with the great improvements in generating plant, is now a small fraction of the cost of supply, and our facilities will be no better than elsewhere. Works, such as those of the Imperial Chemical Industries at Billingham, who are using a large amount of current in a confined area, may find it profitable to open up in the coal area, but for the average manufacturer, anywhere will do now, providing he gets the water supply and railway sidings required.

I would like to offer a few suggestions which may seem very far-fetched and improbable, as to how the electrical industry may progress here and hold its own, and perhaps even keep ahead, as it has done in the past.

The outstanding advantage we have is the coal field. The electro-chemical processes, such as those adopted by the Thermal Syndicate which is against the wall of Carville, and where practically no distribution costs are incurred, may be developed if run in conjunction with power stations or waste heat or coking plants.

My view is that we should look to pulverised fuel for the salvation of the north-east coast. Pulverised fuel is only in its experimental stages, but it has a great future. Surely, through research and experiment, means will be found for storing and transporting it. If coal could be pulverised at the pit, or even below the ground, and sent by pipe lines to the bunkering docks, pumped aboard the ships, stored in our coaling stations, this would mean prosperity again for the north-east coast, and not only would it be an advantage to our district, but it would be an enormous advantage to the financial position of the country. Millions of money are now spent in oil, and instead of this money going abroad, it would be spent at home.

We are now waiting for an invention to find a method of storing and transporting coal-dust as easily as oil, and if this is done the north-east coast has a great future.

Incidentally, I notice that a British patent has been issued to the B. and L. Powdered Fuel Co. which covers the complete system of bunkering and unbunkering powdered fuel with inert gases, whether on land or sea, which renders the handling of all classes of powdered fuel absolutely safe from the risk of spontaneous combustion or explosion.

The Outlook.

It will be wondered why I am digressing on coal so much, but I am leading up to the point as to whether I think Tyneside can advance and again become the leader in an important branch of the electrical industry. My opinion is that it will be marine electrical engineering, with coal-dust either used as fuel for an internal combustion engine or to fire boilers for marine propulsion, the latter method being first, that we shall probably have to look to.

If speeches recently made by Sir Wm. Seager and Sir Philip Nash are referred to, they both hold out a great prospect for electrically-driven ships. Lord Kylsant stated at the recent Marine Engineers' dinner, that the mammoth White Star liner being built at Belfast was to be electrically driven.

Surely, Tyneside that built the "Mauretania," has works like Parsons, who built the largest of generators, shipyards that have built the largest battleships in the world, is equipped for marine electrical engineering. Why should Belfast or the Clyde take the lead? Why should these generators be built elsewhere, when everything, to say nothing of switchgear, could be built on Tyneside? There is scope for an enterprise such as this. Can Tyneside not respond? Surely an area that has produced such a wonderful electricity supply undertaking should not be backward, considering its facilities and experience, in developing electric propulsion at sea?

Consider what scope marine electrical propulsion has. Look at a liner or battleship. They would be complete power stations, super power stations, in many cases, 50 000 to 100 000 kW, with all motors and auxiliary gear. What an enormous amount of work and outlay of money, which could come to the district—engines, generators, motors, control gear, wiring, fittings, lamps—something for everybody.

We must look to marine electrical engineering and perhaps to railway electrical engineering—the self-contained unit in the latter case—for our future developments.

* Extracts from a lecture to a North-East Area Conference of the E.D.A. in Newcastle on March 20th.

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ELECTRICAL INSTRUMENTS AND METERS FOR BULK SUPPLY & GENERAL MEASUREMENTS.*

Indicating and Recording Instruments—Integrating and Special Meters—Summation Metering—Instrument Transformers.

By C. L. LIPMAN, A.M.I.E.E.

THE paper gives a general survey of modern indicating and recording instruments and integrating meters for various purposes. Some particulars are given regarding recent improvements in induction type instruments and in phase-meters. Special meters are described for the purpose of special tariffs; together with methods used for obtaining summated consumption and demands. Finally, a few remarks are made regarding instrument transformers.

The rapid growth of electricity supply in "bulk" has brought to the fore the question of its proper measurement and control. The problems of correct measurement and registration of the fundamental electrical quantities have occupied the thoughts of power engineers and instrument makers for a long time, with the result that this branch of electrical engineering is now in a state of high development.

Recent Improvements.

The object of this paper is to describe some recent improvements in electrical instruments and meters for bulk supply and general measurements, and it is hoped that it may tend towards a better understanding of good metering practice.

For the measurement of electric current and pressure, moving-iron and induction type ammeters and voltmeters are recommended.

Considerable advances have recently been made in the design and construction of induction-type instruments, with the result that they can now be supplied with an inherent accuracy higher than B.E.S.A. first grade.

The following technical particulars relate to a new induction ammeter manufactured under the author's patents, and wound for 5 amps 50 cycles.

By way of comparison similar data are given for the ordinary shaded-pole type of induction ammeter.

	Nalder-Lipman improved induction ammeter.	Ordinary shaded-pole induction ammeter.
(a) Change of reading for a rise or fall of 1 deg. C. in temperature..	0·015%	0·4%
(b) Change of reading for a change of 20% up or down in frequency.	0·4%	12%
(c) Change of reading after being left in circuit for 2 hours ..	0·5%	3%
(d) Weight of moving parts ..	9 gms.	30 gms.
(e) Volt ampere consumption for full scale deflection	4	10

The new induction voltmeter and wattmeter possess similar advantages as regards accuracy and construction.

Wherever power-factor regulation is attempted, a direct reading power-factor meter is necessary, as it is out of the question to calculate the power factor from the readings of wattmeters, ammeters and voltmeters. The improvement of power factor of an a.c. system is a question of great importance, as a low power factor is extremely undesirable for several reasons. In the first place, the cost of the supply mains is largely increased if, for a given kilowatt load, the power factor is low, and the losses in the mains are likewise increased. The alternators can give a larger output at a high power factor, while at the same time the inherent regulation of the machines is better, the variation of the voltage with changes in the load being much less at a high power factor than when the power factor is low.

Satisfactory direct reading power-factor meters are of the moving-iron type working on the "alternating field" (as opposed to the "rotating field") principle. The distinguishing feature of these phase meters is that owing to their special construction no resultant rotating field is set up, and, consequently, no "rotational drag torque" upon the moving-iron system is produced, and the disadvantages and errors arising from that torque are eliminated.

For important polyphase circuits unbalanced load pattern instruments and meters should be specified.

Whilst most of the leading switchgear manufacturers have adopted this policy, the author is aware of instances where, by reason of economy, balanced load power-factor meters are being coupled together with unbalanced load wattmeters. The method of using a single-element meter assumes equality of current, pressure and phase angle on the three phases, a condition which is very rarely obtained on polyphase power circuits.

Considerable developments have taken place in chart recording or "graphic" instruments. In addition to recording ammeters, voltmeters and wattmeters, the details of which are well known, power-factor indicators and frequency meters have been introduced. Combination instruments are also obtainable for such purposes as feeder logs, etc., multiple pen recorders for telephone work, and revolution recorders or speed indicators, which generally consist of a magnetogenerator and a recording voltmeter.

Recorders have been specially adapted for fitting to electric trains, and a special system of cradle mounting has been devised which protects the instruments from the effects of excessive vibration.

These recorders give valuable information, and tend to promote the efficient and economical running of the trains.

With regard to the method of marking the chart, the original method was to fix a pen at the end of the pointer arm. The disadvantage of this method lies in the fact that errors due to the variation of the amount of ink in the pen can never be wholly eliminated. Various methods of getting over this difficulty have been adopted by different makers, amongst which the following serve as examples.

A tapping mechanism by which the chart is inked at regular intervals. The inking device consists of a short length of fine tube fixed to the end of the pen arm, one end of which moves in a trough, at the back of which is an inking pad; the other end taps on the chart at regular intervals, generally a quarter or half minute, and is depressed on to it by a bar actuated by an electro-magnet, thus (simultaneously) causing the ink to flow in the tube from the pad and making a dot on the chart. If the time intervals are sufficiently short, the record differs little from a continuous line.

Recording Methods.

The advantage of this method of inking is that the pen is not continuously in contact with the chart, and thus "pen to paper friction" is eliminated. This ensures accuracy, and is particularly valuable in the case of instruments wherein the forces are necessarily small, as in recording frequency meters and power factor indicators.

Another type of recording instrument which also gets over the error due to variation of ink in the pen was originally introduced by the Esterline Company of Indianapolis, and has since been further developed in this country by various instrument makers.

In this type the pen arm consists of a fine tube which is normally full of ink, one end moving in a vessel containing the ink and the other end over the chart; the error due to variation of the amount of ink is thus eliminated.

With regard to charts, there has been little alteration in these in the last few years.

Generally speaking, the hour, or time, lines are curved. Some time ago a recording instrument was patented by Murday, which gives rectangular co-ordinates.

Generally speaking, an integrating meter may be derived from the corresponding indicating pattern of meter by substituting for the spring control and pointer and eddy current brake and a counting train respectively. Practically all modern a.c. integrating meters operate on the induction principle, and are capable of giving a high degree of accuracy under working conditions. The most important integrating meter is the energy meter, upon the kWh readings of which is based the fundamental Board of Trade unit tariff for electricity supplied. For the meter to read correctly, the speed of rotation of the rotor must be proportional to the power in the circuit in which the meter is connected.

Numerous forms of construction of energy meters have been devised, the principal differences in construction being confined chiefly to:—

1. The arrangement of the operating electro-magnets.

*From a paper read before the London Branch of the Association of Mining Electrical Engineers.

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2. The methods of obtaining the correct phase difference between the fluxes of the series and shunt windings; and
3. The method of compensating for friction.

Wattless component or reactive meters are similar to watthour meters; the only difference consists in the phase relation between the magnetic fluxes. In the wattless component meter the flux from the coil energised at the full pressure lags to such an extent that there is a phase displacement of 180 deg. between this field and the applied pressure producing it. For the purpose of registration of total kVA hours several methods have been devised, most of which are, however, of an approximate nature. The torque of the induction type a.c. meter changes with the power factor according to a sine function. As a result, the torque is practically constant in the neighbourhood of the power factor at which it is a maximum.

The instrument registers the kVA hours with a relatively small error, irrespective of the power factor. By suitable choice of the displacement between the active shunt flux and the impressed voltage, the maximum value of the torque can be arranged to occur approximately in the middle of the power factor range for which the instrument is designed. These meters are, therefore, only suitable for a fixed range of power factor.

Another method of arriving at the total kVA hours is by the employment of two meters, one of which is a standard energy meter and the other a wattless component meter. The total kVA hours is the vectorial sum of the two component readings taken over a given time interval.

The "Trivector" Meter.

A more recent development of kVA hour meter is the "trivector" meter, in which an integration of kVA hours is obtained by a mechanical combination of an energy meter with a reactive meter, and is suitable for use over a wide range of power factor and voltage. In another interesting construction of kVA hour meter the revolutions of these two meter rotors are transmitted to a suspended sphere, which rotates at a speed and in a direction representing

$$\sqrt{(WH^2 + (RVAH)^2}$$

A floating gear is arranged to take the drive off this sphere at the point where the peripheral speed is greatest, and this drive is transmitted to the maximum demand indicator mechanism which records the maximum demand in intervals of 15 or 30 minutes, both in kW and kVA.

The type of meter adopted for the metering of bulk supplies depends largely on the tariff which is selected for the supply. The usual form of tariff for a supply of this nature is one which includes a term proportional to the maximum demand on the system. Taking kilowatt maximum demand as the first example, the usual induction meter is used together with a Merz-type maximum demand indicator. The maximum demand is averaged over a certain definite period, which is controlled by a contactor. This contactor may be either self-contained with the meter, or separate.

As an alternative an averaging recorder is available. When the maximum demand is required to be in kVA a separate kVA and maximum demand indicator must be employed, or as an alternative the trivector type of meter can be used. The latter incorporates both kilowatt and kVA records.

A further alternative tariff is based on the average power factor or on the minimum power factor, as the case may be, given by the consumer. For the former tariff a reactive component meter or recording power factor meter is used in conjunction with the kWh meter, and for the latter a minimum power factor indicator is used in conjunction with the kWh meter. In connection with large supplies chart recording maximum demand meters of the "Printometer" or "Maxigraph" pattern are particularly recommended. Besides integrating the total energy consumed, they record the units consumed during successive periods, so as to demonstrate exactly the load conditions during each individual period of maximum demand. In connection with an interchange supply two simple watthour meters with ratchet devices can be used, one recording incoming and the other outgoing power.

A type of supply often met with in connection with bulk supplies is that where two or more feeders are used, and the load from each of these feeders has to be summated in order that a true maximum demand may be obtained. If the several circuits are supplied from a common voltage, then the secondaries of the current transformers are often connected in parallel to the current coils of the meter, the latter of course being wound suitable for the sum of the secondary currents. A better solution of this problem is to use meters compounded on to a common spindle. Four-element meters have been specially developed for this purpose. They integrate the total energy and simultaneously give an indication of the combined maximum demand in two or more independent circuits.

Numerous Applications.

Messrs. Nalder Brothers and Thompson have produced a four-element recording wattmeter of the improved induction type giving a uniformly divided chart combined with large working forces. This recorder finds a number of different applications, some of them being :—

(*a*) The metering of two independent supplies, as for example, sectionalised busbars, or a pair of feeders not paralleled.

(*b*) The metering of two supplies, one three-phase three-wire, and one three-phase four-wire.

(*c*) The metering of two supplies at different frequencies.

(*d*) The metering of two supplies at different voltages.

(*e*) The metering of three supplies, say one three-phase and two independent single-phase supplies.

The indicating pattern of the four-element wattmeter is fitted with a maximum demand pointer and the great utility of such an instrument in connection with multi-feeder supplies is quite apparent.

Where more than two polyphase circuits are involved special summation equipment becomes necessary.

In America such summation is carried out by the "impulse" method, but in the present author's opinion a more accurate, simple, and technically sound method is to convert the a.c. quantities to correspondingly proportional direct current voltages or currents and then add up the latter by means of ordinary d.c. meters.

Switchboard instruments and meters are, as a rule, working in conjunction with instrument transformers. The chief point in connection with an equipment of this nature is the type of current transformer employed. Considerable errors can be introduced to the metering equipment as a whole if this point is not carefully looked into. Generally speaking, for best results the nominal volt-ampere rating of the transformer should be as high as possible consistent with the requirements and the secondary burden as low as possible. Precision current transformers are now available having nickel-iron cores. The greatest difficulty arises when "bar" type or "bushing" type current transformers are employed with limited primary ampere turns.

Straight-through Metering.

Some time ago the author had been considering the problem of straight-through metering on extra-high tension systems with primary currents as low as 10 A, in conjunction with Messrs. Nalder Brothers and Thompson, Ltd., and Messrs. A. Reyrolle and Co., and we concluded our investigations with the development of a new series of highly efficient low volt-ampere consumption instruments, including ammeters, wattmeters, power factor meters and protective relays, the current windings of which were made suitable for a secondary current of 0·5 A instead of the usual 5 A. This recommendation has now been approved by the Central Electricity Board for the British grid.

The advantages arising from 0·5 A as full-load secondary current instead of 5 A are manifold. The 0·5 A metering improves the performance of the bushing transformer, permitting a finer turn adjustment; it reduces the secondary burden; it reduces the losses in the long run of connecting leads; it enables accurate measurements to be carried out in the usual manner on extra high tension systems; and it has led to the development of a new and improved series of instruments, requiring very low power consumption and giving exceptionally high working forces, control springs of normal strength being employed.

In order to keep the size and weight of the low ampere-turns bushing transformers within reasonable limits, it is further recommended to make the magnetic core of such transformers of metal laminations.

From the above considerations it is clear that "straight-through" metering in general, and that metering of high-tension bulk supplies in particular, can now be carried out economically and with a high degree of accuracy.

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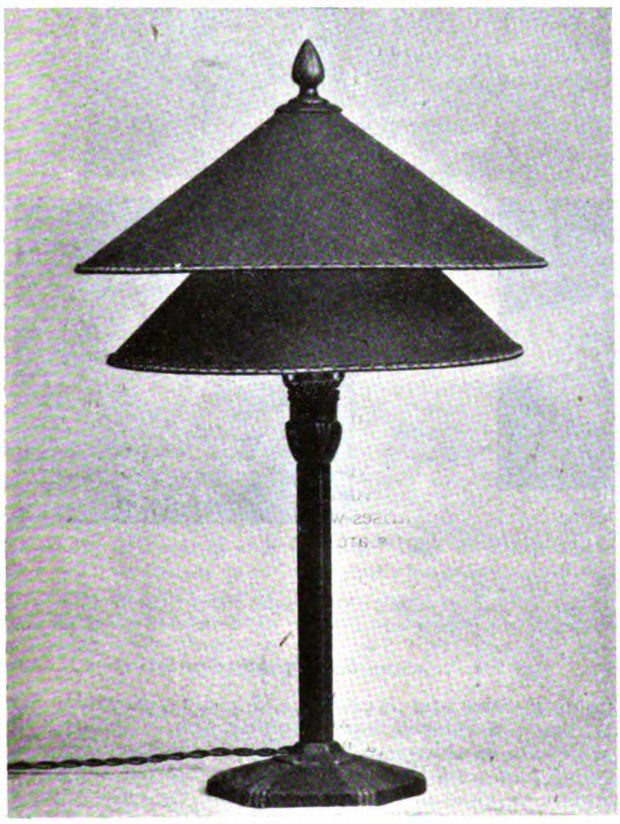
MODERN LIGHTING FITTINGS.

Beauty as a Medium for Light—Lovely Children of the Ugly Gas Bracket—Recent Tendencies in Fittings Design—Illuminated Ornaments.

FOR several years past we have called attention to the need of a higher standard of attractiveness for fittings designed as coverings for the electric lamp used for interior lighting. Over two years ago we saw, and explained, symptoms of a coming definite change in the methods of domestic and other interior lighting, and now, in 1929 it is generally recognised that it is no longer necessary to have sources of light which do not give real pleasure to the eye both as lamps and as daytime decorations. The following notes, compiled after a brief tour of some of the London showrooms should, therefore, be of interest to those supply authorities and contractors who desire to get away from the more conventional lighting styles.

For the initial introduction of some of the best forms of fitting, credit is largely due to M. Réné Lalique, an artist in glass, who has produced, in Alsace, a surprising variety of exquisite pendant and appliqué fittings—moulded, engraved, coloured.

Breves' Lalique Galleries carried out the lighting in the principal rooms of the Hotel Cathay, Shanghai. In the dining room were used: "Swallows" hanging bowls; "Birds"



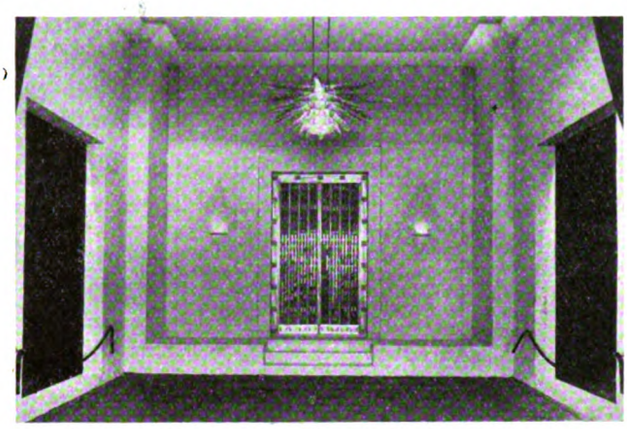
A novel table lamp by Best and Lloyd.

wall brackets, the design consisting of an elegantly shaped lower vessel containing water, through which the light passes, with an upper purely decorative panel depicting birds swooping down to drink; and "Ladies of the Fountain," set into the pillars of the room. The last-named were designed, as each symbolising a river of France, for the Exposition des Arts Décoratifs of 1925; a remaining one is on view at the showrooms, 2, Basil Street, Knightsbridge, London, S.W.3.

In the bedrooms, opalescent "shell bowls" were installed. These nearly hemispherical bowls have decoration in the form of four shells, their points meeting at the centre to produce an effectively simple effect. Bathrooms were fitted with "Stalactites lights," in ice colour—appropriate for Shanghai's summer.

Sir Philip Sassoon's ballroom at 25, Park Lane is lighted with four "Sunflowers," which are spherical pendants. Each division of the convex surface is of brown glass engraved with a sunflower; orange frosted Osram lamps are used.

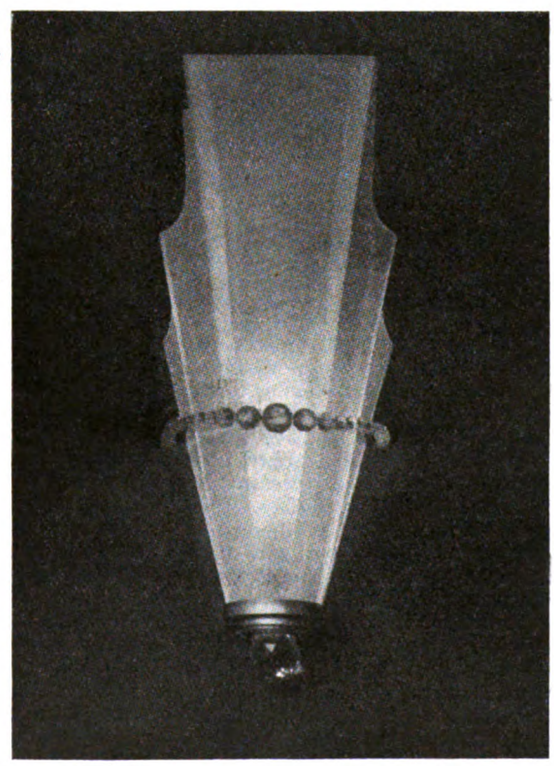
Table lamps are catered for by the adaptation of coloured vases of marvellously detailed designs, which form the bases. The vases are filled with water, which gently reflects the downward rays from the bulb. A fascinating development is seen in illuminated ornaments. There is a carp, constructed to stand on a bronze base which has at top a glass disc (for which any colour may be used), with the result that the 40W lamp



A modern décor showing the "Lustre Piccadilly" hanging lamp by Lalique.

in the base can impart to the fish above a sea-green or any other shade.

Best and Lloyd, Ltd., who are now located at 40, Great Marlborough Street, W.1, are doing good work in adapting Continental ideas to conform with the architecture of general British interiors. "Firelight" glass, manufactured by the firm, is used effectively, and a hand-spraying process on obscured rimpled glass produces panes with graduated tones—delicate orange merging into pale yellow. The light is said "to flatter everything and everybody," and this claim is certainly not without foundation. Simplicity is the basis of



A delightful wall fitting by Louis Dernier and Hamlyn.

most designs. An example of the wall brackets conceived by the firm, in conjunction with Mr. P. Morley Horder, F.R.I.B.A., for Nottingham University is illustrated. In such brackets brass supports are generally used for the glass panels.

In the showrooms at Magnet House, Kingsway, W.C.2, the General Electric Co., presents many interesting fittings in "Perlique" glassware; many of the designs employ polygona

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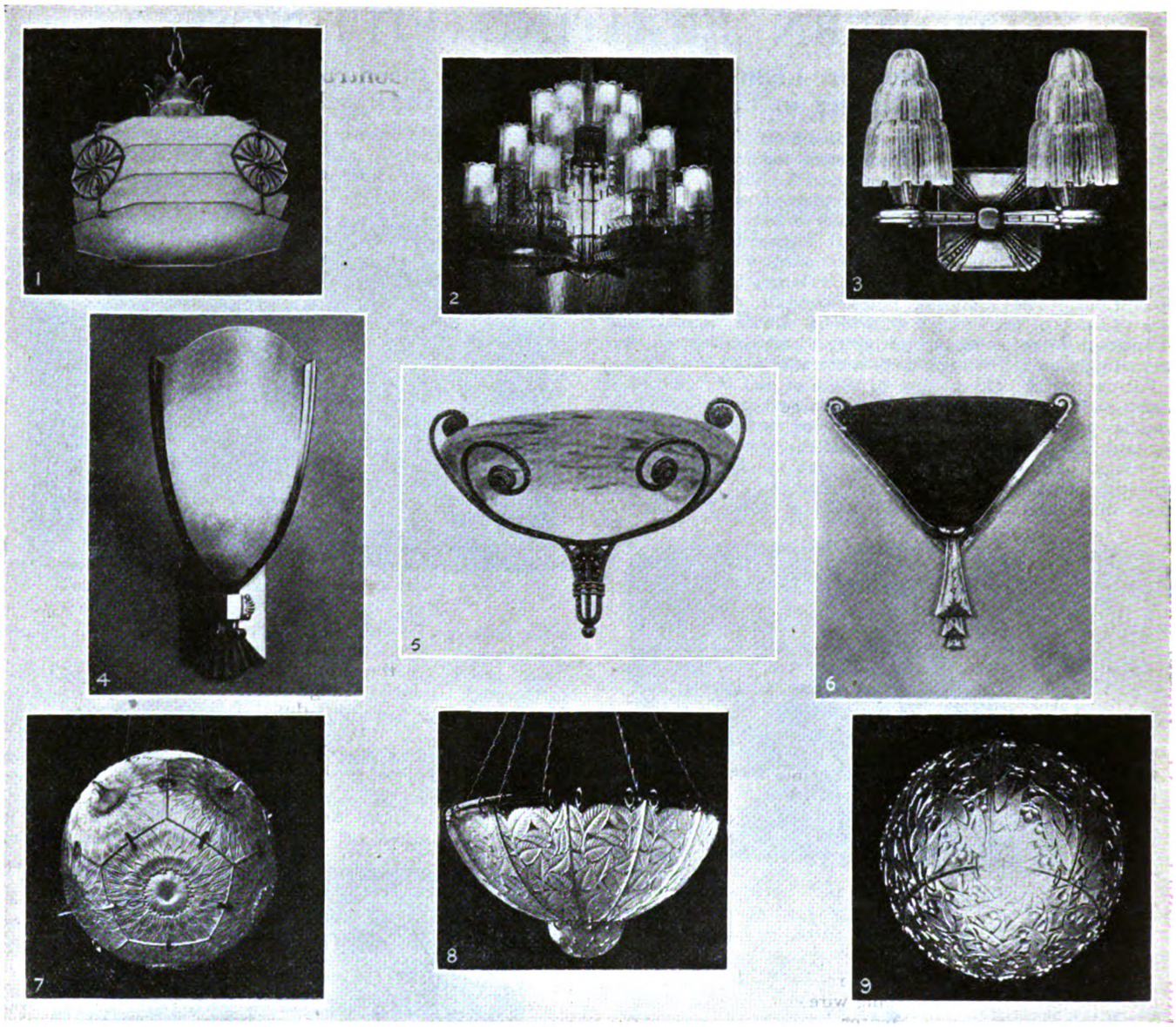

MODERN LIGHTING FITTINGS.

THESE pictures of modern lighting fittings show :—(1) *The Neolux* (*Louis Dernier and Hamlyn*); (2) "*Lustre Paris*" (*Lalique*); (3) *Applique bronze fitting* (*Borghys and Ling*); (4) *Wall plate with obscured rimpled pane* (*Best and Lloyd*); (5) *Bracket in etched glassware* (*General Electric Co.*); (6) *Wall bracket on enamelled wood frame* (*Osler and Faraday*); (7) "*Sunflower*," *a design favoured for ballroom lighting* (*Lalique*); (8) "*Hornbeam*" *bowl, available in grey or brown* (*Lalique*); (9) "*Mistletoe*," *another popular spherical design* (*Lalique*).

panels in accordance with modern artistic ideas. Diffusion is carefully studied and some of the colour schemes are distinctly interesting. A particular forte of the G.E.C. is architectural lighting.

An effective and inexpensive innovation is found in the "Icicle Shades" of H. G. Ascher, Ltd., Manchester, who are represented in London by Messrs. Plowman and Blackett, 40-44, Holborn Viaduct, E.C.1. These shades are made of Czecho-Slovakian glass; to display melting they are internally frosted for the upper half of their length, an artifice helping to prevent glare. The chased appearance results from spraying with cold water when the glass is red hot. It is claimed that the reflective powers given by the incisions allow a 40 W. lamp to give similar effective illumination to that given by a 60 W. lamp in other fittings.

"Atmospheric lighting" is the term applied by Osler and Faraday, Ltd., 89, Newman Street, London, W.1, to the current method of concealing light-giving points; in many of their pendants the maximum of diffusion is very successfully attained. One unusual wall bracket has Japanese lacquer mounts carrying coloured daum dishes.

Pressed glass fittings in a large range of designs and prices are shown by Messrs. Borghys and Ling, 4 and 5, Warwick Court, Holborn, W.C.1. They are the work of M. Sabino, whose entries at Paris exhibitions are well-known. Of particular interest to those desiring pleasing and novel pendants at fairly low prices is the standardised glass box used as a unit in many quite different settings.

Louis Dernier and Hamlyn, Ltd., of 23, Newman Street W.1, have developed very recently the "Neolux" unit of which the most arresting features are efficiency and ease of cleaning and packing. In these lamps slotted supports for the glass are used in place of angle-iron, the chief advantage being that, even with very large lamps, there is no danger of splintering through the rapid contraction, at different rates, of glass and iron when switches are opened. The single-unit pendant "Neolux" consists of four parallel glass panels—for which many shapes and shades can be chosen—held in place by a metal frame, the three upper panels being pierced to receive the opal lamp. In wall brackets and pendants, the panels can be removed readily by any one; pendant supports fold, and lamp positions and suspension lengths are adjustable.

Reproductions of several interesting designs by Bagues, Ltd., adjoining 22, Grosvenor Square, W.1, have already appeared in THE ELECTRICIAN. At the moment, this firm seems to be concentrating on threaded-crystal work, with Prince of Wales feathers as the foundation of most designs. "Nacrolaque" appears frequently.

Troughton and Young, Ltd., of 143, Knightsbridge, S.W.1, is another firm which is playing a vigorous part in developing the new lighting art, and readers will doubtless remember that a number of their productions were illustrated recently in these columns. The special showroom which they have equipped for the display of new lighting fashions is probably unique both for the novelty of its arrangement and equipment, and for its suitability for the purpose for which it was designed.

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WATER HEATING DEVELOPMENTS.

Electrical Applications Outlined at E.D.A. Conference—Controlling the Load at Off-peak Times—Remarkable Progress at Croydon.

AT the final E.D.A. Salesmanship Conference of the present session, held in London, on March 15th, Mr. M. O. F. England, of Messrs. Benham and Sons, Ltd., dealt with water-heating developments.

Electrically-heated water boilers, Mr. England said, could not only be arranged to supply all the hot water required in a system, but could also be arranged to act as a standby plant to some other fuel such as oil, coke, and gas. Another application was for humidification, the steam being drawn off through ducts containing warmed air, and distributed to the point or points where it was required. Sterilisers could also be heated electrically, and were frequently controlled automatically. There was also the application of electricity for heating water to prevent freezing in large tanks.

A more unusual application of electric water heating was for what was known as continuous bathing, a process used for soothing mental patients in asylums, the heated water entering at the foot of the bath and returning at the head. A bottle containing 2 kW immersed type element was situated at the end of, and below, the bath, the thermostat lying parallel with the flow, the water in this way being kept at a constant temperature.

Apart from purely domestic water boilers, there were the non-pressure, and the pressure, types of boiler used for restaurants and tea rooms. In the former, the water was boiled electrically, either by clamped on or immersion types of elements, whilst in the pressure type of boiler the elements were usually immersed. Thermostatic control of the non-pressure type of boiler had, until fairly recently, been regarded as an enormously difficult problem, and still remained so when the water was boiled in urns.

Owing to the effect of a water heating load upon central stations, it was urged that the aim should be to encourage water heating at off-peak times, and it was further suggested that calculations, at least for large buildings, must be based upon a charge of ¼d. per unit.

High tension boilers had been developed principally for high loadings and were suitable only for a.c. systems. With these boilers there were no elements, the water inside the boiler acting as a resistance through which current passed direct from the h.t. mains. Heat regulation was a comparatively simple matter, although the necessary relays were rather complicated. With large units containing wire elements, the problem of automatic control was greater. The electrode type of boiler had been made as a three-phase boiler up to 6600 kW capacity. It could operate up to 16 000 V, although boilers on this principle could be obtained for voltages as low as 500.

Heating of Floors.

Apart from the improvement of load factor by water heating controlled at off-peak times, another kind of off-peak load was being developed in connection with the heating of individual radiators, in which a mass of material or a quantity of water was heated, the heat absorbed being allowed to dissipate itself, under control, when the current was switched off. In Germany experiments had been carried out with the heating of floors by means of buried wires. It seemed to the lecturer that floors could be heated in much the same way as walls and ceilings by hidden hot-water pipes.

Mr. England then gave some explanation of the various types of apparatus for controlling off-peak hot water heating. Manual operation, of course, under the control of the supply undertakings, was the simplest and cheapest, but he did not know of any case where this was adopted in practice. The most common form of apparatus was the time switch.

Reference was then made to Mr. George Wilkinson's "change-circuit" method, the aim of which is to supply water heating loads entirely automatically without load jumps of any kind. Mr. Wilkinson provides "change circuits" which are operated at the sub-station in such a way that as the line or network load increases, the water heating loads are decreased in the same proportion, or in a proportion best suited to the running of the station.

Dr. Ferranti had made a special study of domestic water heating loads, and had evolved a device which would cut off water heating circuits when the current taken by other circuits reached a pre-determined value. This scheme seemed particularly sound, because the levelling devices were cheap to instal, and because metering was simple. Mr. Wilson, of Ashford, had developed a scheme of automatic water heating control in individual houses. By means of a pilot wire control and house relays, he caused the water heating circuits to be shut off when the street lights were lit up. A system in operation in Southend only differed from this in detail.

In the "M.O.F.E." system of pilot wire control, a current transformer was fitted at the power station having a two-way switch arrangement controlled by the current in the main bus-bar. Alternating current at a low potential was conveyed by two pilot wires to the customer who had a mercury relay switch. The station transmitter was adjusted to cut off the current at a pre-determined value. Future developments in a similar direction might be made by the potential drop along a cable in the street, the voltage rise in the cable causing a house or building relay to operate and cut off the heating circuits.

THE DISCUSSION.

In the discussion which followed, Mr. C. H. RAYNER remarked that the paper had little to say about salesmanship and was more suitable for a meeting of the I.E.E. In his view thermostatic control was not necessary with domestic water heating appliances.

Mr. P. M. EDINBOROUGH urged the need for closer co-operation between the supply authorities and manufacturers in order that an efficient range of apparatus might be produced, at a suitable price, to meet domestic requirements. Indeed, the time was ripe for the formation of a joint Committee to consider the subject. We should concentrate on apparatus suitable for from 5 to 20 gallons with a loading not exceeding 1 kW, suitably controlled by some bi-metal type of thermostat, because that type was cheapest to produce. A booster element was also necessary, not perhaps as a standard but for those people who desired it, for the purpose of getting a number of baths from, say, a 20-gallon boiler.

Mr. BRYAN spoke of the success of the lagged storage cylinder up to 30 gallons capacity in private houses, and also of apparatus for raising the temperature of water quickly for industrial purposes. For instance, in film washing, the electrically heated geyser had proved to be the solution of the problem of varying the temperature in a manner which was impossible with the storage system. At the same time, heating water to a very high temperature for domestic purposes was quite wrong, as a lower temperature was ample for all ordinary purposes.

Mr. HONEY said that during the cold spell the contractors and the supply authority in Croydon made such sales of heating apparatus that the demand on one sub-station went up by 120 per cent. His experience had shown that with current at ¼d. per unit or less it was possible to compete with 500 B.Th.U. gas at 3s. per 1 000 cu. ft. for water heating. At Croydon they had specialised on the storage type of apparatus having a capacity varying from 1½ to 33 gallons. In this way 1 000 apparatus having a maximum demand of 800 kW had been connected to the mains, the machines being always connected to the supply with thermostatic control. A special night tariff of ¼d. per unit between 11 p.m. and 7 a.m. was in use, the hire charge being £2 8s. 6d. per quarter with a rebate to the consumer if he had not used the maximum number of units. This charge covered hire of heater, time switch, separate meter and the total number of units that could be used during the eight hours. At Croydon, there was a 2 000 000 units per annum water heating load out of a total of 34 000 000 units, with 30 000 consumers.

Mr. F. SELLY spoke with regard to the cost of heating London tap water to a temperature of 150 deg. and gave details of experiments he had carried out. With current at 0·3d. per unit he had found that to heat 1 000 gallons of London tap water per day throughout the year—the figures are the average of the years 1922-23-24—to 150 deg. F. cost roughly 7s. 1d., or 1d. for 10 gallons; with current at 0·375d. per unit the cost worked out at 8s.9·37d., whilst with current at 0·5d. per unit the cost would be 11s. 8d. per day. It was therefore, advisable to adopt the storage system for domestic purposes, using thermostats and sufficient storage and taking advantage of night tariffs.

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ELECTRICITY AND SALES PROMOTION.*

Importance of Accurate Market Surveys—The Language Question—Need for Intensified Electrical Propaganda—Increasing the Home Market.

By T. H. McARTHUR (Managing Director, Edward Hunter and Co., Ltd.).

NOBODY who comes into contact with average British selling methods will be inclined to dispute a single point of the notable speech made by the Prince of Wales on the eve of the British Industries Fair. Our salesmanship is too often but a poor advertisement for our goods, and the attitude of mind of many of our manufacturers is reflected in their "take it or leave it" methods of doing business.

There is only one factor that has saved us from commercial oblivion, and that is the quality of our goods. That quality has withstood ineptitude in selling on a major scale, and the outlook of many of our overseas customers must be one of amazement that such people are able to produce such effective goods.

An Anachronism.

The whole outlook of the majority of our manufacturers is that of the parochial politician, who can see good in no one, who trusts no one, who learns from no one. That may be the result of conservatism carried to the *n*th degree, or it may be evidence of British reserve. In either case, it is anachronistic in this highly competitive world, and the sooner a more intelligent and more enterprising outlook takes its place the sooner shall we obtain that measure of prosperity which our ability as manufacturers has won for us in the past.

Let us take a leaf from American practice in this direction. They are alive to the need for facts, facts, and still more facts, in relation to their business.

"Every business must rest upon three legs: finance, law and facts. Good financial advice is obtainable, good legal advice is not hard to come by; but accurate facts must be worked for with patience and intelligence," says a well-known American publicist, and the correctness of his remarks cannot be denied.

Economic facts are elusive; they are not obtained by sitting in an office and waiting for data to come out of the blue. They must be pursued, and in their pursuit they demand highly-trained technicians, men possessed of the cold-blooded temperament that actuates the truly scientific mind. All over America there are men trained for this work, to whom facts are all-important. They do not colour the data they collect to suit their own inclinations: they regard the unsupported statement as anathema. They give market surveys which are models of accuracy, full of cold facts that are allowed to speak for themselves. They go right down to fundamentals: they build from the foundations upwards.

When an article is to be put on the market, these trained men analyse that market with knowledge and care. They take every possible precaution to see that their client is prevented from making big or little mistakes. The mass of data they produce is not written for the sake of filling so many pages of foolscap: it is based on psychology: it deals with matters of wrapping and packing; in indicates the appropriate type of carton for the article: it suggests the best slogan: it outlines the advertising media to be used: it suggests suitable "copy."

All this data is not collated by haphazard methods. One of the most valuable sources is found in the readiness with which American manufacturers are willing to exchange information, and a logical sequence to the manufacturers' policy is a willingness on the part of the retailer to co-operate in the creation of market surveys and marketing plans.

Both the manufacturer and the retailer have come to realise that it is good business to help business, and this attitude of mind is dictated by business acumen and not by sentiment. Its success is proved by the amazing expansion in American business, and it is only the seemingly unlimited capacity of his home market to absorb merchandise that makes export a secondary consideration to the average American producer for the time being.

If that home market of his were anywhere near saturation point, the position of British exports would be substantially worse than it is to-day: and it most certainly behoves us to put our house in order before the scientific selling methods which have brought such immense prosperity to United States manufacturers are turned to the capture of overseas markets.

I often think that our finest advertisement to the visitor from abroad is the Pullman train which whisks him from the landing stage to London. A railway compartment that is a model of luxury and comfort, an outward and visible sign of our prosperity and appreciation of the comforts of life.

Our visitor comes to a London hotel—and there are none better in all the world, seasoned travellers will tell you—and then sets about doing business. Maybe he visits the British Industries Fair and finds it located in a semi-derelict, draughty, awkwardly placed situation, some considerable distance from anywhere. He buys a catalogue besides which the programme of the Horse Show is a miracle of good printing and fine production, and then he wanders round the stalls, wondering why on earth he came all this distance to see so many exhibits displayed in such an inartistic setting. Not a very flattering contrast to the Leipzig Fair!

Perhaps our visitor goes into the provinces, and he finds that his reception at those works at which he calls is typically abrupt—a sort of "who-are-you-and-what-do-you want?" attitude. He is often met by an ignorance of his own language which makes it doubly hard for him to do business unless he happens to speak English freely.

In that point is indicated one of our greatest weaknesses, both here and in our overseas representation. We assume that everybody talks English, and if they don't, "then they darn well ought to"! Your Continental manufacturer is either a first-class linguist himself, or else he has ample staff to handle the visitor. How many thousands of young Continentals are to be found in Great Britain, and how many young Britishers go abroad to learn languages? The answer is well known to every observer, and yet this language question is of real and growing importance. The German salesman is at least tri-lingual, knowing German, English and French—and often he can speak Spanish and Italian as well. If he is doing business in South America, he speaks the Spanish of that part of the American Continent unless he is in Brazil, when he will talk Brazilian Portuguese. He knows that the language bar is a severe handicap and he takes the necessary steps to surmount it.

The idea that the Britisher is a bad linguist will not stand examination. We are lazy about foreign languages—that's all, and we must overcome this laziness if we are to win a volume of overseas trade commensurate with our post-war manufacturing resources.

But all these points, important as they are, sink into insignificance beside the attitude of mind that is so reminiscent of the small shop-keeper. I often think the truth of Napoleon's contemptuous phrase "a nation of shop-keepers"—was its greatest insult.

An Advertising Point.

Many of our manufacturers believe in gargantuan stocks of goods and Lilliputian expenditure in sales promotion in all or any of its branches. The idea that stock must stand at £10 000 to permit of an advertising expenditure of £1 000 is so different from the American theory that has proved so successful—they take £10 000 worth of advertising space when their stock stands at £1 000 and they arrange to meet the business that advertising, properly carried out, brings to them.

The American sells by reason of his courage: we sell in spite of our lack of confidence. We are conservative: the American is progressive. The last ten years have seen all the accepted theories of so-called economists shattered into a thousand pieces by the strides which American production has made. Where is the limitation of output in Detroit? Where is the exhaustion of the market for Pittsburg steel?

Courage and applied salesmanship have conquered the preconceived "laws" of economics, and in their place there has arisen a new state of affairs. The upward tendency of living, not only in the United States, please remember, but in Great Britain and elsewhere, has created a thousand new desires, a thousand new lines of production.

Electricity alone has opened up so many new markets that

[* This article, from the pen of a well-known authority on sales promotion, contains many points of interest to readers of THE ELECTRICIAN.—ED.]

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we are beginning to realise that we have another world to deal with, another field to supply with its electrical requirements.

Let us tackle this new field with properly directed efforts. Let there be genuine collaboration amongst those engaged in the electrical industry in all its branches. Let manufacturers of all kinds of electrical equipment be willing to pool their knowledge of the home and the overseas markets. Let the almost innate sense of distrust be banished once and for all from the minds of those directing this great and comparatively undeveloped industry. Let us have some system of creating public interest in the advantages of electricity, some body which is really competent to make electricity a living force in both public and private life.

Surely there are enough "bull" points for electricity to permit of much more systematic propaganda in which advertising plays its appointed part? I have the interest of the average man in something new, and if I have studied the advantages of electricity I have done so of my own accord. The information I happen to possess has been sought out: it has not been handed to me by any manner of means.

That this is a fact simply goes to prove the need for intensified propaganda for the electrical industry, and the present is almost an ideal time for widening the basis of our co-operative advertising. We are emerging from a slough of considerable despond and people's minds are unusually receptive. Here is an opportunity for the industry to capitalise the present propitious circumstances and to undertake a really intensive campaign for more electricity users.

Let us strengthen our hands for attacking the overseas markets available for this industry by increasing our home market to something much nearer its capacity than the present position indicates. With a substantially larger turnover here at home—and there is no shadow of doubt that this market is capable of immense expansion—we can bring down our overheads at our factories, and beat the foreigner on his strongest point—his price.

Given, at the same time, a willingness to profit by other people's successes and to learn from our own mistakes, I can see such a future before the electrical industry as will go a long way to compensate the nation for some of the irretrievably lost markets in other classes of manufacture.

CORRESPONDENCE.

The Editor welcomes the free expression in these columns of genuine opinion on matters of public interest, although he disclaims responsibility alike for the opinions themselves and the manner of their expression.

Electricity and Motor Boats.

[To the Editor.]

Sir,—As a Londoner who used to find week-end peace and quietness in skiff or punt on some of the beautiful near-by reaches of the Thames, I am grateful to you and to Mr. H. T. Young for the protests against the development of the motor-boat craze on our rivers and at popular seaside resorts.

During recent years, the amenities of the Thames, and doubtless many other rivers, have been ruined by the use of outboard motor boats, and the threatened production of these foul-smelling water churning devices on a large scale bids fair to make the rivers quite useless for ordinary boating unless those participating turn out in bathing costumes and provide themselves with a sufficiency of baling instruments.

As you rightly point out, people who require some non-manual means of propulsion cannot do better—for their own convenience as well as that of other users of our beautiful waterways—than adopt electric propulsion.—I am, etc.,

"Aquatic."

Shepperton, March 23rd.

A Fountain of Light.

[To the Editor.]

Sir,—The picture reproduced on page 361 of your March 22nd issue of a fountain of light suggests a development which might be encouraged for the decoration of domestic interiors. Many people are deterred from using illuminated fountains because of the difficulty, real or supposed, of securing the necessary water supply. A device which is capable of imitating a fountain of water by means of neon tubes, without any water, should therefore prove popular. As, however, I have not yet had an opportunity of observing the effect of such an arrangement, I am anxious to know whether anything has been done along those lines in this country. If any of your readers have seen one perhaps they will be good enough to give their opinions in this column.—I am, etc.,

C. H. Dodswell.

Blackpool, March 25th.

"Developing the E.D.A."

[To the Editor.]

Sir,—Whilst agreeing that the Electrical Development Association needs greater financial support from the industry, I do think that the Association should put a considerable proportion of the increased revenue to a contingency fund which would thus allow it to counter rival propaganda on certain occasions. Only the other day a well-known daily paper issued a film supplement, the first advertisement in which made surprising claims for the employment of gas for cinema lighting and heating. The issue was remarkable for the absence of any reference to the uses of electricity in this field.

Perhaps E.D.A. holds the view that the use of electricity is so widespread in cinemas that it is unnecessary to advertise the fact. If it does, it only furnishes another instance of our tendency to under-estimate competition. The gas industry is using all the arts of advertising and propaganda. Surely we of the electrical industry cannot do less.

The example quoted is only one of many current instances. In fixing its publicity appropriation, E.D.A. should provide something for such contingencies.—I am, etc.,

H. Murdon.

London, March 25th.

Electrical Firms and the B.I.F.

[To the Editor.]

Sir,—I have a recollection that immediately prior to the British Industries Fair this year Mr. T. R. Martin made a special point of writing criticisms of the Birmingham Section in order that the Fair may be further improved in 1930 and subsequent years.

Criticisms, both constructive and otherwise, were frequently heard during the period of the Fair, but there seems little evidence that these views have since been transmitted to the proper authorities. As it is desirable to have these matters aired well before next year's exhibition, I venture to put forward my own views in the hope that they will stimulate discussion among electrical exhibitors.

(1) Visitors travelling by rail should be able to book direct to Castle Bromwich if desired.

(2) Invitation tickets should be exchangeable at the Fair entrances for a season ticket valid for the duration of the Fair.

(3) The general public should be excluded.

(4) Additional and more effective steps should be taken to secure the attendance of prospective overseas buyers.

(5) Special arrangements should be made for the entertainment of foreign buyers.

(6) Banners similar to those displayed in the gas section this year should hang in the electrical section.

(7) Electric battery vehicles should be employed for transporting visitors from the main entrance to the electrical exhibits.

(8) Electric heating should replace the gas fires in the cloakrooms.

The views of your readers on these points would, I feel sure, be of great interest and value.—I am, etc.,

"Hopeful."

London, March 25th.

THE BATTI-WALLAH'S SOCIETY.

At the annual general meeting of the Batti-Wallah's Society the following officers and committee were elected for 1929:—

President: Mr. H. L. Howard; Vice-President: Mr. H. J. S. Mackay; Hon. Sec. and Treasurer: Mr. M. Whitgift; Committee: Messrs. A. E. Apps, G. M. B. Hilton, H. S. Jacob, W. E. Lang, H. S. May and A. E. Mohring.

At a Committee meeting on March 19th, the following were elected Batti-Wallahs:—Mr. E. A. Gatehouse, Mr. H. D. Harris, Mr. J. W. Porter, Mr. E. Stuart Russell, Mr. A. A. Campbell Swinton, F.R.S., and Lt.-Col. W. A. Vignoles. It was also decided that in future the entrance fee for new members shall be increased to two guineas.

For the Society's luncheon on April 25th, at which Sir Hugo Hirst will deliver an address, tickets (5s. 6d. each) may now be obtained.

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ELECTRICAL APPLIANCES FOR SPRING TRADE.

Manufacturers' Suggestions for Promoting Sales in Spring Trade Goods—Some Selected Domestic Electrical Items Described.

THOUGH a certain amount of space is devoted each week to describing new lines of interest to the electrical industry, we have this week confined such descriptions to those items which electrical contractors will find appropriate to spring trade requirements. The appliances are, of course, in considerable demand all the year round, but in the spring such items as vacuum cleaners, etc., possess even added attractions to the feminine mind. The bright days of spring, the longer hours of daylight, the sunshine, all reveal the necessity for new lamp shades, etc., while the increased labours associated with spring cleaning lend themselves to the sale of labour saving devices.

We give below, in brief, a few suggestions from manufacturers as to what, in their opinion, may be regarded as suitable spring trade lines, and though on account of space it has not been possible to give complete descriptions of these appliances, sufficient information is given upon which an opinion may be formed.

We have received from SMITH AND ANSELL, LTD., of Acocks Green, Birmingham, particulars of the new "Essalite" lighting unit. This fitting embodies more advantages than at first might be supposed and, in dealing with these, the maker's point out that when the half watt lamp was introduced the necessity for screening and diffusing the brilliant filament was partly responsible for the bowl fitting becoming generally adopted. This type of fitting, though possessing many virtues, suffered from the disadvantage of being a dust collector and because of this was, in a measure, responsible for the "enclosed unit" being designed. Whilst this type of fitting avoided the dirt-collecting possibilities of the bowl fitting, in many cases it created a difficulty arising from the method of carrying the glass. First, it is in some cases, risky, and the heat generated by the lamps sometimes causes the glasses to crack as a result of expansion against the binding screws. Secondly, access to the lamp for replacement or for cleaning is not easy. In the case of the "Essalite" enclosed unit the glass fitting is suspended from chains attached to studs fitted to the lower portion of the bowl, while the top portion may be lifted off without difficulty for purposes of cleaning or replacing the lamp.

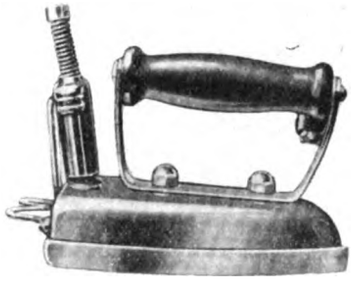
Among the many domestic electrical appliances of the ELECTRIC HEATING CO., of George Street, Croydon, may be mentioned a 3-pint coffee percolator with a 400 W loading. The body of this appliance is made of seamless aluminium, while the handle is of heat-resisting material.

The SLOAN ELECTRICAL CO., LTD., 8-12, Golden Lane, London, E.C.1, is marketing an electric washer under the name of the "Locomotive." This machine is made of metal throughout, is fitted with a seventeen ounce copper boiler and washes by means of a "loop" action without a mechanical device inside the washer. The machine is fitted with an electrically-driven wringer, and an electric water heater is fitted directly under the bottom of the tub, the consumption of the heater being 6 A. A special ironer attachment is available for use with the "Locomotive," the shoe being a 26 in. type,

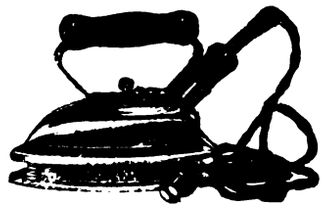
An electrical device of interest to motorists is the "Setalite" fitting of SETALITE, LTD., 314-322, Regent Street, London. W.1. This is a device which automatically lights the lamps of a car at a given time. In appearance it resembles a speedometer, and is 3 in. in diameter. The same device can be fitted to nursery lighting circuits, electric fires, water heaters, etc.

GEORGE KENT, LTD., 199-201, High Holborn, London, W.C.1, are now marketing an electrically driven knife cleaning machine which is designed to clean 500 to 800 knives per hour.

SOME SUGGESTIONS FOR PROMOTING SPRING TRADE.

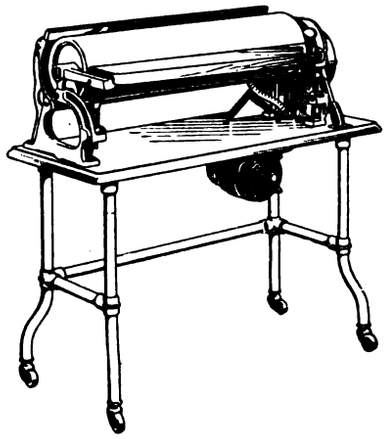


The 250 W, 3½ lb. iron of The Electric Heating Co.



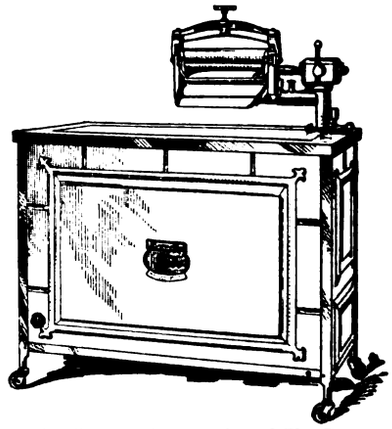
The safety iron of L. G. Hawkins and Co., Ltd.

A 5 lb., 450 W iron by The Electric Heating Co.



One of the ironing machines offered by L. G. Hawkins and Co., Ltd.

An attractive cooker by The General Electric Co., Ltd.



The "Locomotive" washer of The Sloan Electrical Co. Ltd.

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These machines are specially constructed and so arranged to meet the requirements essential when in use at hotels, schools, etc. They are mounted on a heavy iron base plate, and are fitted with starting switch, special spring pressure, driving chain and special motor, ready for use. Similar machines are also made for cleaning fewer knives, the range extending from 2, with a space for carvers, up to ten. The machines are available for both a.c. and d.c. supply. The same firm also markets an electrically-driven ice-cream freezer fitted with a ¼ H.P. motor and starting switch. This is made in various capacities ranging from 6 to 20 quarts. Other freezers fitted with ½ H.P. motors have capacities of 10, 14 and 20 quarts.

The SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, London, W.C.2, has introduced a range of violet ray outfits under the trade name of "Vilite." These equipments are available in four types. The latest addition to the range of "A B C" washing machines by the same firm is the "Spinner," so called because of the spinning dryer contained within the machine. The container for the dryer is a cone-shaped compartment without perforations, which is rotated at high-speed so that water forced out of the clothes will rise up the inclined sides and out over the top into a special reservoir provided. The washing tub contains an aluminium agitator which gives 104 impulses per minute. Both the dryer container and the tub washer are made from one piece "Armco" metal, finished inside with royal blue vitreous enamel. The machine is fitted with two controls and a single motor drives both the washer and the dryer. The "A B C Oscillator" washer and the "A B C" super model 65 E are also machines of interest when considering spring trade possibilities.

The COOPER STEWART ENGINEERING CO., LTD., 136-137, Long Acre, London, W.C.2, have introduced a novel grill and toaster, fitted with cooking pan and "griddle" plate. The makers claim that no less than 49 different dishes may be prepared with the appliance, while the consumption of the device is 600 W.

The BRITISH VACUUM CLEANER AND ENGINEERING CO., LTD., of Parsons Green, London, suggest that the "Goblin" electric vacuum cleaner, Model G.50, is another suitable line for spring trade. This is a new model with an improved construction of the motor and turbine unit which now floats in rubber, thus insulating the motor housing.

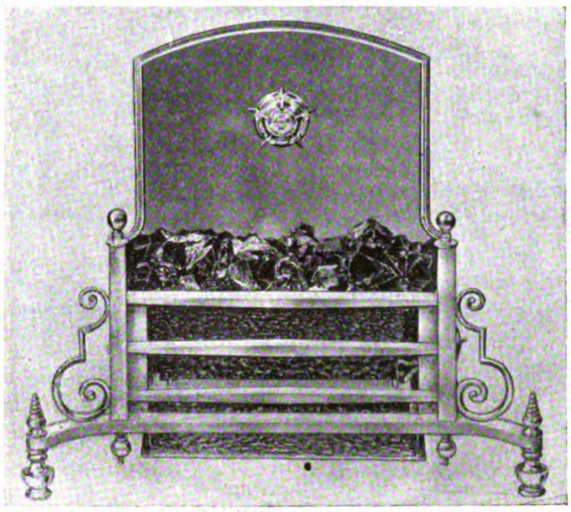
Among the "Magnet" range of domestic appliances of the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, may be mentioned the automatic cut-out type electric kettle fitted with a device which protects the kettle and element from damage should the kettle be allowed to boil dry or the current be switched on with the kettle empty. The safety device takes the form of a fusible link which causes the circuit to be broken before any damage can be done due to overheating. The kettle is made of heavy gauge copper and is mounted on three heat insulating feet. The handle upright incorporates a device to prevent the lid falling when the kettle is tilted. The "Magnet" electric wash boiler is another line, and this operates on the thermo-syphon principle. The machine is controlled by a three heat switch and heat loss is reduced by ample air spacing between the inner container and the outer casing. A pilot lamp holder is provided on the switch box for use if desired, and by means of the 4-core C.T.S. flexible both the boiler and switch box can be earthed. The "Magnet Minor" electric cooker for three or four persons is another item of spring trade interest and this with a total wattage of 3 200 is provided with separate self-contained units for boiling and grilling, and the grill element. Part of the oven heater is separately regulated, an additional switch being fitted to control the bottom heat when required.

Vacuum Cleaners and Refrigerators.

The HOTPOINT ELECTRIC APPLIANCE CO., LTD., 24, Newman Street, London, W.1, also offers an extensive range of spring trade items such as the "Premier Duplex" and "Junior" vacuum cleaners, electric washers and ironers and a comprehensive range of small appliances, such as irons, coffee percolators, immersion heaters, kettles, and so on.

Probably the chief item of interest in the range of the BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych London, W.C.2, is the new refrigerator which was shown at the Ideal Home Exhibition. A very comprehensive range of domestic lighting fittings is another suitable line, while the radio appliances offered also fall within spring trade possibilities.

METRO-VICK SUPPLIES, LTD., Charing Cross Road, London, W.C.2, also cater for the needs of spring trade, the range including cooking and heating devices, small appliances, vacuum cleaners, and fittings. Radio receivers and loud speakers are offered in numerous designs, including moving coil instruments. The safety kettle and gyratory washer will play important parts, while the already widely known range of "Cosmos" cookers will also receive attention. Many of the models have been improved in some way or other, the cookers offered being of such diversity in design as to fulfil every possible requirement. Another interesting line is the small model cooker designed for use in flats, bungalows, etc. This



An electric fire for use during the chilly spring evenings is another suggestion. The model illustrated is by Metro-Vick Supplies, Ltd.

is made in two types with one 8 in. diameter boiling plate, or with one 6¼ in., and one 4¼ in. boiling plates; extra rapid boiling and totally enclosed tubular elements are fitted. The "Cosmos" table model boiling plate is also a recent development, and this is mounted on a suitable stand with nickel-plated lag plate and fitted with either a 6¼ in. boiling ring rated at 1 200 W, or with an 8 in. plate of 2 000 W rating. Metro-Vick Supplies, Ltd., have also introduced a number of new "Silverstone" glassware fittings.

SIEMENS ELECTRIC LAMPS AND SUPPLIES, LTD., 38-39, Upper Thames Street, London, E.C.4, offer small domestic appliances such as shaving mugs, irons, electric irons, toasters, safety kettles, etc., while the range of shades available is one of the most extensive. The company's suction cleaner is another interesting line.

The ELECTRIC APPLIANCES CO., LTD., 8, Fisher Street, Southampton Row, London, W.C.1, suggest the "Eureka" model 11 vacuum cleaner and steriliser as a spring trade item, and this, it may be interesting to note, is quickly adaptable for use as a motor-car cleaning appliance.

The EDISON SWAN ELECTRIC CO., LTD., 123-5, Queen Victoria Street, London, E.C.4, also suggest vacuum cleaners as being appropriate to the season. The "Ediswan" machine, made for a.c. and d.c. at all standard voltages, is of the bag type and is available with a wide selection of attachments.

The "Junior" and other cookers of the JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, London, S.W.1, are further interesting lines, while the company's other appliances, all of which have been previously described, also offer a wide selection.

Apart from water heaters, table stoves and saucepans, SADIA, LTD., 22, Newman Street, London, W.1, offer an electrically heated drying stand. This has been designed with a view to overcoming the difficulty experienced in wet weather in drying clothes, washing, etc.

As so many electrical appliances of all kinds have been introduced for use in the kitchen, this drying stand is made to take to pieces and can be packed away when not in use. It consists of a box heater loaded to 750 W, single heat, mounted on a wooden white enamel post. The extending arms are made of wood and can be placed in any position. The heater and arms can each be adjusted to four different heights, so that anything from an overcoat to a handkerchief can be dried. The heater can be used separately for heating a room or drying cupboard and it can also be used for drying fruit and vegetables.

Where summer bungalows and so on are being prepared for the forthcoming months the new "Delco-Light" plants

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of FRIGIDAIRE, LTD., Chapter Street, London, S.W.1, are of interest. These are made in a variety of sizes for water systems and lighting.

L. G. HAWKINS AND CO., LTD., of 30-35, Drury Lane, London, W.C.2, have recently placed on the market a new all-electric laundry equipment which comprises the "Universal" washer and dryer, the "Coffield" ironing machine, the "Universal" washer and wringer, and the "Universal" super automatic electric safety iron. The first of these is equipped with a centrifugal dryer and what is claimed to be a new safety cleansing action is also combined in this washer. It is of the agitator type and empties itself electrically. The "Coffield" ironing machine is driven by an electric motor, and is suitable for institutions, hotels, etc. An electric iron is also marketed by the same company. It is known as the "Universal" super automatic safety electric iron. The chief of its features is that the current is automatically switched off when the iron reaches the temperature of 575° F., and remains off until switched on again. In addition to this, two conveniently placed finger-tips controls enable the user to regulate the heat of the iron according to the fabric being ironed. The weight is 6 lb.

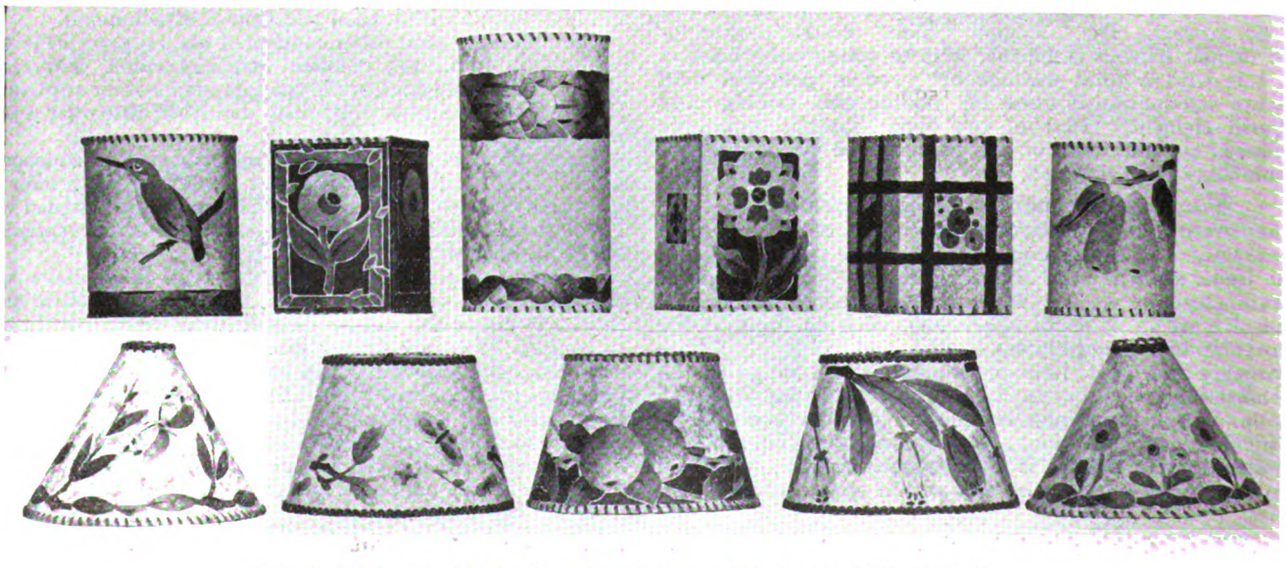
The new "Eureka" cleaner with the sterlising attachment in use.

GEORGE NOBBS, LTD., of 89, Cleveland Street, London, W., have introduced the "Genii" Maclaren thermostats suitable for the automatic temperature control of all kinds of electric water heaters and domestic hot water storage tanks. The chief features of the device are robust construction with minimum of moving parts, and one type is adjustable so that it can be used in any position through the side, top or bottom of tanks or even in a canting position. It is fitted with an adjustable temperature regulator with a dial graduated 100–200° F., which simplifies adjustment to any temperature without guesswork. The expansion movement is by invar steel rod and brass tube for the "M.T." type control and by the addition of bellows to obtain finer regulation, for room and refrigerator controls, etc. A tank protection sleeve with spring clip is provided so that the thermostat may be inserted or withdrawn without drawing off water in the tank, while the mercury tube switch is fitted with a ceramic liner to withstand the flash at the breaking of the electrical circuit, thus prolonging the life of the tube.

A new immersion heater, which embodies several notable improvements in design, is being put on the market by CHARLES JOYNER AND CO., Icknield Square, Birmingham, the makers of "Angelus" electric fires and cookers. The new heater is made in all loadings from 0·25 kW to 10 kW—the latter size being intended for heavy duty in large institutions—and utilises four heater tubes. The contacts in all types are self-aligning and of ample capacity, and the elements are so arranged as to permit of easy withdrawal without necessitating the removal of the tube or the emptying of the tank. Switchgear on the walls is eliminated, the mains being connected to a busbar system in the heater. The loading on the surface of the tube is arranged at a low wattage per square inch, so as to minimise the formation of deposit from impurities in the water. The same firm is producing a new "Angelus" cooker for small family work, in which the grill chamber is fitted with a front drop-door, permitting the whole of the heat to be utilised both during and after cooking. The boiling plate with griller combined is braced to prevent warping and cracking, and the oven is vitreous enamelled throughout.

CREDENDA CONDUITS, LTD., Oldbury, Birmingham, are now manufacturing a range of kettles having extra heavy bodies, handles and feet, large diameter lids and swan-neck spouts. Each kettle is supplied with 6 ft. of connecting cord, and in the case of the 2 pint 650 W and 3 pint 650 W models, lamp adaptors are provided. These models are each fitted with two elements, while other models are 3 pints, 975 W; 4 pints, 975 W; 6 pints, 1 300 W and 8 pints, 1 300 W; these have 3, 3, 4 and 44 elements respectively. A 2½ pint kettle with a rating of 500 W and a whistling model in 2 and 3 pint sizes, with loadings of 650 and 975 W respectively, are other interesting items offered in the domestic range. A wide selection of cookers and fires is offered as well as tubular and pedestal heaters.

The REGENT LAMPSHADE CO., of Brixton, London, S.W., has introduced a wide selection of parchment shades which have a seasonable appeal. These are painted on both the inside and the outside, thus giving a good depth of colour. Some of the many shapes and designs available are illustrated below.



A range of shades offered by the Regent Lampshade Co., all shades are painted on both sides.

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NEWS IN BRIEF.

The Annual Meeting of the B.E.A.M.A.—The British Delegation to Russia—Hired Cookers in Manchester—Hull's Good Progress with Assisted Wiring—The Shanghai Electricity Undertaking—German Enterprise.

A NEW electric lighting experiment is being made in the choir of St. George's Chapel, Windsor Castle.

The total production of electricity in the United States during January amounted to 8 218 544 000 kWh.

During Whit week the Electrical Trades Union is holding its annual conference at Blackpool, when 60 delegates will attend.

The annual conference of the Cheltenham Branch of the Electrical Association for Women took place at the Town Hall, on March 20th.

The Thames Conservancy Board has decided to purchase, at a cost of £3 200, electric cranes for the wharves at Kingston and Hampton Wick.

The British Columbia Government has adopted legislation for placing complete control of the sale of electrical energy in the hands of the Provincial Water Board.

Electricity as applied to the printing trade will be clearly demonstrated at the International Exhibition of the Printing and Allied Trades, to be held at Olympia, London, from April 11th to 25th.

At a meeting of the Meter and Instrument Section of the I.E.E. on April 5th, Mr. E. W. Hill will read a paper entitled "Some Technical Considerations Concerning Power Factor in Relation to Tariffs."

The Calgary Power Company is now operating 332 miles of 66 000 V lines and 839 miles at 132 000 V. The Canadian Utilities Corporation has 130 miles of 33 000 V lines and 232 miles at 132 000 V.

At the next general meeting of the Institution of Automobile Engineers, to be held at the Royal Society of Arts, on April 9th, Mr. H. S. Rowell and Mr. C. G. Williams will read a paper entitled "Automatic Spark Advance."

Members of the Cardiff Branch of the Electrical Association for Women made a tour of inspection of the Roath power station last week, and were afterwards joined at tea in the mess-room by members of the Electricity Committee.

A meeting of the Institute of Wireless Technology will take place on April 8th at the Engineers' Club, London, at 7 p.m., at which a lecture will be given by Mr. M. A. Hutchins entitled "Wireless Receiver Design from Pre-Broadcasting Days to the Present Time."

Features of a new coal handling plant which has been installed at Sutton Harbour by the Plymouth Coal, Co., Ltd., are two electrically-propelled cranes, by the aid of which it will be possible to deal much more quickly and easily with the discharge of cargoes from steamers.

It is reported that the Beauharnais Power Co. will accept the conditions imposed by the Canadian Federal Government in connection with the approval of plans for the power development project of the St. Lawrence under a 75-year concession granted by the Quebec Legislature.

At the annual dinner of the Northern Division of the E.P.E.A. at Manchester, on March 23rd, Dr. B. Mouat Jones referred with satisfaction to the progress made in negotiations between the Association and educational authorities with regard to an apprenticeship training scheme.

Among the representatives of 150 firms and trading organisations forming the British Delegation to Russia, which left London on Monday, are members of the staffs of Messrs. Mather and Platt, R. A. Lister and Co., Ruth's Steam Storage, Henry Wiggin and Co., Messrs. Spencer Melksham, and Marshall, Sons and Co.

Mr. E. J. Lansbury, speaking at the first annual dinner of the Liverpool Branch of the Guild of Telephonists, on March 23rd, said the Guild was making progress. Their first task was to secure recognition from the Postmaster-General. The advance of science in telephony meant that in time the human element would become redundant.

Princess Mary Viscountess Lascelles has kindly consented to be present at a special matinee of "Mr. Cinders" at the Adelphi Theatre, London, on Tuesday, May 7th, at 2.30, in aid of the John Benn Hostel and Milner Hall, Bower Street, Stepney, E.1. Binnie Hale and Bobby Howes and the entire company will appear, and the minstrel troupe, composed of boys of the Hostel, will also give an entertainment. Tickets (from 2s. to 16s.) from Miss F. Robinson, Bouverie House, Fleet Street, London, E.C.4, or from the box office at the theatre.

The Clyde Navigation Trustees are about to erect a new electric cantilever crane at Stobcross Quay.

An electric goods lift is to be erected at the North British and Mercantile building, St. Vincent Street, Glasgow.

Mr. Justice Clauson decided in the Chancery Division last week that a wireless set is classed as household furniture.

Demonstrations of radiators, fires, cookers, etc., are being given at the electrical exhibition now being held in the Council Offices of Formby U.D.C.

The number of orders received by Manchester Corporation for hired cookers during January was 61, and 56 were connected, making a total of 5 081.

Hornsey Electricity Committee recommends the purchase of a Hewittic rectifier set to be installed at the electricity works, at an estimated cost of £3 886.

Gravesend Electricity Committee recommends that to celebrate the 25 years' successful working of the electricity undertaking, the staff and employees be entertained.

Following the installation of electricity in several of the houses at Thornton, Mr. H. Wallace, addressed the Young People's Guild, on March 15th, on "Electricity in the Home."

Carlisle Electricity Committee has instructed the Electrical Engineer to prepare a scheme for additional facilities under the assisted wiring scheme, for applicants occupying Council houses

A meeting of the Paisley Association of Electrical Engineers was held on March 19th. Awards in connection with apprentice papers were made. The annual supper and smoker were given on Tuesday.

Bradford Parks Committee has expressed its thanks to the Electricity Department for the excellent arrangements made for the illumination of the Lister Park Lake on the occasion of the recent ice carnival.

At a meeting of the Western Centre, I.E.E., on Monday, Mr. S. E. Britten gave an informal lecture entitled "The Planning and Layout of a Rural Overhead Line." The E.D.A. film "Country Currents" was also shown.

At a meeting of the Institution of Engineering Inspection at the Royal Society of Arts, London, on Wednesday, Mr. A. M. Hallawell gave a lecture entitled "Acoustics in relation to the Gramophone and Radio Loud-speaker."

The New England Power Association, one of the power units of the International Paper and Power Company system, produced 121 728 000 kWh of electric energy in February, an increase of 18% over February, 1928, and 51% over February, 1927.

For a small extra charge the German Post Office now delivers telegrams consisting of "greetings," such as Christmas or New Year wishes, birthday, wedding or betrothal congratulations, etc., on forms bearing coloured pictures suitable to the occasion.

Last week a number of members of the E.T.U. employed on buildings in London ceased work with the object of enforcing their demand that men employed on lift construction should join the E.T.U. The lift work contractors maintain that they cannot coerce their men to join the union. About 250 men in all had stopped work up to the time we went to press, and no settlement had been arrived at.

Good progress has been made by Hull Corporation's assisted wiring scheme, and it was reported last week that over 600 applications were being dealt with.—Hull electricity department will supply electricity free of charge for the flood lighting of public buildings during Civic and Empire Week in October.

In further reference to Shanghai Municipality's desire to transfer its electricity undertaking to private enterprise, with regard to which a note appeared on page 352 of our last issue, a committee appointed to report on the tenders has recommended acceptance of the offer of the American and Foreign Power Co., amounting to over £10 000 000.

At the annual general meeting of the British Electrical and Allied Manufacturers' Association, on March 21st, the result of the ballot was announced electing the following to fill five vacancies on the Council: Brush Electrical Engineering Co., Ltd.; D. P. Battery Co., Ltd.; Electromotors, Ltd.; Ferranti, Ltd.; and Worthington-Simpson, Ltd. Mr. Victor Watlington, managing director, the English Electric Co., Ltd., was at the subsequent Council meeting elected to succeed Col. R. K. Morcom as chairman of the Council.

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PERSONAL.

STOCKPORT Town Council has appointed Mr. W. L. Chubb as mains superintendent.

Mr. James A. Robertson has been elected President of the Manchester Association of Engineers.

Worcester City Council has appointed Miss K. N. Shaw as lady demonstrator at the electricity showrooms.

Senatore G. Marconi and Mr. David Sarnoff have joined the board of the Gramophone (H.M.V.) Co., Ltd.

Dr. T. Yamamoto has been elected president of the Japanese Institute of Electrical Engineers for the ensuing year.

Stockport Electricity Committee has recommended the appointment of Mr. Robert H. Lee as electrical engineer.

Mr. E. L. Tappin, electrical engineer, has been elected a member of the Committee of Lewes Chamber of Commerce.

Marlborough Town Council has increased the salary of Mr. Rance as electrical engineer from £60 to £85 per annum.

Tonbridge Urban Council has appointed Mr. F. Young as installation engineer on completion of his probationary period.

Derby Town Council has increased the salary of the borough electrical engineer, Mr. G. H. Lake, from £1 100 to £1 200 per annum.

Mr. C. Furness, electrical engineer and tramway manager, Blackpool, has been appointed officer in charge of the transport department.

Admiral H. W. Grant has relinquished his position as joint managing director of the Eastern Telegraph Co., a position he has held since 1918.

Mr. J. N. Lindsay, boiler house charge engineer, Hull Corporation, has resigned on obtaining an appointment with the London Power Co.

Mr. Frank Redgrave Cripps, electrical engineer, has been nominated as a candidate for the Durrington Ward on the Worthing Town Council.

Mr. F. A. Dracup has resigned his position as motors and hiring superintendent in connection with the Birkenhead electricity undertaking.

Sir Edmund Wyldbore-Smith has been elected a director of the Metropolitan Railway Co., in succession to Sir H. C. W. Verney, who has resigned.

Ilford Electricity Committee recommends that the salary of Mr. H. King, assistant commercial manager, be increased from £500 to £550 per annum.

The late Dr. C. S. du Riche Preller bequeathed by his will the sum of £100 free of duty to the Benevolent Fund of the Institution of Electrical Engineers.

Estate of the gross value of £139 125, with net personalty £116 039, was left by the late Mr. R. M. Horne Payne, founder and chairman of the British Columbia Electric Railway.

A marriage has been arranged and will shortly take place between John Andrews, eldest son of Sir Ernest and Lady Benn, and Ursula, only daughter of Sir Maurice Alers and Lady Hankey.

Dr. J. A. Fleming, whose knighthood was announced in THE ELECTRICIAN, together with other electrical names in the New Year Honours List, will henceforth be known as Sir Ambrose Fleming.

Mr. Lachlan Mackinnon, general manager of Glasgow tramways, has been elected a member of the executive of the Municipal Tramways and Transport Association. Mr. Mackinnon will represent the Scottish area.

Mr. F. S. Hayburn, deputy managing director of the Marconi International Marine Communication Co., Ltd., was elected on Monday as Conservative representative of the Grove Park Ward of the Brentford and Chiswick U.D.C.

Fifty-six applications have been received for the post of general manager of Aberdeen Tramways Department, rendered vacant by the appointment of Mr. William Forbes to a similar post at Cardiff. The applications include one from Malta.

Mr. Godfrey Gerry, charge engineer at the Newport Street Electricity Works, Stonehouse, was recently presented with a music cabinet by the staff of the Electricity Department on the occasion of his leaving to take up an appointment at Hornsey.

Manchester Electricity Committee has appointed Mr. A. Williams, at present assistant resident engineer at Stuart Street, to the position of assistant resident engineer at Barton, and Mr. C. D. Milsom, at present engineer-in-charge, as assistant resident engineer at Stuart Street.

Mr. Andrew R. Cooper, assistant engineer to Mr. J. Clarke at the Silverwood Colliery, near Rotherham, has been appointed (out of 420 applicants) electrical engineer at the Dorman Long Collieries, near Dover, Kent, and he has been presented by the Silverwood officials and staff with a Jacobean oak timepiece with Westminster chimes.

Hull Electricity Committee has recommended that Mr. C. I. Shuttleworth, deputy city electrical engineer, be paid the difference between his salary as deputy engineer and the full salary paid to Major Bell for the four months during which he was in charge of the undertaking before Mr. J. N. Waite took up his appointment in Hull. It was also unanimously resolved that a letter of high appreciation of the services of Mr. Shuttleworth accompany the payment.

We understand that Mr. C. McKinlay has resigned his position with Metro-Vick Supplies, Ltd., and has been appointed sales representative for England, Wales and Ireland for Lane and Girvan, Ltd. We are also advised that Mr. Douglas Arthur, who was recently associated with the electrical department of the Falkirk Iron Co., Ltd., for a number of years, has been appointed in a similar capacity to represent the company in Scotland.

Mr. Frank Buckley, general manager of the Bury Municipal Tramways, who is leaving to become general manager to the Norwich City Tramways Co., has been presented with a gold hunter watch by the officials of the Tramway Department and Depot and Traffic Staff, with a spirit tantalus by the members of the Lancashire and Cheshire Tramways and Transport Managers' Association, of which Mr. Buckley has been Hon. Secretary, and with a case of cutlery, fish servers and eaters, a dessert stand, forks, and a pair of hair brushes by the Bury Corporation officials.

Mr. J. C. Denison-Pender has been elected chairman of the Eastern Telegraph Co., the Eastern Extension, Australasia, and China Telegraph Co., and the Western Telegraph Co. Mr. Denison-Pender is the elder son of the late Sir John Denison-Pender, the former chairman of the Eastern and Associated Telegraph Companies. He was appointed a director of the Eastern in 1906, became joint managing director with Admiral Grant in 1923, and vice-chairman in 1925. He is chairman of the four West India cable companies recently acquired by the Eastern group.

Obituary.

MR. R. J. CARTWRIGHT, electrical and lighting engineer, of 4, Plashet Grove, Upton Park, Essex.

MR. WILLIAM LANGLEY WILCOX, aged 42 years. He was the electrician at Marlborough College.

MR. JOHN WILLIAM VEALE, aged 55 years. He was for a considerable period with Crompton Parkinson, Ltd.

MR. FREDREICK CHARLES BARTON, aged 56 years. He was in business as a wireless engineer in Ashton Street, Dunstable.

DR. LIONEL SELLS, on March 16th, aged 52 years. He lost several fingers on both hands as a result of early experiments in X-ray work.

DR. PAUL DVORKOVITZ, on March 16th, aged 72 years. He was the originator of the system of low temperature carbonisation which bears his name.

MR. JOHN HARRISON, aged 42 years. He had for about 17 years been in business as an electrical and radio engineer at 33, Lord Street, Earlestown, near Warrington.

THE E.P.E.A.

The London Local Technical Group of the Electrical Power Engineers' Association held their first social function on March 16th at the New Princes Galleries, Piccadilly, London, when 154 members and friends were received by the Chairman of the Group (Mr. W. J. Jeffery) and Mrs. Jeffery. Dinner was served in the Galleries at separate tables, and the function was unique in that there were no speeches. During the period before dinner and the intervals between the dances the members had the pleasure of a private view of the exhibition of water colour paintings and the miniature portraits with which the walls of the galleries were adorned. A splendid dance band, from the Princes Restaurant, was in attendance, and there was ample room for sitting out. This function will, no doubt, become another "annual," and, if the first is any augury for the future, the next one will fill the galleries. As befits the National Technical Group Scheme the gathering was fully representative of those engaged in the design, manufacture, erection, and running of central station plant and accessories. Messrs. Rycroft and Andrews, who were responsible for the arrangements, received hearty congratulations on the success of their efforts.

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IN PARLIAMENT.

West Highland Water Power Bill Considered by Select Committee.

A SELECT Committee of the House of Lords began consideration of the West Highland Water Power Bill last week.

Mr. H. P. Macmillan, K.C., for the promoters, said it was proposed to promote a company to be called the West Highland Water Power Co., to establish a hydro-electric power station at Loch Hourn, and to use the water of the rivers Garry and Moriston and other streams and natural storage facilities provided in Lochs Quoich, Clunie and Loyne. The cost would be £2 730 000. It was hoped to attract industries to the site or make arrangements with the Central Electricity Board.

Mr. C. H. Merz gave technical details of the scheme and said the scheme would work in conjunction with the grid. The present low price for electricity throughout the country was not through the special economy of steam-raised power, but through the increased efficiency and economy in working and centralisation.

Sir Alexander Gibb said he was responsible for the carrying out of the civil engineering portion of the work. Loch Quoich would be used as the central storage base. The Loch Garry works would cost £90 000, and would take three years to complete.

Lord Meston, one of the promoters of the Power and Traction Finance Co., the promoters of the Bill, said the use to be made of the electricity would depend upon the attitude of the Central Electricity Board. If all the power was not required the promoters would try and induce suitable electro-chemical process works to start on the banks of Loch Hourn.

Mr. W. H. Armistead, a fish culturist, said he thought the scheme would give better results than nature afforded in dry weather, as it provided a steady flow of water into the lochs in the summer.

Provost A. M. MacEwan, Inverness, said the local bodies had come to the decision that the scheme would be of no benefit to the Highlands, because as far as it could be understood, the whole of the power would be used in the South.

Mr. F. W. Purse said he did not think the proposals of the Bill would serve any public benefit so far as the County Councils in the northern areas of Scotland were concerned.

Lancashire Electric Power Bill.

This Bill was before the Unopposed Bills Committee of the House of Commons on March 21st, and after evidence had been given was passed for third reading. It was explained that the total capital powers of the company were £3 000 000 with £1 000 000 borrowing powers, of which amount they had issued £2 400 000 capital and £800 000 loans. They now asked for £1 000 000 further capital and £500 000 borrowing powers, and also powers to borrow up to half the original capital. The company was extending the station at Kearsley, and the total expenditure on that station would be about £1 700 000. It had other works in hand which would involve a total of £2 200 000. Three of the company's stations were selected stations for the purpose of the Central Electricity Schemes, and the company was under obligation to extend when called upon to do so by the Board.

London Passenger Traffic.

The hearing by a House of Commons Committee of arguments and evidence in regard to the proposals of the Underground Railways Group and London County Council for co-ordination of transport facilities in the London area has been continued during the past week.

Lord Ashfield, chairman of the five companies in the Underground Group, said the setting up of a common fund and common working by those companies had been amply justified. His view of the need for co-ordination of London's traffic was expressed generally in the report of the London Traffic Advisory Committee. He would not like to suggest that the solution of the London traffic problem could not be found on the surface. If extensive widenings were made the solution could be found, but only at prohibitive cost.

Lord Ashfield referred to the insistent need for the extension of tube railways. A mile of tube railway cost, say, £850 000. He could see no solution except by co-ordination of the different forms of traffic under one management, with one common financial interest. Since the war they had spent £26 000 000 on their undertaking. He read a memorandum setting out his views as to how the common management would operate. If the Bills were passed, he said they were almost pledged to extend the tube from Finsbury Park to Wood Green, at a cost of from £4 500 000 to £5 000 000. He had no hesitation in saying they would be able to come to an agreement satisfactory to London County Council and to themselves. He believed that his companies would be prepared to leave to the Minister of Transport the decision of what was a reasonable return on the capital and the formula for determining it. He had hoped that the Metropolitan Railway would come into the scheme, but they had not yet indicated their willingness.

Mr. E. E. Charteris, K.C., for London County Council, read an abstract from the report of a special committee on tramways to which the Council, in 1920, referred the question of London traffic. The committee reported that the fact had been impressed upon it that it was impossible to effect anything like improvement until some concerted effort was made to meet the present unrestricted competition between the means of local passenger transport.

Sir John Gatti, L.C.C., described the proposals in the Bills as a beginning. What he would regard as an ideal body would be one purely representative of the local authorities. The ownership of the Council's tramways, if the Bills were passed, would still remain with the Council. He hoped that all the dissenting local authorities would come in.

Mr. Moon, K.C., for East Ham and West Ham Corporations, maintained that the municipalities should have controlling interest in the common management.

Lancashire Trolley Vehicle Scheme.

A Bill promoted by the South Lancashire Tramways Co. for authority to run trolley vehicles along the routes of the company's tramways and other routes and to run omnibuses came before a Select Committee of the House of Lords last week.

Mr. Thorpe, for the promoters, said the company had constructed 32 miles of track connecting with such important centres as Bolton, Wigan and St. Helens. They had come to the conclusion that the tramway system was out of date, and that the best thing to do was to substitute trolley vehicles, using the existing overhead standards.

Mr. Wallace said, in order to meet objections raised to the protection clause, they had decided to ask for protection along the routes of the existing trams only.

On behalf of local authorities opposing the Bill, it was submitted that there was no precedent for monopoly over such a large area and that the company's obligation to light the streets along the tramway routes should continue. The company had already powers to run buses through their parent company.

The Chairman (the Marquis of Bath) said the Committee would not allow the restriction of competition proposed in the Bill. The payment of £150 per annum to Leigh for road widening and loss on market tolls would cease, but the liability to light the district should continue.

Replies to Questions.

The results of the recent television demonstration are still under consideration, and the Postmaster-General is not yet in a position to make a statement as to his conclusions on the merits of the Baird system.

It is estimated that during the period 1870 to 1912 the total loss on the Post Office telegraph service amounted to approximately £21 800 000, of which interest charges accounted for about £12 500 000. From April, 1912, to April, 1928, the loss amounted to approximately £24 000 000, including about £5 000 000 for interest charges.

In reply to a suggestion by Sir Robert Thomas that wireless apparatus might be set to send out automatically the S.O.S. signal and the latitude and longitude of a vessel in distress, and so enable the wireless operator to endeavour to save himself when the question of saving the vessel became hopeless, Sir P. Cunliffe Lister (Board of Trade) said he would be happy to discuss the question with Sir Robert, but a difficulty was that the sending out of these automatic messages would interfere with messages exchanged with rescuing ships.

From April 1st, 1912, to March 31st, 1928, the aggregate telephone surplus, after providing for maintenance, depreciation, and operating costs, but not interest, amounted to £24 591 445. The interest charges for the same period amounted to £27 059 534. During the past few years reductions of telephone charges have been made amounting to many millions of pounds. The royalties received from the National Telephone Co. during the last three years of its operation amounted to £970 000.

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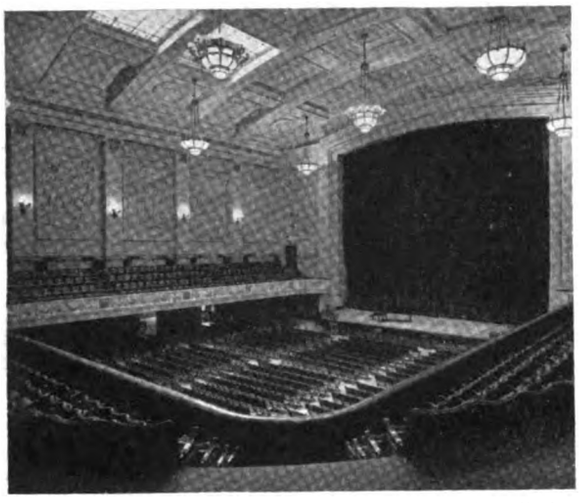
BUSINESS ITEMS.

THE address of the BRITISH SECHERON CO., LTD., has been changed to 158, Stonehouse Street, London, S.W.4.

DIXONIA, LTD., announces that all further correspondence should be addressed to Clifton Street Works, Latimer Road, London, W.11.



AN exclusive photograph of the new lighting installation at Melbourne Town Hall, carried out with Osram lamps and G.E.C. fittings.

SIEMENS BROS. AND CO., LTD., Woolwich, London, S.E., advise us that cables and wires of their manufacture are used throughout in the "Viceroy of India."

A new lamp stores and trade counter has been opened by the BRITISH THOMSON-HOUSTON CO., LTD., at Sherwood Buildings, South Sherwood Street, Nottingham.

The Radio Wholesalers' Federation has recently added the following new members to its strength: B.N.B. Wireless, Ltd., Hobday Brothers, Ltd., Simpson Baker and Co., Ltd., and the Esco Co.

To enable members of the staff to see the latest developments the WESTERN ELECTRICITY SUPPLY CO., LTD., organised a visit to the Ideal Home Exhibition, London, on March 20th. Members of the District and Branch Staffs in Wiltshire, Oxfordshire and Berkshire participated.

A British subject recently resident in Colombia is desirous of returning to Colombia with representations of British firms manufacturing electrical machinery and accessories, engineering accessories, metals, hardware, and heavy chemicals. The Department of Overseas Trade has further details. (Reference No. 150.)

When Mr. Lloyd George addressed his audience in the Albert Hall, London, on Tuesday, his words were relayed to thirteen other towns over an aggregate of more than one thousand miles of special Post Office trunk lines. The public address equipment of the MARCONIPHONE CO., LTD., 210, Tottenham Court Road, London, W.C. was used.

DAVEY PAXMAN AND CO., LTD., Aldwych House, Aldwych, London, W.C.2, point out that though only a few months ago the Ashford (Kent) U.D.C. equipped their generating station with an eight cylinder Paxman cold starting "spring injection" crude oil engine, they have just ordered a more powerful engine of the same type. This second engine will be almost identical with a 1 500 B.H.P. engine which the Basingstoke U.D.C. is about to instal.

The SYNCHRONOME CO., LTD., points out that with regard to our note on "Checking Alternator Frequency" in our issue of March 8th, it should be mentioned that EVERETT, EDGCUMBE AND CO., LTD., as chief contractors, are responsible for the linking up of the London Power Co.'s stations with a combination of the Warren frequency meter and the Synchronome system. Messrs. Everett Edgcumbe handle the Warren master frequency meters in Great Britain, as well as the Warren synchronous motors for this and other purposes.

The business of J. SMITH AND SON, heating, lighting and general engineers, of 33 and 34, North Road, and Foundry Street, Brighton, has for family reasons been converted into a private limited company. Successfully carried on by Mr. J. D. Smith since the death of his father, the late Mr. John Smith, in 1893, it will now be under the control of his brother, Mr. H. L. Smith, as managing director. Mr. J. D. Smith retires from active management, but retains a seat on the Board. The name of the firm appears in the list of members of the Electrical Contractors' Association, and on the National Register.

The new showrooms of Messrs. BEST AND LLOYD, in Great Marlborough Street, London, a photograph of which was reproduced in our issue of March 1st, is an indication of the growing importance of the electric lighting trade. Much of the originality of the front was lost in our illustration of the premises, as the lettering is red against a general scheme of black, well setting out the lights and stoves in the window. Inside on two floors is shown a wide selection of fittings, including a section of decidedly modern designs. Messrs. Best and Lloyd, apart from such recent successes as "Firelight Glass," have carried out several important lighting contracts recently, including the Royal Horticultural Hall at Westminster, and Nottingham University.

In connection with the electric light and power installations at the New Pavilion at Bournemouth, the electrical contractors, Messrs. AISH AND CO., Yelverton Road, Bournemouth, advise us that the new pavilion is the first building in Bournemouth in which a 3-phase electricity supply has been used, 200 V for lighting, 346 V for power, 100 cycles being the periodicity. The supply is taken from the mains of the Bournemouth Power and Electricity Supply Co., a special 11 000 V service into the building being provided; transformers are accommodated in a room near the Power House, whilst an emergency lighting system is provided, using 500 V d.c. to drive a motor generator producing 200 V d.c. The electric light installation consists of approximately 1 750 lamps of varying wattages from 25 to 1 000 W. The power installation consists of 32 electric motors, varying in size from 35 H.P., which drive the ventilating fans, down to ¼ H.P. for the labour saving appliances in the kitchen, totalling 270 H.P. in all.. The installation includes a passenger lift, and 4 service lifts from the kitchen to the restaurants and ball room; the kitchen is equipped with many electrically operated labour saving machines, whilst the refrigerating and soda fountains are operated on the "Frigidaire" automatic refrigeration system. The wiring is carried out in 27 500 ft. of screwed steel conduit, which was erected before the 24 miles of cables were drawn in.

ADVERTISING AND EXPORT TRADE.

Annual Dinner of the National Advertising Benevolent Society.

SIR ERNEST BENN, who was chairman on March 22nd at the 11th annual festival dinner of the National Advertising Benevolent Society at the Connaught Rooms, London, had the satisfaction of announcing that £7 050 had been raised in connection with the gathering.

Sir Robert Horne, M.P., who proposed the toast of "The Society," said he could remember the time when people who advertised largely were looked upon with suspicion. We had entirely departed from those silly old notions. A great truth lay behind the advertising profession. It was that the more goods one could sell the cheaper one could produce them. Sir Robert said the failure of British salesmanship in many instances was due to the fact that there was no proper appreciation of the state of mind of the people to whom they were appealing. Whereas before the war we had by far the largest export trade of the world—and it was necessary for us to have that, because we could not live without export trade—to-day the United States, which prided itself on its skill in salesmanship and its efficiency in advertising, was exporting three hundred million pounds worth of goods more in a year than we were. The U.S.A. export trade had grown to £1 000 000 000 annually, compared with our £700 000 000. There was great scope for new British markets in the Dominions, and he appealed to all engaged in salesmanship to take advantage of every opportunity offered of travelling to the Dominions, and to make themselves familiar with the actual needs of the people, and their attitude towards the various goods produced in this country.

Sir Ernest Benn, responding, spoke of the excellent work of the National Advertising Benevolent Society which during the past year had distributed £6 373 in relief of necessitous cases.

Sir Gomer Berry, Mr. Edgar Wallace and Lieutenant-Colonel E. F. Lawson also spoke.

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BUSINESS OPENINGS.

Latest Particulars of Electrical Engineering and Wiring Installation Contracts for which Tenders are being Invited at Home and Abroad.

WE give below the latest particulars of contracts for which tenders are invited. The closing date is given, when available.

DEVIZES RURAL DISTRICT COUNCIL.—Electric light installations at 42 houses in the council's areas.

BROOK MOTORS, LTD., March 29th.—Electric lighting work in connection with extensions to Empress Works, St. Thomas's Road, Huddersfield. Plans, etc., can be seen at the offices of Mr. J. Arnley, 55, New Street, Huddersfield.

GLASGOW CORPORATION, March 29th.—Supply of poles, bases and cables, for street lighting. Specifications from the Inspector of Lighting, 20, Trongate, Glasgow.

RHONDDA URBAN DISTRICT COUNCIL, March 30th.—Supply of house service, a.c., ordinary and prepayment meters, cable joint boxes, compound, cut-outs, etc., for one year. Specifications, etc., from the Electrical Engineer, Electricity Works, Porth, Glam.

ROSSLYNLEE ASYLUM, March 30th.—Six months' supply of electrical fittings, etc. Forms of tender from Mr. C. L. Addison-Smith, 19, Heriot Row, Edinburgh.

GLASGOW CORPORATION, April 2nd.—Electric light installation in new police station of Millerston. Specification, etc., from the Office of Public Works, 64, Cochrane Street, Glasgow; deposit, £2 2s.

MANCHESTER CORPORATION, April 3rd.—Supply and placing in position at Oldham Road "B" sub-station of one 8 000 kVA forced air-cooled transformers, 32 000/6 600 V, three-phase, 50-period. Specification (No. 232) and form of tender from Mr. H. C. Lamb, Electricity Department, Town Hall, Manchester; deposit £1 1s.

WEST MIDLANDS JOINT ELECTRICITY AUTHORITY, April 5th.—Supply and erection of three single-phase, 4 000 kVA transformers, to form a 12 000 kVA three-phase bank, at the Authority's West Bromwich generating station. Specification, etc., from Mr. E. F. Hetherington, chief engineer and manager, Phœnix Buildings, Dudley Road, Wolverhampton; deposit £2 2s.

GREAT WESTERN RAILWAY, April 9th.—Supply of electrical wires and cables (list 20), telegraph ironwork (list 21), and wire-iron and steel for telegraph work, etc. (list 28). Forms of tender can be obtained from the Stores Superintendent, Swindon.

CENTRAL ELECTRICITY BOARD, April 15th.—Supply and erection of 33 000 V overhead transmission lines, in connection with the North-West England and North Wales Electricity Scheme. Specification (No. N.W.E.–S.L.2) from Mr. R. H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

DUMFRIES CORPORATION, April 17th.—Supply and erection of one water cooling tower, for the Electricity Department. Specification, etc., from Mr. W. S. Johnston, engineer and manager, Electricity Works, Leafield Road, Dumfries; deposit, £1 1s.

WEST RIDING EDUCATION COMMITTEE, April 17th.—Electric light installation at Edlinton New Middle and Elementary Schools and caretaker's house. Specifications, etc., until April 10th, from the Education Officer, County Hall, Wakefield.

Transformers for the Central Board.

CENTRAL ELECTRICITY BOARD, April 22nd.—Supply and erection of 33 000 V and lower voltage transformers. Specification (No. N.W.E.–S.T.2) and form of tender from Mr. Richard H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit, £2 2s.

CENTRAL ELECTRICITY BOARD, April 29th.—Supply and erection of electricity meters, in connection with the Central Scotland Electricity Scheme. Specification (No. C.S.–S.S. 14) and form of tender from Mr. Richard H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

SOUTHAMPTON CORPORATION, April 30th.—(1) Steel-framed building, platform for fans, overhead bunkers, etc.; (2) two water-tube boilers, with superheaters, economisers, stokers, fans, soot blowers, etc.; (3) steam, feed water and other piping, etc.; and (4) water softener, at Electricity Works, Western Esplanade, Southampton. Specification, etc., from Mr. W. G. Turner, borough electrical engineer; deposit, £2 2s.

WEST MIDLANDS JOINT ELECTRICITY AUTHORITY, May 10th.—(a) Main 33 000 V switchgear, each circuit-breaker having rupturing capacity of not less than 1 500 000 kVA; (b) auxiliary 33 000 V switchgear, each circuit breaker having rupturing capacity of not less than 500 000 kVA, with group feeder reactors, for Ironbridge power station. Specification (No. 4) and form of tender from Mr. E. F. Hetherington, chief engineer and manager, Phœnix Buildings, Dudley Road, Wolverhampton; deposit, £2 2s.

WEST MIDLANDS JOINT ELECTRICITY AUTHORITY, May 10th.—(1) One 50 000 kW turbo-alternator, with step-up transformers, etc.; (2) condensing plant, boiler-feed pumps, evaporators, etc.; (3) circulating water pumps, etc., for Ironbridge power station. Specifications (No. 2) and form of tender from Mr. E. F. Hetherington, chief engineer and manager, Phœnix Buildings, Dudley Road, Wolverhampton; deposit, £2 2s.

Overseas.

UNLESS otherwise stated, particulars of overseas contracts are to be had from the Department of Overseas Trade (Room 52), 35, Old Queen Street, Westminster, London, S.W.1. *Note.—An asterisk denotes that local representation is, in practice, essential.*

DUBLIN BOROUGH COMMISSIONERS, March 29th.—Installation of motors, starters, starting switches, etc., at City Abattoir. Specifications from Mr. F. McArdle, architect, 29, Rosemary Street, Belfast; deposit £3 3s.

KAILAN MINING ADMINISTRATION, March 30th.—Supply and erection at Shanghai of two 300 kW turbo-generators. (Reference B.X. 5 714.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, April 2nd.—Supply of jumper rings and terminal strips (schedule C 405). (Reference B.X. 5 066.)

INDIAN STORES DEPARTMENT, April 3rd.—Supply of paper insulated cables, for 660 V and 6 600 V, respectively, with joint boxes and joint compound (order No. N. 9 530). (Reference B.X. 5 164.)

ARGENTINE MINISTRY OF PUBLIC WORKS, April 4th.—Supply of Diesel electric Titan crane. (Reference A.X. 7 583.)

INDIA STORE DEPARTMENT, April 4th.—Paper insulated, armoured cable, with joint boxes. Form of tender (5s.) from the Director-General, Belvedere Road, London, S.E.1.

INDIA STORE DEPARTMENT, April 5th.—Hospital steam laundry equipment, with Lancashire boiler, electric motors, piping, etc. Form of tender (5s.) from the Director-General, Belvedere Road, London, S.E.1.

SOUTH INDIAN RAILWAY CO., LTD., April 5th.—Supply of electrical materials and fittings. Specifications, etc. (5s.), from the Company's Offices, 91, Petty France, Westminster, S.W.1.

VICTORIAN RAILWAY COMMISSION, April 5th.—Supply of rectifiers and storage batteries, for power signalling purposes (contract No. 42 549). (Reference B.X. 5 166.)

VICTORIAN ELECTRICITY COMMISSION, April 8th.—Galvanised steel transmission lines towers (specification 29/13). (Reference A.X. 7 401.)

VICTORIAN ELECTRICITY COMMISSION, April 8th.—Supply of 22 000 V transformers (specification No. 29/17). (Reference B.X. 5 101.)

DUBLIN BOROUGH COMMISSIONERS, April 9th.—Supply and erection of electrically-driven pumping plant on site adjacent to service reservoir at Stillorgan, co. Dublin. Specification, etc., from the City Treasurer; deposit £1.

NEW ZEALAND PUBLIC WORKS DEPARTMENT, April 9th.—Supply of induction voltage regulators, for Lake Coleridge scheme (section 215). (Reference B.X. 5 018.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, April 15th.—Conductor cords (No. P. and T., 151/1 319). (Reference B.X. 5 098.)

INDIAN STORES DEPARTMENT, April 16th (extension of time).—Supply of 30 kW steam engine driven generator set (order No. N. 9 538). (Reference B.X. 5 167.)

INDIAN STORES DEPARTMENT, April 16th.—Supply and erection of one 5-ton overhead electric three-motor gantry crane (order No. N. 9 536). (Reference A.X. 7 652.)

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NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, April 17th.—Supply of copper earthplates (specification 133). (Reference A.X. 7 556.)

UMTALI MUNICIPALITY, April 18th.—Supply of line sundries, switchgear and transformers, in connection with extensions of electricity undertaking. (Reference B.X. 5 142.)

UMTALI MUNICIPALITY, April 18th.—Supply of 1 000 kW turbo-alternators, spray cooling plant, switchgear and crane (contract B). (Reference B.X. 5 145.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, April 25th.—Supply of three electrically-driven wheel lathes (tender No. 1 410). (Reference A.X. 7 621.)

VICTORIAN ELECTRICITY COMMISSION, April 29th.—Supply of two or three steam turbo generator sets, with condensers, etc., for Yallourn power station extension (specification 29/7). (Reference B.X. 5 062.)

VICTORIAN ELECTRICITY COMMISSION, April 29th.—Supply of two swing hammer mills with electric motors, for brown coal (specification 29/9). (Reference A.X. 7 434.)

STATE ELECTRICITY WORKS, MONTEVIDEO, May 6th.—Supply of electric cables and accessories. (Reference B.X. 5 178.)

EGYPTIAN MINISTRY OF PUBLIC WORKS, May 15th.—Supply and erection at Government Printing Office, Cairo, of 120 kW d.c. Diesel electric generating set, with foundations, artesian well, electrically-driven water cooling pump, etc. Forms of tender, etc. (10s. 6d.), from Chief Inspecting Engineer, 41, Tothill Street, London, S.W.1.

VICTORIAN RAILWAY COMMISSION, May 15th.—Supply of one geared three-phase electric winding engine (contract No. C.M. 778). (Reference A.X. 760.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, May 16th.—Supply and installation of electric signalling apparatus at Johannesburg. (Reference B.X. 5 165.)

TANGANYIKA GOVERNMENT, June 1st. — Concession for utilisation of Pangani River Falls for the development of electric power. Copies of the draft concession may be obtained from the Crown Agents for the Colonies, 4, Millbank, London, S.W.1.

STATE ELECTRICITY WORKS, MONTEVIDEO, July 8th.—Construction and equipment of 50 000 kW power station.

Tenders Accepted.

PORTSMOUTH CORPORATION.—Johnson and Phillips, supply of cable, £1 480.

ORSETT GUARDIANS.—Grays Electrical Co., electric wiring at the Institution, £762.

STOKE-ON-TRENT CORPORATION.—A. Reyrolle and Co., Ltd., supply of switchgear, £2 046.

DEWSBURY CORPORATION.—Ferguson, Pailin, Ltd., supply of h.t. switchgear, etc., £1 143. (Recommended.)

BEDFORD CORPORATION.—Siemens Bros. and Co., Ltd., supply of cables for 12 months. (Recommended.)

WREXHAM RURAL DISTRICT COUNCIL.—Ll. Pritchard, wiring houses on various sites, £1 011. (Recommended.)

DEWSBURY CORPORATION.—Power and Lighting Cables, Ltd., l.t. cable, £1 100; W. T. Henley's Telegraph Works Co., Ltd., e.h.t. cable, £1 495.

CAPE TOWN CORPORATION.—A. Reyrolle and Co., Ltd., switchgear, in connection with bulk supply to Tiger Oats Co., Ltd., £1 027 15s. (Recommended.)

IRISH FREE STATE, LOCAL GOVERNMENT AND PUBLIC HEALTH DEPARTMENT.—Siemens Electric Lamps and Supplies, Ltd., six months' supply of various types of Siemens electric lamps.

PRESTON CORPORATION.—Metropolitan-Vickers Electrical Co., Ltd., supply and erection of 6 600 V switchgear, to control two Preston and Blackpool transmission lines at Ribble power station, £5 325. (Recommended.)

COLCHESTER CORPORATION.—W. H. Allen, Sons and Co., 3 750 kW turbo-alternator, etc., £11 500, and Babcock and Wilcox, Ltd., steel cased marine boiler, etc., £10 390, in connection with extensions at the Hythe.

ST. PANCRAS (LONDON) BOROUGH COUNCIL.—Hackbridge Cable Co., Ltd., supply of l.t. cable, £6 315. Also tendered:—Siemens Bros. and Co., Ltd., £6 336; British Insulated Cables Ltd., £6 451; Standard Telephones and Cables, Ltd., £6 485; Pirelli-General Cable Works, Ltd., £6 525; Greenwich Cable Works, Ltd., £7 194.

WANDSWORTH (LONDON) BOROUGH COUNCIL.—Electric lighting installation work in libraries consequent upon their conversion to the open access system:—Allfarthing Lane Library, L. J. Godfrey, £83; Putney Library, Alpha Manufacturing and Electrical Co., Ltd., £135; Streatham Library, Alpha Manufacturing and Electrical Co., Ltd., £225.

EGYPTIAN STATE RAILWAYS.—Ferranti, Ltd., transformers £564, f.o.b.; British Insulated Cables, Ltd., cable, £259, f.o.b.; English Electric Co., Ltd., switchgear, £443, f.o.b.; General Electric Co., Ltd., switchboard, £183, f.o.b.; Standard Telephones and Cables, Ltd., automatic telephone, £1 792, f.o.b. Antwerp; Ericsson Telephones, Ltd., switchboards, £4 028, f.o.b.

BASINGSTOKE CORPORATION.—Asea Electric, Ltd., transformer (£41), British Aluminium Co., conductors (£17 15s. per mile), in connection with Ash Warren extension. Midland Electric Mfg. Co., switchgear (£26 10s.), supply to Auto Tyre Service, Woking. Davey, Paxman and Co., Ltd., 800 kW heavy oil engine and alternator (£9 306), in connection with extension of generating station plant.

DUBLIN BOROUGH COMMISSIONERS.—Supply of cables and accessories for one year:—Cables—Siemens-Schuckert (Ireland), Ltd., British Insulated Cables Ltd., C. J. Vogel, and Deutsche Kabelwerke A.G.; aerial conductors, British Insulated Cables Ltd., and Deutsche Kabelwerke A.G.; section pillars and disconnection boxes, British Insulated Cables Ltd.; service boxes, W. Lucy and Co., Ltd.; cast-iron troughing, Hammond Lane Foundry, Ltd.

LONDON COUNTY COUNCIL.—Eons Electrical Co., wiring and fittings for electric lighting at Coroner's Court, Bethnal Green, and Weights and Measures Office and Coroner's Court, Clapham, £189. Other tenders:—G. J. Thornton Alder and Co., Ltd., £200; F. R. Skeels, £205; J. Vigor, £205; A. V. Gifkins and Co., Ltd., £243; J. Briggs (Electrical Contractors), Ltd., £248; Harden and Chinery, £250; Harland and Wolff, Ltd., £250; Alpha Manufacturing and Electrical Co., Ltd., £250; M. J. T. Thomas and Co., £272; Fred Hodgson and Co., Ltd., £278; N. and F. Lock, £310; A. E. Tridgell, £350; G. V. Francis, £360; J. Nicoll, £390.

CENTRAL ELECTRICITY BOARD.—Hackbridge Electric Construction Co., Ltd., and British Electric Transformer Co., Ltd., 66 kV and other transformers, in London area, under South-East England scheme; British Thomson-Houston Co., Ltd., and British Electric Transformer Co., Ltd., 132 kV transformers, under Central England scheme; British Electric Transformer Co., Ltd., British Thomson-Houston Co., Ltd., and Ferranti, Ltd., 132 kV transformers, under North-West England scheme; Ferguson, Pailin, Ltd., and Metropolitan Vickers Electrical Co., Ltd., 132 kV outdoor switchgear, under North-West England scheme. The total amount of these contracts is approximately £1 500 000.

ESSEX COUNTY COUNCIL.—Power Contracts, Ltd., wiring of the Brentwood Mental Hospital, in screwed steel conduit, with fuseboards, motors, etc., £9 674. Also tendered:—Rylands Electrical Co., £12 700; Etna Lighting and Heating Co., £12 101; W. E. Hutchinson, £13 720; Colston Electrical Co., £10 434; Mann, Egerton and Co., Ltd., £11 151; Barrow and Co., Ltd., £19 274; Electrical Installations, Ltd., £12 801; Read and Partners, Ltd., £9 239; V. G. Middleton and Co., Ltd., £12 044; A. V. Gifkins and Co., Ltd., £12 601; T. Clarke and Co., Ltd., £13 346; A. Higginbotham and Sons, £11 699; G. E. Taylor and Co., Ltd., £12 828; M. Allen (London), Ltd., £13 171; S. Dixon and Son, Ltd., £10 265; Tredegars, Ltd., £13 043; Ellis and Ward, £13 827.

TELEPHONE DEVELOPMENT.

AT the fourth annual meeting of the Telephone Development Association on Monday, the chairman, Sir Alexander Roger, referred to the propaganda methods of the Association and their satisfactory results. He remarked that during the past 12 months there had been on every single day, on the average, at least ten friendly comments on telephones in the newspapers, apart from the Association's own advertisements. Dealing with the growth of the telephone organisation, he said 1 825 new kiosks were established in 1928, making the total 6 021; between March, 1924, and December, 1928, there had been an increase of 902 exchanges, 7 841 call offices, including kiosks, and 564 091 telephone stations. They must be allowed, with all respect, to differ from the pronouncement of the Postmaster-General that even if he had had more money to spend he did not think he could have spent it economically on developing the telephone system. The programme of new construction work should be accelerated, and demand for the service should be created simultaneously by a definite policy of publicity. It was true that in the last five years we had made a larger advance on a percentage basis than any other country, but we remained tenth on the list. The report and accounts were adopted.

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WORK IN PROSPECT.

AMERSHAM.—Grammar school extensions, for Bucks Education Committee. Particulars from the secretary, Mr. C. G. Watkins, Aylesbury.

BURNHAM (BUCKS).—Factory, for Slough Estates, Ltd.

BANNOCKBURN.—Housing scheme (21), for Stirlingshire County Council. Particulars from the clerk, Mr. Thomas Lupton, Stirling.

BRIGHTON.—Cinema theatre to cost £160 000, for the Associated British Cinemas, Ltd.

CHURCH STRETTON.—Houses (18), for the Urban Council. Particulars from the contractors, G. and H. Jones, Cartref, Gwaenysgor, Prestatyn.

CONNAH'S QUAY.—Housing scheme, for the Urban Council. Particulars from the architect, Mr. S. H. Garratt, Chester Road, Shotton.

DUKINFIELD.—Housing scheme (86), for the Town Council. Particulars from the Borough Surveyor.

HARPENDEN.—Housing scheme (50) for the Urban Council. Particulars from the Surveyor.

HERTFORD.—Business stores, Bengeo, for the Enfield Highway Co-operative Society. Particulars from the Secretary.

HIGH WYCOMBE.—Houses (12), Princes Risborough, for the Rural Council. Particulars from the architect, Mr. C. H. Wright, 24, Temple Street, Aylesbury.

KINGSTON (HEREFORDSHIRE).—Houses (20), Sunset, for Mr. E. Deacon.

KINGSTON-ON-THAMES.—Extensions, Victoria Hospital, to cost £13 000. Particulars from the secretary, Mr. Oliver Parker.

KNOTTINGLEY.—Additional 48 houses, for the Urban Council. Particulars from the Surveyor.

LEWES.—Housing scheme, for the Town Council. Particulars from the Borough Surveyor.

LONGLEVENS.—School, for Gloucestershire Education Committee. Particulars from the Education Architect, Gloucester.

MARLOW.—Handicraft and cookery centre, for Bucks Education Committee. Particulars from the secretary, Mr. C. G. Watkins, Aylesbury.

MIDDLEWICH.—Housing scheme (56), for the Urban Council. Particulars from the surveyor, Mr. F. W. Stocks.

NORTH NEWTON (Taunton).—Village hall. Particulars from the secretary, Mr. John Pope, Stoddens.

OLDHAM.—Housing scheme (200), Limeside, for the Town Council. Particulars from the Borough Engineer.

PORTSLADE.—Housing scheme, for the Urban Council. Particulars from the Surveyor.

PRESTON.—Infants' school, Ribbleton Avenue, for the Town Council. Particulars from the borough engineer, Mr. W. Platt.

ROTHERHAM.—Housing scheme (300), Herringthorpe site, for the Town Council. Particulars from the borough engineer, Mr. Vincent Turner.

SOLIHULL.—Housing scheme (14), Shirley, for the Rural Council. Particulars from the Surveyor.

SOUTH MIMMS.—Housing scheme (118), for the Rural Council. Particulars from the architect, Mr. G. Simcox, Bearwood, The Causeway, Potter's Bar.

STIRLING.—Housing scheme (16), for the Town Council. Particulars from the burgh engineer, Mr. A. H. Goudie.

ST. ALBANS.—House for master and matron, for the Board of Guardians. Particulars from the architect, Mr. H. F. Mence, 43, Upper Lattimore Road.

ST. COLUMB.—Housing scheme (26), for the Rural Council. Particulars from the Surveyor.

STAFFORD.—Police station, to cost £11 000, for the Town Council. Particulars from the Borough Surveyor.

STOURPORT.—Houses (200), for the Housing and Town Planning Trust.

SUTTON-IN-ASHFIELD.—Housing scheme (50), for the Urban Council. Particulars from the architects, Warner, Bocock and Dean, Mansfield Road.

SWINDON.—Chapel, for the Board of Guardians. Particulars from the contractor, Mr. Smith, Parva Hinton.

TILEHURST (READING).—Church, Norcot Estate. Particulars from the architect, Mr. A. H. R. Tenison, 21, Great Peter Street, Westminster.

TRURO.—Housing scheme (18), for the City Council. Particulars from the city engineer, Mr. F. A. Barnes.

WARWICK.—Houses (16), Cubbinton and Whitnash, for the Rural Council. Particulars from the contractors, Johnson and Newton.

TRADE PUBLICATIONS.

"RINGSDORF" carbon brushes and brush holders are the subject of a new issue by RINGSDORF-CARBONS (ENGLAND) LTD., Colindale Avenue, London, N.W.9. The booklet consists of some fifty odd pages and is well illustrated.

G. P. DENNIS, LTD., 66, South John Street, Liverpool, have published two special lists illustrating the "Desco" pressure contact self-aligning fuses, covering H.O. porcelain totally enclosed types up to 100 A, and switchboard mounting types up to 200 A.

A new publication by the E.D.A. for window display purposes.

Three adhesive window bills dealing with h.t. batteries, moving coil, loud speakers, and the deferred payment scheme have been issued by the MARCONIPHONE Co., LTD., of 210/212, Tottenham Court Road, London, W.1.

A new descriptive catalogue of Wild-Barfield industrial electric furnaces has been published by WILD-BARFIELD ELECTRIC FURNACES, LTD., Elecfurn Works, North Road, London, N.7.

BRITISH INSULATED CABLES LTD., Prescot, Lancs., have issued a pocket volt calculator, which gives at a glance voltage drop in respect to length of cable, size of cable in respect to voltage drop and similar information. The device is worked on the slide rule principle.

List BA/V-BB/V, dealing with Vicma and Vinazo wires and cables, has been published by W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Holborn Viaduct, London, E.C.1. List BC/V, dealing with the same subject, has also been published. Both these issues are for binding in the binder already issued by the company.

WIRELESS PICTURES (1928), LTD., Dorland House, 14/16, Regent Street, London, S.W.1, have published in leaflet form full particulars of the components required for the construction of a "Fultograph" picture receiver. A leaflet devoted to the electro-magnetic clutch used in these receivers has also been published.

The SUN ELECTRICAL CO., LTD., 118/120, Charing Cross Road, London, W.C.2, has published the second edition of the general catalogue of electrical supplies, apparatus, and appliances. In the accessories section of the issue in particular, the company's policy of naming alternative makes for similar articles is most marked. Another interesting point is that of the 576 pages of listed goods, 82% of the items mentioned are manufactured in this country. It will be understood that the general catalogue is distinct from the same company's electric lighting fittings and radio lists, which are issued as separate volumes.

FALK, STADELMANN AND CO., LTD., 83/93, Farringdon Road, London, E.C.1, has published catalogue No. 612 concerning lighting fittings, and No. 613 dealing with glass shades. The former of these publications is a well-produced reference on current forms of lighting, including "architectural" designs, vellum shades, bowls, and so on. Part of the catalogue is devoted to radio, while another gives the "Efes-code" for sending cables in connection with the items listed. In all, the catalogue consists of 243 pages and is well illustrated. In cases where the fitting or shade includes considerable detail, the reproduced photographs are large, while in every case the description is ample.

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ELECTRICITY SUPPLY.

Hire and Hire-Purchase at Lichfield—South-East England Transmission Lines—Stretford Extensions—L.C.C. School Lighting—Irish Free State Electricity Board Acquires Existing Undertakings—Glasgow Economy Scheme.

GLASGOW Electricity Committee has authorised mains extensions at a cost of £5 676.

Upholland U.D.C. has given its consent to the application by the Wigan T.C. for a Special Order to supply and distribute electricity within the urban area.

Pocklington U.D.C. has decided not to oppose the application of the Holderness Trust, Ltd., for an Order to supply electricity within the Council's area.

Preston Electricity Committee has adopted a proposal to construct an additional water inlet for condensing purposes at Ribble power station, and to borrow £52 000 to cover the cost.

The Aldershot Gas and Electricity Co., which has acquired the Hindhead electricity undertaking, has applied to Farnham R.D.C. for permission to cross the Council's district between Farnborough and Hindhead, by means of overhead and underground electric cables.

Lichfield T.C. has applied for a loan of £2 990 for overhead cables to give a supply of electricity to Shenstone.—Sanction has been received to a loan of £2 100 for wiring installations on the hire-purchase scheme, domestic apparatus for hire, and additional testing instruments.

The first portion of the new high-pressure grid lines for the South-East England electricity scheme has been completed between Bedford and Little Barford, and will be used shortly. This section of the transmission system is ten miles in length, and consists of four cables supported by steel towers varying from 66 ft. to 83 ft. in height.

Dunoon T.C. has confirmed agreement with Messrs. Johnson and Phillips, Ltd., under which the company will establish an undertaking to supply electricity within the burgh. Power has been granted the company to negotiate with the Electricity Commissioners to obtain a Special Order. The maximum rates for electricity agreed upon are 8d. per kWh for lighting, 3d. for heating, and 4d. for street lighting.

Stretford Electricity Committee is considering the purchase of a new 288 tube economiser.—The Committee has authorised the overhauling of the blading of a turbine at a cost of about £1 000.—The Central Electricity Board had approved tenders amounting to £80 000 for high-tension cables, transformers and switchgear and approved the purchase of 1 369 square yards of land for the erection of a station as an extension of Moseley Road sub-station.

Machynlleth U.D.C., after considering electricity schemes submitted by Crompton, Parkinson, Ltd., and the Electric Development and Securities Trust, Ltd., has decided to ask the latter if it is prepared to proceed with the Order applicable to the town, independent of the support of other authorities mentioned in the Order, and also whether, in the event of sanction, it would be open to the Council to arrange terms as to overhead and underground mains.

Oxford Electricity Committee recommends that it be authorised to carry on proceedings in order to secure compliance with the notice served on the Oxford Electric Co., Ltd., requiring the company to sell its undertaking, and to engage such expert assistance as may be required for that purpose. The Committee is advised by Counsel that the Corporation will be entitled to the income of the company from the date of the service of the notice, unless a different date is fixed by agreement.

In a report on school lighting, London County Council Education Committee states that the benefits given by electric lighting, such as increased cleanliness, convenience and improved health conditions, justify electric lighting wherever it can be installed, economically, in new and remodelled schools. Having regard to the cost of installation, however, a general change-over to electric lighting in existing schools can hardly be regarded as practicable whilst prices remain substantially as they are to day.

Bedford Electricity Committee reports that it is necessary to lay cables and carry out such works as will allow of the l.t. network being sub-divided into smaller areas. It is also necessary to provide additional transforming sub-stations in various parts of the town, most of which to be fed from a new Scott bank sub-station. The cost would be for buildings, £1 450; underground mains, £4 800; and sub-station equipment, £3 650.

The St. James and Pall Mall Electric Light Co. has informed Westminster City Council that great difficulty has been experienced in obtaining suitable premises for sub-stations necessitated by the change-over from the d.c. to the a.c. system, and has asked the Council's permission to construct five sub-stations under the carriageways or footways of certain streets, with small kiosks above ground for ventilation or drainage purposes. The Highways Committee recommends that the Council disapprove the proposal.

The Irish Free State Electricity Supply Board has given notice of its intention to acquire as from March 28th, the Dublin, Clonmel, Rathmines, Thurles, Pembroke and Swinford municipal electricity undertakings. It is stated that the price of current to consumers will not be adversely affected. Other local authorities' undertakings acquired to date are: Dun Laoghaire, Bray, Limerick, Waterford, Wicklow, Wexford, Enniscorthy and Edenderry. There remain in the Free State four local authority electricity undertakings which have not as yet been acquired, viz., Ballaghadereen, Navan, Kildare and Dundalk.

Regulations dealing with installations at premises licensed for public entertainments were drawn up by Mr. A. M. Sillar for Middlesex County Council and adopted by the Council in June, 1925. Since that time developments have taken place in the use of electricity, particularly in connection with Neon signs and talking picture installations, and the Licensing Committee is of opinion that the regulations should now be revised. Mr. Sillar is prepared to undertake this work at a remuneration of three guineas an hour for the time spent, his total fee not to exceed sixty guineas. The Committee recommends that Mr. Sillar be engaged to carry out the work.

Glasgow Electricity Committee has approved a report by Mr. H. Bell, general manager of the Electricity Department, giving details of a proposed reorganisation of the Department, by which it is believed substantial economies can be effected without sacrificing efficiency. Mr. Bell states that it is estimated that savings in capital expenditure in respect of wages will amount to £31 000 and of materials to £149 000, while the saving in revenue expenditure, in respect of wages, material, debt charges, rates, etc. will amount to £40 000. A proposal in the report is that a sales manager be appointed, to co-ordinate with the existing technical staff and relieve them of many of their present duties, and to pay special attention to the development of the industrial load.

Portsmouth Electricity Committee has had under consideration the question of providing an additional main transmission line to supply electricity to the district outside the Island of Portsea. The Engineer reports that it would be most advantageous for the proposed relief main to be taken to the Corporation's existing sub-station at Emsworth. The land to the south of the Southern Railway offers no serious obstacle to the erection of overhead lines from Portsmouth to Bedhampton, nor do the northern shores of the harbour from Bedhampton to Emsworth, and it is proposed to erect overhead lines on these sections. The Committee recommends application to the Minister of Transport and the Electricity Commissioners for their consent to the carrying out of the work, and to the borrowing of £28 000.

Hornsey Electricity Committee has been informed by the Electricity Commissioners that the Commissioners are not satisfied that the corporation would, if consent were given to its extension proposals, be in a position to give a supply of electricity adequate in quantity and regularly to meet the present and prospective demands of the consumers at a cost not greater than that at which it could give a supply if it obtained a supply of electricity from the London and Home Counties Joint Electricity Authority. The Commissioners have accordingly decided to refuse their consent. The Committee is advised that the Commissioners, after designating the Central Board as the alternative source of supply, have no power to act as they propose, and the Committee therefore recommends that any necessary steps should be taken for the protection of the Council's legal rights.—The Committee proposes to instal a 300-kilowatt motor-converter at the Highgate sub-station at a cost of £3 076.

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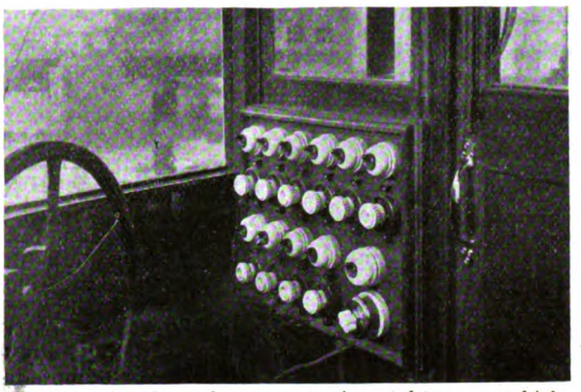
ELECTRICAL NEWS OF THE WEEK IN PICTURES.

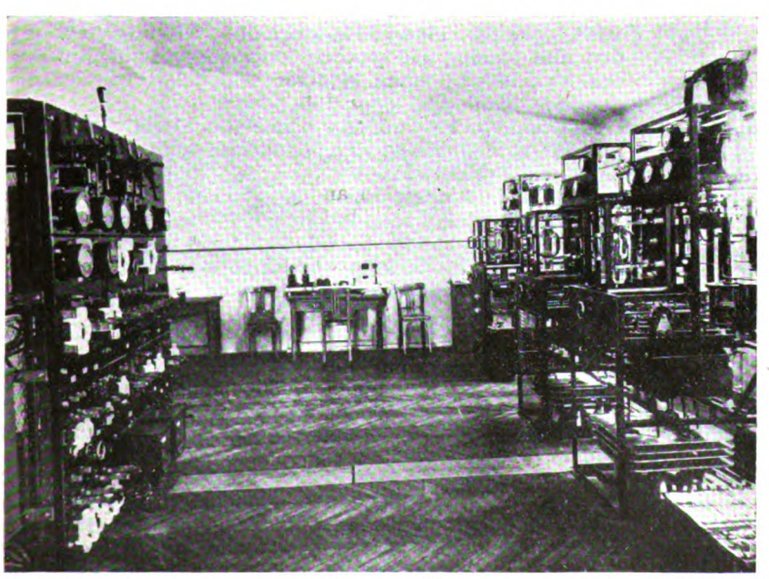
Mr. R. H. Palmer, who has become engaged to Miss Muriel Cracknell. Mr. Palmer is principal of Palmer's Publicity Service, and handles the advertising of several electrical firms.



The driver's cab on the new experimental tramcar which, when licensed, will be put into service on the Metropolitan (London) Electric Tramway Company's lines. The new car is the result of public suggestion and criticism, and experience gained from the two previous experimental cars, "Bluebell" and "Poppy," put on the road some two years ago.

Mr. Richard H. Fox, the recently appointed secretary to the Central Electricity Board. He was formerly solicitor to the Board, a position which he will still hold, jointly with that of secretary.

Two views of classes in the use of domestic electrical appliances in one of the elementary schools in Barnsley. Eight such schools have been equipped with a total of 12 electric cookers, 15 electric wash boilers, and 130 electric irons, whereby the scholars receive instruction in their uses. The knowledge thus gained can be easily applied to their home life, the Corporation wiring schemes having brought electricity supply within the reach of all residents.



The new broadcasting transmitter at Belgrade, a Marconi 9 kW installation, began regular daily transmissions on Sunday, March 24th, signals being well received in England. The whole of the transmitting station (left) is in the centre of Belgrade in the Academy of Sciences, and three studios are used. The aerial is suspended between masts approximately 80 ft. high, erected on the top of the building, and the transmitter works on a wave length of 452 metres with an aerial energy of about 2 kW. The right-hand picture shows the interior of one of the studios used for talks.

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COMPANY NEWS.

Quiet Market in Electrical Securities—Waygood-Otis Satisfactory Record—Chairman of T. C. & M. Co. on Loaded Cables—British Insulated Cables Share Bonus—Directors' Reports and Dividend Announcements—New Companies.

WITH the approaching Easter holidays the market for electrical shares—supply, transportation, equipment and telegraph—has relapsed into a more or less lethargic condition, and our usual list of share quotations shows few alterations compared with a week ago. General Electric shares have reacted to some extent after their last sharp advance, and are now quoted somewhat below £3. Eastern Telegraph ordinary stock is near 270 again, and Marconi's, both Wireless and Marine, are also firmer. Several electricity supply shares—County of London, Kensington, London, and Yorkshire—are slightly lower.

Last Annl. Divd.	Description.	This Week.	Last Week.	1926 to 1928. Highest ▲	Lowest.
%	**Electricity Supply.**				
(*d*)	Brompton & Kensington Ord. ..	27/-	27/-	35/6	23/9
4	Central Elec. Sup. 4% Deb. ..	94	93	95½	88½
(*a*)	Charing Cross Elec. Ord. (£1) ..	26/-	20/-	51/-	24/3
4½	,, ,, ,, 4½% C.P. (£1)	17/6	17/6	18/3	16/6
(*b*)	Chelsea Elec. Sup. Ord.	27/-	27/-	45/3	24/-
10	City of Lond. Elec. L'ting Ord. ..	31/10½•	31/10½	52/10½	26/-
6	,, ,, ,, ,, ,, 6% C.P.	23/-•	23/-	24/3	21/6
7½	County Lon. Elec. Sup. Ord. ..	53/-	53/6	68/6	25/9
6	,, ,, ,, ,, 6% C.P. ..	23/-	23/-	24/-	21/3
(*c*)	Kensington & K'bridge Ord. (£1)	26/6•	27/-	27/6	23/9
1/9⅔	Lon. Elec. Sup. Ord. (£1).. ..	27/-•	27/6	37/6	23/-
1/9⅔	Metro. Elec. Sup. Ord.	42/6	42/6	53/-	24/9
4½	,, ,, ,, 4½% C.P. ..	17/6	17/6	18/3	16/3
7½	N'castle & Dis. Elec. Ltg. Ord. ..	28/1½	28/1½	31/9	17/6
1/2½	N'castle-upon-Tyne Elec.Sup.Ord.	25/-	25/-	30/3	19/3
6	N. Metro. Elec. 6% C.P.	23/-	23/-	23/9	20/10
6	Notting Hill 6% C.P. (£10) ..	10½	10½	11½	9½
(*c*)	St. James & P.M. Ord. (£1) ..	27/6	27/6	28/6	23/6
1/4½	Shrops.Worcs.&Staffs. Power B.Ord.	37/6	37/6	37/6	21/4
1/9⅓	W'minster Elec. Sup.Ord. (£1) ..	26/-	20/-	52/9	24/-
4½	,, ,, ,, 4½% C.P. (£1)	17/6	17/6	17/10½	16/7½
8	Yorks. Elec. Power Ord.	34/-	34/6	38/9	24/6
6	,, ,, ,, 6% C.P. ..	24/-	24/-	26/9	20/7
	Railways and Tramways.				
8	Brit. Elec. Trac. Pfd.Ord. Stk ..	128	128	152	117
6	,, ,, ,, 6% Pf. Stk.	128½	128½	133	103½
4	Cent. Lon. Ry. Ord. Stk. (asstd.)	72	72	72	54
4	,, ,, ,, 4% Deb.	80	80	83	77½
4	City & S. Lon. 4% Perp. Deb. ..	79½	79½	81	76½
5	Lon. Elec. Rly. Cons. Ord. Stk. ..	73½	73½	75½	42½
4	,, ,, ,, ,, 4% Pf. Stk.	73	73	77	68
4	,, ,, ,, ,, 4% Deb. ..	80	80	83	76½
5	Lon. & Sub. Trac. A. Deb. ..	97½	97½	97½	74
4	Lon. Un. Trams, 1st Deb. ..	61	61	63	39
4½	Met. Elec. Trams,4½% Deb. ..	72	70	73½	62
5	,, ,, ,, 5% Deb. ..	67½•	69½	70½	65½
3½	Met. Rly. Cons. Ord. Stk. ..	60	60	81	54½
3½	,, ,, ,, 3½% Pf. Stk. ..	63	63	67	60½
3½	,, ,, ,, 3½% Deb. ..	70	70	73½	67½
5	Met. Dis. Rly. Ord. Stk.	76½	76½	77½	52½
4½	,, ,, ,, 4½% 1st Pref. ..	80½	80½	84	74½
6	,, ,, ,, 6% Perp. Deb. ..	116½	116½	118½	110
4	S. Met. Elec. Trams, 4% Deb. ..	70	70	70	64½
7	Uderground Electric Rlys. Ord.	23/6•	24/6	28/2	11/-
—	Yorks. (W.R.) Trams, Ord. ..	5/-	5/-	16/-	3/-
4½	,, ,, ,, 1st. Deb. ..	59	59	78	60
	Electrical Manufacturing.				
7	Brit. Elec. Transformer 7% C.P...	15/-	15/-	19/10	4/6
15	Brit. Insulated Cables Ord. ..	93/9	93/9	86/3	56/-
6	,, ,, ,, 6% C.P. ..	22/6	22/6	23/10	21/-
7	British Thomson-Houston Pref. ..	23/9	23/9	24/9	19/7
7	,, ,, ,, ,, 7% Deb.	104½	104½	109½	102½
10	Brush Electrical Ord.	27/6	27/6	30/9	24/-
15	Callender's Cable Ord.	87/6	87/6	91/3	66/-
6½	,, ,, 6½% C.P. ..	25/-	25/-	25/9	22/-
7½	,, ,, 7½% B. Pref. ..	27/6	27/6	28/3	25/-
8	Crompton-Parkinson 8% Cum. Pf.	25/-	25/7½	27/-	14/-
6	,, ,, 6% Cum. 2nd Pf.	18/-	18/-	19/6	9/7
7½	Edison Swan Elec. 1st Pref. ..	25/7½	25/7½	13/-	7/4½
5	,, ,, ,, 1st Deb. Stk.	86½	86½	92	81½
7½	Elec. Construction Ord.	20/-	20/-	32/6	23/6
7	,, ,, 7% C.P. ..	22/6	22/6	22/9	21/-
—	English Elec. Ord.	7/6	7/6	15/9	5/-
6	,, ,, 6% C.P. ..	9/4½	9/4½	18/9	7/-
7	Ericsson Telephones 7% Pref. ..	20/-	20/-	22/7½	17/6
35	Ever Ready (Gt. Britain) Ord. ..	22/6	21/6	92/3	18/1
6	Ferranti 6% Pref.	18/-	18/-	19/4½	16/9
7	,, 7% 2nd Pref.	21/3	21/3	19/3	13/9
10	General Elec. Ord.	55/-	63/9	46/6	26/6
‡25	W. T. Henley's Ord.	120/-	120/-	120/-	99/3
12½	Johnson & Phillips Ord.	38/9	38/9	67/11	34/-
7½	Lon. Elec. Wire. & Smith's Pref ..	23/9	23/9	25/-	22/3
7½	Siemens Bros. & Co. Ord. ..	27/6	27/6	30/6	24/9
10	Telegraph Const. Ord. (£12) ..	25½	25½	30½	20
	Telegraph.				
3½	Anglo-Am. Tele. Ord. Stk. ..	61½	61½	63½	56½
10	Eastern Ord. Stk.	209½	202	273	135
3½	,, 3½% Pref. Stk.	68½	68½	70½	59
4	,, 4% Deb.	79½	79½	81½	74
10	Eastern Extension Ord. (£10) ..	27	26½	27½	14
22	Gt. Northern Telegraph (£10) ..	32½	32½	43½	26
10	Indo-European (£25)	55½	55½	48½	30
20	Marconi's Wireless T. Ord. ..	82/6	81/3	84,4	12/-
15	,, Int. Mar.	65/-•	63/9	90/-	16/6
10	Western Tel. Ord. (£1)	26½•	26½	27½	12½

(*a*) 19 4/9d. per share. (*b*) 1s. 9·3d. per share. (*c*) 1s. 6·949d. per share.
(*d*) 1s. 8·706d. per share. (*e*) 1s. 7·223d. per share. ‡ Including 1s. bonus.
•Ex dividend.

WESTERN TELEGRAPH CO., LTD.—Div. of 5s. p. sh., tax free, in respect of qrtr. ended Dec. 31, 1928, payable March 11.

COUNTY OF LONDON ELECTRIC SUPPLY CO., LTD.—Fin. div. of 7% recommended on ord. shs. for 1928, makg. 10% for year (agst. 7½%).

POWER CORPORATION OF CANADA.—An issue is being made of $10 000 000 series B 4½% 30-year convertible debs. at $100 and accrued int.

SOUTH LONDON ELECTRIC SUPPLY CORPORATION, LTD.—Fin. div. of 5½% recommended on ord. shs., makg. 8½% for year 1928 (same as previous year).

SOUTH METROPOLITAN ELECTRIC LIGHT AND POWER CO., LTD.—Fin. div. of 5½% recommended on ord. shs. for 1928, mkg. 8½% for year (same rate as in 1927).

J. STONE AND CO., LTD.—Net pft. for 1928, £243,459, plus £128 388 brt. in. After provisn for pref. div., £50 000 is being placed to res., ord. div., 20%, agst. 15%; fwd., £162 767.

MIDLAND ELECTRIC CORPORATION FOR POWER DISTRIBUTION LTD.—Net pft. for 1928, £154 460, plus £9 128 brt. in. Further div. of 5½% recommended on ord. shs., makg. 8% for year. Fwd., £24 549.

EGHAM AND STAINES ELECTRICITY CO., LTD.—Pft. for 1928, £32 661, agst. £29 507. After providg. for loan int. and pref. div. and placing £10 562 to depreciatn. acct., div. of 7½%, less tax, is recommended on ord. shs.

MID-CHESHIRE ELECTRICITY SUPPLY CO., LTD.—Pft. for 1928, £9 254, plus £1 609 brt. in. Div. 5% (same as last year); written off new issue exes., £500; to employees' div. bonus acct., £350. Fwd., £1 833.

RADIO CORPORATION OF AMERICA.—This co. recently announced the formation of a subsidiary, called the Radio Corporation of America Communications, Ltd., which will take over its communication business, except ship-to-shore.

DIRECT SPANISH TELEGRAPH CO., LTD.—Directors recommend divs. for year 1928 of 10% on pref. shs. less tax, of wh. div. for half year was paid on Oct. 1 last, and 10%, tax free, on ord. shs., of wh. intm. div. of 4% was also paid on Oct. 1.

BRISTOL TRAMWAYS AND CARRIAGE CO., LTD.—Rev. for 1928, £1 145 473. Workg. and gen. exes. and renewals amtd. to £1 033 203. Fin. div. on ord. shs. 4%, less tax, makg. 7% (same as last year); to res. for contingencies and renewals, £15 000. Fwd. £3 786.

INTERNATIONAL AUTOMATIC TELEPHONE CO., LTD.—Earnings for 1928, £130 823, agst. £124 369. Fin. div. on ord. shs., 6½%, makg. 10% for year, plus 2½% bonus, less tax; div. on dfd. shs., 10%, plus 2½% bonus. To res., £10 000. Fwd., £69 734, agst. £59 592.

CLYDE VALLEY ELECTRICAL POWER CO.—Blce. of pft. for 1928, £304 296, plus £84 290 brt. in. After paymt. of pref. div. and placing £120 000 to contingency fund, fin. div. on ord. shs. is 5%, makg. 8% for year. To benevolent fund £30 000. Fwd. £84 586.

LLANELLY AND DISTRICT ELECTRIC SUPPLY CO., LTD.—Pft. for 1928, includg. £1 279 fm. last acct., £53 704, agst. £43 652. Deb. and loan int., £14 728; to deb. stk. redemptn., £4 648; res. and renewals accts., £19 000. After paying div. on pref. shs., carry fwd. is £3 327.

BERRY'S INSULATING AND BUILDING PRODUCTS, LTD.—This co., which has been formed to acquire the sh. cap. of Berrite, Ltd., invited subscriptns. last week for an issue of 528 000 ord. shs. of 5s. each at par. In addition, 172 000 shs. will be issued credited as fully paid up.

ERICSSON TELEPHONES, LTD.—Net pft. for 1928, £31 011, increase £4 006, plus £18 223 brt. in. Pft. on tradg., etc., £59 313, agst. £60 014. Div. at rate of 5%, less tax, on ord. shs. (same as last year); to res., £5 000; fwd., £18 235. Orders in hand show increase over last year.

WASTE HEAT AND GAS ELECTRICAL GENERATING STATIONS, LTD.—Net pft. for year endg. Jan. 31, 1929, £28 470, agst. £28 348, plus £15 244 brt. in. Deductg. amt. voted to charities at last mtg., £200, leaves £43 514, agst. £40 844. Div. for year, 8%, includg. intim. div. paid in Aug., 1928. Fwd. £17 914 agst. £15 244.

FOLKESTONE ELECTRICITY SUPPLY CO., LTD.—Pft. on rev, accts. for the three undertakings (Folkestone, Sandgate, and Hythe) for 1928, after paymt. of tax, £40 781, plus £2 046 brt. in. After provisn. for deb. stk. int., pref. div.

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and bonus to staff and employees, blce. is £39 019. To depreciatn., £11 249; to res., £8 000; and to employees' superannuatn. fund, £1 000. Div. on old ord. shs., 6%, tax free, making 10% for year, and on new ord. shs. at rate of 10% p.a., tax free. Fwd. £1 894.

ASSOCIATED TELEPHONE AND TELEGRAPH CO.—Divs. payable on April 1: on 1st pfd. stk., qrtrly div. of $1·75 p. sh.; on class D stk., qrtrly div. of $1 p. sh.; on class A stk., qrtrly. div. of $1 p. sh.; and on class C stk., qrtrly. div. of 75 cents p. sh.

Company Meetings.

DAVIS AND TIMMINS, LTD.—At the meeting on March 14th, Mr. F. Le Neve Foster, chairman, said the policy of concentrating upon a reduction of cost of production by the installation of modern machinery had been continued, and the directors felt that the company was in possession of an installation of automatic machinery second to none in their trade. The accounts showed a handsome net profit of £23 417, after providing for depreciation and management commission. The board proposed a balance dividend on the ordinary shares at the rate of 16¼%, making 20% for the year. He looked forward to the future of the company with greater confidence to-day than at any time during the period in which he had been chairman. The report was adopted.

ENFIELD CABLE WORKS, LTD.—The Earl of Verulam, presiding at the meeting on March 20th, said the winter trade during the past year did not come up to expectations. Repairs and renewals at the new Harrow branch were charged to revenue, and a large expenditure for dilapidations of certain parts of their premises helped to increase the adverse balance. They were shortly opening new branches at Reigate and High Barnet. Mr. Wm. Cooper, managing director, said financially he thought they had cause for congratulation. The total indebtedness was £130 000, against £212 500 in 1925, and they had liquid assets, £34 000, against £10 400 in 1925. If their overhead expenses were divided over more branches, it might mean the difference between loss and profit to those branches. The report and accounts were adopted.

CITY OF LONDON ELECTRIC LIGHTING CO., LTD.—Mr. J. B. Braithwaite, presiding at the meeting on March 20th, said the Electricity Commissioners had fixed the company's standard price to private consumers at 3·069d. per kWh, and for street lighting at 0·794d. They had added to special reserve £86 651, making the total £185 095. In 1921 the average price charged was 4·37d. per kWh, and this had been gradually reduced to 2·23d. in 1928—a reduction of 49%. It was interesting to point out that this reduction of 49% compared with a reduction of 38·57% in the case of the gas companies in the period 1920–28. There had been an increase of 4 768 kW in their connections during the year, raising the figure to about 100 000 kW; an increase of over 8 000 000 kWh in their sales; an economy of £32 595 in their generating and distribution expenses; an addition of £45 989 to their reserves available for capitalisation; and after adding £11 831 to the benevolent fund, £2 830 to the provident fund, making the necessary allocation to the "A" and "B" sinking funds, setting aside £31 694 for the co-partners, providing the statutory dividend of £120 000 for the ordinary shareholders, and adding £9 250 to the contingency fund, they were still able to carry forward £7 656. The report and accounts were adopted, and a dividend of 10% on the ordinary shares was approved.

LONDON AND SUBURBAN TRACTION CO., LTD.—Lord Ashfield, presiding at the meeting on February 26th, said the number of passengers carried on the three tramway systems controlled by the company amounted to 193 millions in 1928, an increase of nearly 7%. But while in 1922 the average fare paid per passenger was nearly 2d., in 1928 it was only 1½d., and that made a lot of difference in the results. Outstanding reasons for the increase of passengers were that the tramways had afforded the public better service, and that the areas served by their tramways were on the outskirts of London, and had benefited under the intensive housing programmes of these last years. With regard to the proposals submitted to Parliament by the London County Council and the Underground group of companies for a co-ordination of the local passenger transport facilities within the London traffic area, they would look to play their part in such a scheme. They would claim for their tramways equal and fair treatment under such a scheme with other tramways. Only by a common management, capable of surveying and planning to cover the whole field of transport, and by a common fund capable of equalising the financial burdens and gains for all interests could undivided attention be given to fulfilling the purposes of a transport system which was to meet the needs of the passengers; only by such means could a margin of resources be secured which would allow of the steady expansion of the facilities provided.

WAYGOOD-OTIS, LTD.—Mr. H. C. Walker, presiding at the meeting last Friday, said the rebuilding of their factory had been completed, and, as a lift factory, it was, they believed, superior to any in Europe. Developments in gearless electric machines were very rapid, culminating in 1924 in the automatic signal control lift, combined with micro drive, or self-levelling, which to-day was the highest form of lift machine for intensive service. They were constructing lifts with signal control for the Westminster Bank, Ltd. There was a further adaptation of control known as collective automatic control,

A PANORAMIC view of the square and environments of Palmerston North, N.Z., where Turnbull and Jones, Ltd., electrical engineers and contractors, of Wellington, N.Z., were responsible for the electrical reticulation of the town, the work for which commenced in 1924. In the aggregate there were used 392 970 yards of cables, comprising Henley Class "A," Class "G," Class "DDD" and Class "BC"; 13 422 yards of twin, three and four-core underground cables; 120 tons bitumen; 920 lb. assorted binding wire; 22 lb. indiarubber strip; 156 lb. black tape; 2 100 lb. joint box compounds; 364 various joint boxes; 37 terminal boxes; 8 manhole network boxes, and 450 fuse boxes. Among the important wiring installations carried out by Messrs. Turnbull and Jones during recent years may be mentioned the Henley wiring system fire alarm installations in the Featherstone Street Post Office, Wellington, and the Auckland public library and art gallery; and installations in the Wellington Grand Opera House; the National Bank of New Zealand in Auckland; the Auckland War Memorial Museum; the Dunedin City Corporation's new gas retort house; and Knox College, Dunedin.

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which ensured level landings under all conditions, thereby permitting speeds up to 450 ft. per minute. They were building lifts with this type of control for the Royal London Mutual Insurance Co. and others. Department store control was another form of automatic operation, intended for stores and other service, where stops were always made at each floor. They installed four such lifts for Messrs. Harrods in 1925, and had just received a repeat order from them for six similar lifts. Hitherto, in this country, electric supply for power purposes in most cases had been direct current, but it was the policy of the Central Electricity Board to convert this gradually to a universal system of alternating current. This change had necessitated many alterations in design and manufacture of lift apparatus. The company had given this matter serious attention, and had actually supplied a large number of installations for speeds up to 400 ft. per minute on alternating current, which were giving complete satisfaction. The report was adopted, and a final dividend of 7½% on the ordinary shares, making 10% for the year, was declared.

TELEGRAPH CONSTRUCTION AND MAINTENANCE CO., LTD.—The Earl of Selborne, presiding at the meeting on March 21st, said the net profit for 1928 was £106 144, plus £112 618 brought forward from previous year. Interim dividend of 2½% was paid on July 12th, 1928. It was proposed to distribute a further dividend of 7½%, tax free, to add £15 000 to reserve, and to carry forward £114 123. Loaded cables had fully proved their worth, and their great capacity for disposing of traffic had enabled the American Transatlantic cable companies to introduce the cheaper rate of 1½d. a word across the Atlantic. If the anticipated increase in the use of letter telegrams became general the demand would come for more fast-working cables of high capacity. This had been fully recognised by the Western Union Telegraph Co., the pioneers of the loaded cable, and for whom the company manufactured in the autumn a cable that, in addition to high speed, was capable of being duplexed. Research work had now definitely established the fact that a long loaded telegraph cable of the ordinary type of construction could be adapted not only for telephony but for the far higher requirements of facsimile telegraphy, and they had developed a method of dealing with their usual gutta-percha insulating material whereby its electrical characteristics rendered it of extreme value for these purposes. The International Standard Electric Corporation had favoured them with an order to lay two cables with this improved insulation, one between Tenerife and Gran Canaria and the other between Algeciras and Ceuta. If reliability was important for telegraph work, it was still more essential for communications by telephone, as people could not afford to wait for their telephone calls when interruptions occurred due to periods of fading, and it was the cable alone which in any form of transmission provided continuous communication throughout the 24 hours. He also believed that the submarine cable would provide the most reliable medium for facsimile telegraphy, which was now growing out of its infancy and was likely to become the cheapest and most important form of communication in the future. There were welcome signs of a revival in the demand for new cables. The report was adopted and the dividend approved.

BRITISH INSULATED CABLES LTD.

Bonus Share Distribution—Important Contracts on Hand—Chairman on the Company's Success—Good Progress of Allied Companies.

THE 33rd ordinary general meeting of British Insulated Cables Ltd. was held on Tuesday at Liverpool.

Mr. D. Sinclair (chairman), in moving the adoption of the report and accounts, congratulated the shareholders on another successful year of trading. They would agree, he said, that the profit of £617 951, which compared with £609 242 for the previous year, was a satisfactory result. The profit, with the balance brought forward of £305 880, made a total of £923 831. After payment of directors' and trustees' fees, etc., debenture interest, preference dividend, and interim dividend on ordinary shares, amounting to £140 442, a disposable balance remained of £783 389. Allowing for the transference of £100 000 to depreciation account and £299 966 to reserve account, the balance available for dividend was £383 423. From this was recommended a further dividend of 10% on ordinary share capital, making, with the interim dividend already paid, a total distribution of 15% for the year, and leaving £250 089 to be carried forward.

Issued share capital and debenture stock remained unchanged in the balance sheet. The reserve account, increased by last year's appropriation of £200 000, now stood at £900 000. Besides being augmented by the transference of £299 966 from trading account, the directors had brought £185 034 from investment reserve and £150 000 from special reserve, thus merging all the reserves in one group, aggregating £1 535 000. The value of property, plant and machinery, standing at £1 564 823, was an increase of £167 877 on last year.

The company's reserves now amounted to the large sum of £1 535 000, exclusive of the carry forward of £250 089. It was the opinion of the directors that this amount was in excess of the requirements of the company, and it was, therefore, proposed to distribute from this reserve to the ordinary shareholders, by way of bonus, one ordinary share free for every existing four ordinary shares held, together with 500 000 "A" 5½% preference shares of £1 each in the proportion of three such shares free for every existing eight ordinary shares held, such shares to rank for dividend as from January 1st, 1929.

The various companies in which British Insulated Cables Ltd. was particularly interested continued to do well. The Midland Electric Corporation for Power Distribution, Ltd., having distributed the bonus of share for share referred to last year, now proposed to pay a dividend of 8% on the increased capital, equivalent to 1% better than last year. The Electric Supply Co. of Victoria was in a much more favourable position, and had entered into a provisional agreement with the Victorian Government by which the whole undertaking would be sold to them in three years' time on terms and conditions fair and advantageous to both parties. The "closer working" agreement, to which he had previously referred, continued to work smoothly and satisfactorily. Valuable results had been achieved by combination in research, and these were reflected in the improvement of quality and processes of manufacture.

To the excellent staff pension fund the company had now contributed a sufficient sum to place it on a thoroughly sound actuarial basis, making unnecessary the provision of further sums beyond the regular contributory payments. With regard to the workpeople, the year had been marked by an absence of disputes and an increase in cordiality. As denoting their keen interest in the welfare of the employees, the directors recommended that £50 000 be set aside from reserves, the income from which was to be utilised to provide compassionate allowances for workpeople and their dependents.

During the last twelve months the company had fully maintained its position in the electrical world. Its products covered all kinds of electric conductors, both bare and insulated, and they were well equipped to deal efficiently with all reasonable demands that might be made upon them. The large contract recently secured to supply and lay cables in the London area for the Central Electricity Board was of a value of well over £500 000. The major portion of the cable would be for a working pressure of 66 000 V, practically a replica of their cables which had been working successfully for the past three years on the North-East coast. These were still the only cables in this country working at so high a pressure. Important contracts on hand included railway electrification in India, big transmission lines in this country for the Central Electricity Board, and in the Federated Malay States for the Perak River Hydro-Electric Power Co. The conductors for the overhead grid system in this country were of steel cored aluminium, and, in addition to supplying their own requirements for this material, they had secured large orders for the sections being carried out by other contractors.

Steel cores coated with copper were a recent development of the business. They had entered into an arrangement with an American firm to manufacture and sell material of this description known as copper-weld wire, which had the advantage of high tensile strength coupled with comparatively high conductivity, and was particularly suited for overhead line work, in which a growing business was being done in this country and abroad.

The report and accounts were unanimously adopted.

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NEW COMPANIES.

S. HATHAWAY AND CO., LTD.—Cap., £1 500. Electricians, manufacturers of and dealers in wireless telephones and telephonic and telegraphic apparatus, parts and accessories, etc. Reg. office: 3, Bold Place, Liverpool.

NORTH ELECTRICAL CO. (1929), LTD.—Cap., £1 000. To adopt agreement with Sophia Miller, and carry on business of electricians, electrical and wireless contractors, factors, merchants and manufacturers at 63B, North Street, Leeds.

DORIAN WIRELESS CO., LTD.—Cap., £2 000. Merchants and manufacturers of and dealers in wireless, electric, magnetic, telegraphic, telephone and other appliances, etc. Solicitors: Kennedy, Lindo and Co., 79, Coleman Street, London, E.C.2.

ELECTRIC LAMP DISTRIBUTORS, LTD.—Cap., £500. Manufacturers, importers, exporters and sellers of electric lamps, electrical accessories, cables and commodities appertaining to electrical industries, etc. Reg. office: 55–63, Goswell Road, London, E.C.1.

ANGLO HARBIN ENGINEERING CO., LTD.—Cap., £1 000. Importers, exporters and manufacturers of and dealers in machine tools, machinery, appliances and equipments for electrical purposes, etc. Reg. office: 11, Grasmere Avenue, Stoneleigh, Coventry.

PARK ELECTRIC RADIO PRODUCTIONS, LTD.—Cap., £1 000. Manufacturers and producers of and dealers in apparatus, instruments, machines and materials for use in connection with wireless telegraphy or telephony, etc. Solicitors: Godden, Holme and Ward, 34, Old Jewry, London, E.C.

J. SMITH AND SON (BRIGHTON), LTD.—Cap., £12 000. To acquire business now carried on at Brighton and elsewhere by Mary A. Smith and J. D. Smith as "J. Smith and Son," and to carry on the business of heating, lighting and electrical engineers, etc. Reg. office: 33 and 34, North Road, Brighton.

ADEY RADIO, LTD.—Cap., £25 000. To adopt agreement with Adey Wireless, Ltd., and H. W. Adey, and to carry on business of manufacturers and repairers of and dealers in portable wireless sets, loud speakers, long range receivers, cabinet receiving sets and wireless parts. Reg. office: 99, Mortimer Street, London, W.1.

CATHODE CORPORATION, LTD.—Cap., £1 000. To exploit inventions for metallising of substances of all kinds; to construct and maintain plant, installations, cables, etc., for working by electricity any railways, tramways or other works, etc. Solicitors: Slaughter and May, 18, Austin Friars, London, E.C.2.

Sound Recording and Reproducing.

MIDLAND RADIO SERVICE, LTD.—Cap., £5 000. Manufacturers of and dealers in apparatus for receiving, transmitting, reproducing or recording sounds, pictures, written or printed matter, and electrical, magnetic, radio-operated, chemical, optical and scientific apparatus, etc. Reg. office: 7, Farquhar Road, Edgbaston, Birmingham.

MOTOR LAMPS, LTD.—Cap., £21 000. To acquire certain patents and provisional patents relating to motor lamps and lens belonging to P. Allman and A. W. Pougher, to carry on business of manufacturers of, agents for and dealers in motor lamps, drawn wire electric cabling, electric lamps, etc. Reg. office: 17, Balfour House, 119, Finsbury Pavement, London, E.C.2.

POLPERRO ELECTRIC AND COLD STORAGE CO., LTD.—Cap., £6 000. To adopt agreement with liquidator of Polperro Electric and Cold Storage Syndicate, Ltd., and carry on at Polperro and elsewhere in Cornwall, the business of an electric light and power company, cold storage proprietors, etc. Solicitors: Spring and Co., 13, Henrietta Street, London, W.C.2. (Public Co.)

W. E. AMIES AND CO., LTD.—Cap., £2 000. To acquire the business of manufacturers of mouldings and synthetic materials carried on by G. L. Ackland and W. E. Amies as W. E. Amies and Co., at 36 and 38, Matilda Street, Sheffield, and to acquire from W. E. Amies a patent relating to improvements to an electric plug fuse switch and contact blocks and the like.

WM. AYRTON AND CO., LTD.—Cap., £50 000. To acquire the business of textile machinists and general engineers carried on by E. N. Baines and J. W. Schmidt at Gorebrook Ironworks, Longsight, Manchester, as "Wm. Ayrton and Co.," and to carry on same and business of mechanical, electrical and hydraulic engineers, etc. Reg. office: Gorebrook Ironworks, Longsight, Manchester.

TIDAL ENERGY, LTD.—Cap., £10 000. To carry on the harnessing, exploitation and utilisation of power from tidal waters, waves and more generally power supplied by the sea, or of waterfalls and watercourses, with the object of creating hydraulic power, the transformation of hydraulic power into electric power and the use of electric power for all purposes, etc. Solicitors: Maxwell Batley and Co., 44–6, Leadenhall Street, London, E.C.3.

BRITISH DOMINIONS POWER SYNDICATE, LTD.—Cap., £50 000. To form, promote and assist companies, syndicates and partnerships to carry on all or any of the businesses of electrical and general engineers and manufacturers, maintainers of plant for the generation, accumulation, transmission and supply of electrical energy, to carry on business as electricians, electrical engineers, etc. Solicitors: Herbert Smith and Co., 62, London Wall, London, E.C.

DAVID ROWAN (VIDRO), LTD.—Cap., £5 000. To adopt agreement with D. Rowan for acquisition of business carried on as "David Rowan and Co.," at 142A, Islington, Liverpool, and to carry on business of manufacturers of electrical, mechanical and illuminated signs, motors, generators, switches, electrical, wireless and mechanical apparatus, electrical and mechanical engineers, etc. Reg. office: 32, Imperial Chambers, 62, Dale Street, Liverpool.

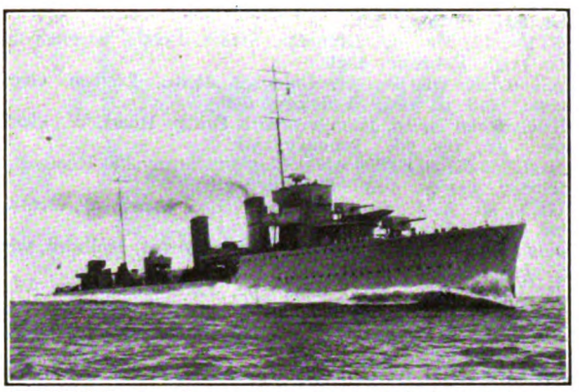
ELECTRICAL TRADE MARKS.

This list has been specially compiled for us from official sources by GEE AND CO., Patents and Trade Mark Agents, 51 and 54, Chancery Lane, London, W.C.2, from whom further information may be obtained.

DUNCO.—494 730. Class 6. Electri vacuum cleaning machines. Sir Duncan Watson, trading as Duncan Watson and Co., 61-62, Berners Street, London, W.1; electrical engineer.—September 5th, 1928. (To be Associated. Sect. 24.)

GILECTRA.—497 438. Class 6. Electric turntable motors for gramophones. Matthew Gill, Brunswick House, City Road, Manchester; manufacturer.—November 26th.

EXIDE.—497 299. Class 8. Instruments and apparatus for use in wireless telephony and telegraphy, and instruments consisting of a combination of a wireless receiving set and a gramophone. The Chloride Electrical Storage Co., Ltd., Clifton Junction, near Manchester; manufacturers.—November 21st, 1928. (To be Associated. Sect. 24.)



THE "Serrano," one of six new torpedo boat destroyers built for Chile by Thornycroft and Co., Ltd. The installation involves nearly sixty miles of v.i.r. cable and nearly a mile of paper insulated lead sheathed ring main cable, made by Pirelli-General Cable Works, Ltd., Southampton.

MOVEX.—497 587. Class 8. Philosophical instruments, excluding thermionic valves, electric discharge tubes and similar vacuum tubes. I.G. Farbenindustrie Aktien-Geselischaft, Mainzerlandstrasse 28, Frankfort-on-Main; manufacturers. November 29th, 1928. (By Consent.)

BETA.—496 093. Class 13. Electric lamps (ordinary). John Wilson Naylor, 53, Lancaster Gate, London, W.2; manufacturer. October 18th, 1928.

Opposition to the registration of the following trade marks can be lodged up to March 29th.

EDISON.—493 476. Class 8. Electrical storage batteries, other than medical Edison Storage Battery Co., Lakeside Avenue, West Orange, N.J.; manufacturers. July 21st, 1928. To be associated with No. 311 170 (1 620) and another. Advertised before acceptance, the applicants alleging distinctiveness.

INDICTA.—492 718. Class 8. Electrically illuminated advertising signs and indicators. James McCreath, 49, Whitechapel, Liverpool; manufacturer. June 26th, 1928.

ELECTROGRAPHOPHONE.—498 568. Class 8. Philosophical instruments. Columbia Graphophone Co., Ltd., 102 to 108, Clerkenwell Road, London, E.C.1; manufacturers. December 31st, 1928. To be Associated with No. 219 222 (1 102) and others.)

CELESTIONA.—498 621. Class 8. Wireless telephonic apparatus and parts thereof Cyril French, Celestion Radio Works, London Road, Kingston-on-Thames; manufacturer. January 2nd, 1929. (To be Associated with No. 452 463 (2 433) and others.)

J.T.O.K. (monogram).—498 701. Class 8. Electric accumulators and batteries, other than medical. Julius Toubkin, 33, Long Millgate, Manchester; merchant. January 4th, 1929.

Opposition to the registration of the following trade marks can be lodged up to April 6th.

STRADONOLA.—497 086. Class 8. Sound reproducing and recording instruments and apparatus, and instruments and apparatus for use in wireless telephony and telegraphy. A. J. Balcombe, Ltd., 51, Tabernacle Street, London, E.C.2; manufacturers. November 15th, 1928. (To be associated with No. 388 533 (2 142) ix and another.)

ROTOROHM.—498 852. Class 8. Apparatus for use in wireless telephony and telegraphy. The Rotor Electric, Ltd., 34, Kingsway, London, W.C.2; merchants. January 9th, 1929.

RAMACO.—496 230. Class 8. Instruments and apparatus for use in wireless telephony. The Radio Maintenance Co., 8, Clarendon Road, Edgbaston, Birmingham; engineers. October 23rd, 1928. (By consent.)

SPEEDIX.—496 247. Class 50. Electrical insulating substances of asbestos, mica and resin. Dick's Asbestos Co., Ltd., Cory Buildings, 117, Fenchurch Street, London, E.C.3; manufacturers. October 23rd, 1928.

TENSULAM.—497 436. Class 50. Electrical insulating preparations of asbestos, mica, resin, oils or bitumen. Berry Wiggins and Co., Ltd., Halling Works, Channelsea Road, Stratford Market, London, E.15; manufacturing chemists. November 26th, 1928. (To be associated with No. 497 435 (2 653) xl.)

ZICO (sign).—497 466. Class 50. Bell pushes, bell pulls, bell push plates, ceiling rosettes, table and floor standards for electric light, switch cases, electric lamp holder adaptors, speaking tube mouthpieces, bell cases, bell indicator boards, blocks for mounting electric light switches, and candlesticks, all being goods made of wood. Alfred Feustel, trading as P. Zimmermann and Co., Deutschkatharinenberg, Germany; wood turner. November 27th, 1928.

Opposition to the registration of the following trade marks can be lodged up to April 13th.

SOPRANIST.—490 126. Class 8. Scientific instruments and apparatus. S. Kalisky (Aldgate), Ltd., 75, High Street, Aldgate, London, E.1; general merchants. April 3rd, 1928.

ELECTRONETTE.—491 858. Class 8. Scientific instruments and apparatus. The Parlophone Co., Ltd., 1, Broad Street Place, London, E.C.2; manufacturers. May 26th, 1928. (To be associated with No. 433 315 (2 354)).

YEP.—495 316. Class 8. Instruments and apparatus for use in wireless telegraphy and telephony. George Constable, 49, Ballater Road, Acre Lane, Brixton, London, S.W.2; wireless manufacturer and dealer. September 25th, 1928.

CENTROLIAN.—498 875. Class 8. Scientific instruments and apparatus. The Central Radio Co., Britannia Buildings, Fenwick Street, Liverpool; radio manufacturers and retailers.—January 10th, 1929.

GILARMONIC MAJOR. 499 230. Class 8. Scientific instruments and apparatus. Matthew Gill, Brunswick House, City Road, Manchester; manufacturer. January 21st, 1929. (To be associated with No. 495 427 (2 640) and others).

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COMMERCIAL INFORMATION.

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debt. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

ATLAS ELECTRIC AND RADIO CO., 16, Lower Richmond Road, Putney, electricians. £11 17s. 2d. January 2nd.

ABRAHAMS, Nathan, 93, Sidney Street, E., electrical engineer. £44 12s. 8d. January 30th.

AUSTIN, C., Mr., 97, Domestic Street, Leeds, wireless dealer. £15 10s. 11d. February 18th.

CHANDLER BROS., 32, Calderon Road, Leyton, electrical engineers. £18 3s. 10d. February 6th.

JONES, Owen E, 20, Hammersmith Bridge Road, W., electrical engineer. £17 19s. 7d. January 15th.

LANGLEY MEADOWS AND CO., 31, Sunnyside Road, Ealing, electricians. £31 4s. 10d. February 7th.

LENEY, Mr. A. J., 101, Rowlands Road, Worthing, electrician. £26 12s. 7d. February 7th.

O'DONNELL, Patrick S., 40, Furnival Street, Holborn, wireless agent. £24 19s. 6d. September 11th.

PARKES, W. T., AND CO., 102, Lichfield Street, Walsall, electrical engineers. £20 17s. December 19th.

ROLFE, Mr. R. S., The Beck, Feltwell, wireless dealer. £14 1s. 10d. February 9th.

SKEELES AND LEYS, 357, Upper Richmond Road, Putney, electricians. £16 15s. 11d. February 15th.

STEREOSCOPIC X-RAYS, LTD., 67A, Baker Street, W., manufacturers and agents for electrical instruments. £20 9s. 9d. January 28th.

UPTON, Alex. Joseph, 88, Waud Street, Leicester, wireless dealer. £14 4s. 1d. February 5th.

WILKINSON, Edgar, 44, Gladstone Street, Bradford, electrician. £17 3s. 6d. February 11th.

YELDON, G., 29, New Road (or street), Portsmouth, wireless dealer. £10 3s. 6d. January 25th.

Bill of Sale.

HOLLOWAY, John Henry, 188, Northfield Avenue, West Ealing, wireless dealer. Dated March 12th, filed March 16th. £50.

Receiverships.

AXUEL TIME SWITCHES, LTD.—L. Macandrew, of 9, The Avenue, Ealing, W., was appointed Receiver and Manager, on March 11th, 1929, under powers contained in debenture date March 20th, 1928.

BELBIN AND BOWDEN, LTD.—A. C. Read, of 159, Queen Victoria Street, E.C.4, was appointed Receiver and manager on March 8th, 1929, under powers contained in debenture dated January 28th, 1929.

SAUNDERS ELECTRICAL CO., LTD.—R. B. Leech, C.A., of 23, Warwick Row, Coventry, was appointed Receiver and Manager on March 9th, 1929, under powers contained in 1st mortgage dated May 23rd, 1922.

SIDERMAN ELECTRICAL SUPPLIES, LTD.—J. Stone, of Legality, Canvey Island, was appointed Receiver on February 19th, 1929, under powers contained in debenture dated May 9th, 1927.

SUN RAY TREATMENT CENTRE, LTD. S. F. Homewood, C.A., of Monument House, Monument Street, E.C.3, was appointed Receiver and Manager on March 9th, 1929, under powers contained in debentures dated November 16th, and 23rd, 1928.

Mortgages.

[NOTE.—*The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *— allowed by the date of the Summary, but such total may have been reduced.*]

HARRISON AND SEARLE, LTD., Birmingham, electricians.—Registered February 27th, £1 000 debentures to W. Tregellas, 955, Pershore Road, Selly Park, insurance manager; general charge. *Nil. September 14, 1928.

PRECISION RADIO AND MANUFACTURING CO., LTD. Woking.—Registered March 4, £100 debentures to W. C. Powers, 56, Fleet Street, E.C., paper merchant; general charge.

Satisfactions.

CLEVELAND AND DURHAM ELECTRIC POWER, LTD.—Satisfaction registered March 4th, £13,400, part of amounts registered October 23rd, 1913, and January 17th, 1919.

HORLEY AND DISTRICT ELECTRICITY SUPPLY CO., LTD.—Satisfaction registered February 27th, £1 500, registered April 16th, 1927.

RADIO SERVICE (LONDON) LTD.—Satisfaction registered March 5th, £125, part of amount registered July 26th, 1927.

SIEMENS BROTHERS AND CO., LTD., London, S.W., telegraph engineers. Satisfaction registered February 18th, £33 400, part of amount registered January 21st, 1918.

London Gazette, etc.

Companies Winding-up Voluntarily.

COLLINGE AND CORRIGAN, LTD.—By reason of its liabilities, March 16th. G. Miller, 19, Castle Street, Liverpool, Incorporated Accountant, appointed as liquidator.

KLEIN BROS., LTD.—By reason of its liabilities, March 14th. R. F. Sheppard, Chartered Accountant, 22, Martin Lane, Cannon Street, London, E.C.4, appointed as liquidator.

Partnership Dissolved.

NORMAN R. PHELP (Norman Rupert PHELP and William Reginald PALLETT), wireless engineers, 54, Queen's Road, Brighton by mutual consent, as from November 8th, 1928. Debts received and paid by N. R. Phelp.

Order Made on Application for Discharge.

WALLIS, Cyril Kenneth, electrical engineer, Bedford Street, Bognor, and then at Longford Road, Bognor. Discharged subject to judgment for £20, February 14th (paid).

Bankruptcy Proceedings.

LAWRENCE, Louis Haydn, in the petition and Receiving Order described as Henry Frederick Lawrence, trading as Henry F. Lawrence, 43, Canterbury Road, Margate, Kent, electrical engineer. The public examination herein was held on March 19th at the Guildhall, Canterbury, when a statement of affairs was lodged showing a deficiency of £484. The debtor, it appeared, commenced trading on his own account in 1923, taking his present premises in 1924. His turnover during 1928 was £1 600, but owing to the large rental, the shop did not justify itself. He estimated a gross profit of 25 per cent. on the £1,600, or £400, and his wage bill absorbed that £400. It was pointed out that the debtor was losing at the rate of £200 per annum. The examination was closed.

METAL AND CHEMICAL PRICES.

TUESDAY, March 26th.

		Price.	Inc.	Dec.
Copper—				
Best Selected ..	per ton	£105 nominal	£6 0 0	—
Electro Wirebars	,,	£113 12 6	£13 2 6	—
H.C. Wires, basis	per lb.	1s. 2¾d.	1⅛d.	—
Sheet	,,	1s. 2⅛d.	2¼d.	—
Phosphor Bronze—				—
Wire (Telephone) basis	per lb.	1s. 5¾d.	1⅛d.	—
Brass 60/40—				—
Rod, basis ..	per lb.	9d.	—	—
Sheet ,, ..	,,	1s. 0¼d.	1d.	—
Wire ,, ..	,,	1s. 0¼d.	¼d.	—
Pig Iron—				
Cleveland Warrants	per ton	£3 9 6	—	—
Galvanised Steel Wire, basis 8.S.W.G. ..	,,	£14 15 0	—	—
Lead Pig—		Not Quoted		
English	per ton	Nom. £28 10 0	—	£2 10 0
Foreign or Colonial	,,	£26 12 6	—	£3 2 6
Tin—				
Ingot	per ton	£220 15 0	—	£2 7 6
Wire, basis ..	per lb.	2s. 10¼d.	—	¼d.
Aluminium Ingots	per ton	£95 0 0	—	—
Spelter	,,	£27 5 0	—	£1 15 0
Mercury	per bottle	£22 5 0	—	—

Sulphur—Flowers, Ton £12 0 0 ***Sulphuric Acid***—
,, Roll ,, £10 10 0 (Pyrites, 168°) Ton £6 15 0
Copper Sulphate ,, £25 to £25 10 0 ***Sodium Chlorate*** per lb. 2¾d.
Boric Acid (Crystals),, £30 0 0 ***Sodium Bichromate*** per lb. 3¼d.
Rubber—Para fine, 1s. 1¼d.; plantation, 1st latex, 11¼d.

*. The metal prices are supplied by British Insulated Cables Ltd., and the rubber prices by W. T. Henley's Telegraph Works Co., Ltd.

THE LEAD MARKET.

James Forster and Co. state that an unprecedented jump in prices was seen on Monday, the opening price being about £3 higher at £27 for March, values further advancing until £30 was paid for June with March nominal at £29 15s. The market has since been firmer again under the stimulus of the raising of the official American price from 7.25 to 7.75 cents per lb.

Closing prices on March 22nd were £28 13s. 9d. for March, and £29 for June, a rise of £4 12s. 6d. per ton on the week.

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Infringement of C.M.A. Trade Mark

(Registered Nos. 422219, 422220, and 422221)

Cable Makers Association v. Edward William Knight sued and trading as City Engineers' Supply Company (a firm)—

On January 18th, 1929, in the High Court of Justice, a perpetual injunction was granted restraining the Defendant, his servants or agents from infringing the said trade mark, and the Defendant was ordered upon oath to deliver up to the Plaintiffs or destroy in their presence all infringing articles in his possession or power and to pay the Plaintiff's costs.

The Cable Makers Association are owners of the following Trade Marks:—

C.M.A.	-	Regd. Nos. 422219-20-21.
NONAZO		Regd. No. 458865.
VICMA	-	Regd. No. 486180.
VINAZO	-	Regd. No. 486179.

Licenses to use these are granted to members of the Cable Makers Association only.

Advt. of The Cable Makers Association, Sardinia House, Sardinia Street, London, W.C.2

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PATENT RECORD.

The following information is prepared from the Illustrated Official Journal (Patents) by permission of the Controller of H.M. Stationery Office. Printed copies of full Patent Specifications, when accepted, may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at 1s. each.

Specifications Accepted.

305 738 H. F. Joel, Sen. Electric secondary batteries or accumulators. (21/9/28.)
305 747 H. Baron (C. Aldendorff). Automatic switches for telephone exchanges and remote control systems. (1/12/27.)
305 749 B. R. Wingfield and B. T. Wingfield. Electric thermostats. (5/12/27.)
282 115 Felten and Guilleaume Carlswerk Akt.-Ges. Manufacture of wire cables. (13/12/26.)
305 781 General Electric Co., Ltd., and R. J. Kaula. Locking devices for electric incandescent lamps or the like. (3/1/28.)
305 724 Oldham and Son, Ltd., and W. D. Wilde. Means for carrying and holding together a number of galvanic batteries. (10/11/27.)
305 799 J. Katunsky. Electric heating element. (24/1/28.)
305 802 W. S. Taylor. Manufacture of electric cables. (28/1/28.)
305 818 J. Vigneault. Radiators heated by steam generated electrically. (13/2/28.)
305 822 A. H. Marks and P. Russell (legal representatives of E. C. R. Marks (deceased). Suddeutsche Telefon-Apparate-Kabel-und-Drahtwerke. Long distance cable installations. (14/2/28.)
285 843 C. H. F. Muller A.-G. Incandescent cathode discharge tubes. (22/2/27.)
305 847 C. Bruynis. Electromagnetically or pneumatically operated main current switch. (7/3/28.)
290 564 De Forest Phonofilms, Ltd. Talking motion picture apparatus. (14/5/27.)
305 849 W. W. Nobbs. Electric heating-elements of the immerson type. (9/3/28.)
287 453 Aktiebolaget Birka Regulator. Thermostatic switches. (19/3/27.)
287 503 Spezialfabrik fur Aluminium-Spulen Und-Leitungen Ges. Producing insulating-coverings on wires, bands, plates, or sheets of aluminium or aluminium alloys. (22/3/27.)
287 937 Westinghouse Lamp Co. Electrodes for electron-discharge devices and the like. (30/3/27.)
288 518 Telffunken Ges fur Drahtlose Telegraphie. Electrical condensers. (9/4/27.)
305 875 P. J. Maffey and J. B. L. Foot. Method of and means for rectifying alternating currents. (16/4/28.)
290 667 Benjamin Electric, Ltd. Lighting-apparatus. (19/4/27.)
305 887 H. D. Symons. Insulation material for electric apparatus. (19/5/28.)
291 114 G. Haagen and Cie. Electrode-holders for electric arc-welding. (27/5/27.)
293 353 Soc. Anon. Compagnie de Produits Chimiques et Electro-Metallurgiques Alais, Froges, and Camargue. Electrolytic apparatus for refining aluminium and for like processes. (4/7/27.)
305 895 M. Hentschel and F. Muller (trading as Porzellanfabrik Hentschel and Muller). Electric suspension insulators. (22/6/28.)
291 983 L. M. Telefonaktiebolaget Ericsson. Counting-apparatus. (3/8/27.)
295 580 Westinghouse Electric and Manufacturing Co. Vacuum electric discharge tube devices. (13/8/27.)
305 910 G. G. M. Hardingham (P. Lancier). Apparatus for withdrawing underground cables. (13/8/28.)
298 578 P. Betz. Apparatus for the manufacture of electric insulating-tubes. (11/10/27.)
305 620 E. F. Northrup. Electric induction furnaces. (8/9/27.
306 158 J. L. Baird and Television, Ltd. Television or like systems. (17/8/27.)
305 956 Automatic Telephone Manufacturing Co., Ltd., and O. A. Pearce. Telephone systems. (10/10/27.)
305 957 J. A. Crabtree. Electrical switches. (12/10/27.)
306 056 S. G. S. Dicker (N.V. Philips' Gloeilampenfabrieken). Wireless receiving sets. (15/10/27.)
306 164 J. Wilson. Producing gramophone records from wireless electrical impulses. (18/10/27.)
306 011 B. Marchini (G. Passatti). Production of insulating material. (8/11/27.)
296 660 C. H. Everett and G. R. Carr. Storage batteries. (3/9/27.)
283 193 Associated Telephone and Telegraph Co. Telephone systems. (8/1/27.)
306 014 H. Martin. Apparatus for electrically measuring fluid-flow. (12/11/27.)
306 010 A. West and Co., Ltd., and A. West. Oil-immersed electric switchgear. (14/11/27.)
300 178 A. Reyrolle and Co., Ltd., J. Mirrey and G. H. Gardner. Protective arrangements for alternating current electric circuits. (17/11/27.)
306 183 A. L. Jones. Lighting of indicating instruments on automobile and like vehicles. (17/11/27.)
289 763 Vereinigte Gluhlampen und Electricitats Akt.-Ges. Method for the production of cathodes for electric discharge tubes. (30/4/27.)

Applications for Patents.

January 31st.

3 218 Landis and Gyr. Soc. Anon. Time switch. (1/3/28, Switzerland.)
3 306 Siemens-Schuckertwerke A.G. Distribution of electric power at working face of mines, etc. (3/2/28, Germany.)
3 347 Siemens-Schuckertwerke A.G. Regulating potential in a.c. trunk lines (21/12/28, Germany.)
3 272 T. S. Skillman and Standard Telephones and Cables, Ltd. Telephone systems.

February 1st.

3 400 Associated Electrical Industries, Ltd. Relay systems for paralleling circuits. (1/2/28, U.S.)
3 460 Automatic Telephone Mfg. Co., Ltd., and J. E. Ostline. Timing apparatus.
3 432 British Thomson-Houston Co., Ltd. Electric switches. (1/2/28, U.S.)
3 493 W. A. Burns and E. I. Hicklin. Illuminated signs, etc.
3 194 W. A. Burns. Portable wireless receivers.
3 453 Celestion, Ltd., and C. French. Telephone instruments.
3 491 Cie de Forges et Aciéries de la Marine et d'Homecourt and G. Grant. Electric distant control systems. (30/3/28, France.)
3 402 E. G. and P. A. Craven. Telephonic loud speakers, etc.
3 450 A. Daniker. Electric heat regulator. (6/2/28, Germany.)
3 431 L. J. L. Debelmas. Antitheft device for electric lamps. (6/2/28, France.)
3 442 L. Flandrin and G. C. Levy. Mercury-switch. (4/2/28, France.)
3 451 L. G. S. Hebbs. Production of electrolytically deposited metal coatings.
3 434 International General Electric Co., Inc. Electric rectifiers. (1/2/28, Germany.)
3 501 H. Martin. Apparatus for electrically measuring liquid flow. (12/11/27.)
3 449 J. L. Pech. Incandescent lamps. (3/2/28, France.)
3 407 A. Schuhmann. Electric toy railways, etc.
3 479 Siemens-Schuckertwerke A.G. Regulating phase of voltage in distribution systems. (3/2/28, Germany.)
3 480 Siemens-Schuckertwerke A.G. Determining rotation speed of commutator machines. (21/2/28, Germany.)
3 417 E. H. Tarlton. Picture telegraphy, etc.
3 428 H. F. J. Thompson. Means for interrupting a.c. circuits.

February 2nd.

3 599 S. G. Brown. Means for establishing electrical contact between two oscillating bodies.
3 601 S. G. Brown. Electrical make and break devices.
3 570 H. R. Cool. Recording operation of electrical devices.
3 575 S. G. S. Dicker (N. V. Philips' Gloeilampenfabrieken). Synchronising movements.
3 511 S. E. Foster and F. Grocott. Connector for electric radiators, etc.
3 593 A. Graves. Wireless transmitting, etc., apparatus.
3 595 International General Electric Co., Inc. (Allgemeine Elektricitats Ges.). Casing for motors, etc.
3 585 G. C. and P. A. Lundberg, A. P. Lundberg and Sons, Ltd., and G. Pegg. Adaptors for electrical installations, etc.
3 522 G. H. Neep and Switchgear and Cowans, Ltd. Electrical contacts.
3 523 G. H. Neep and Switchgear and Cowans, Ltd. Electric switchgear.
3 603 Siemens-Schuckertwerke A.G. Lead-sheathed submarine cable. (25/2/28, Germany.)
3 577 R. W. Strawson. Radiators for cooling transformers.
3 589 C. C. Turner and Young, Osmond and Young, Ltd. Means for electrically connecting together electric heaters.
3 528 R. L. Woosnam. Electric control of starter motors of moter-cars

February 4th.

3 621 J. E. Allan. Insulators for wireless apparatus.
3 618 American Fire Prevention Bureau. Thermionic circuit controlling device. (11/4/28, U.S.)
3 748 J. L. Baird and Television, Ltd. Television apparatus, etc.
3 619 W. T. Barnes. Carrier for accumulators, etc.
3 704 British Thomson-Houston Co., Ltd. Circuit interrupting devices. (4/2/28, U.S.)
3 771 British Thomson-Houston Co., Ltd. Electric switching stations. (4/2/28, U.S.)
3 712 Callender's Cable and Construction Co., Ltd., and J. Urmston. Protection of electric circuits, etc.
3 729 V. G. V. Colle. Wireless apparatus.
3 668 R. D. H. Davy. Electrical sound reproducing means.
3 706 S. G. S. Dicker (N. V. Philips' Gloeilampenfabrieken). Transformers.
3 707 S. G. S. Dicker (N. V. Philips' Gloeilampenfabrieken). Directing sounds.
3 601 W. Donnelly and English Electric Co., Ltd. Battery charging systems.
3 731 J. Feldman. Electromagnetic apparatus. (20/12/28, Germany.)
3 732 J. Feldman. Transformers. (20/12/28, Germany.)
3 621 S. B. Freeman. Insulators for wireless apparatus.
3 665 A. Goodchild. Automatic mouthpieces for telephones, etc.
3 620 J. H. O. Harries. Generation, etc., of electric currents, etc.
3 703 International General Electric Co., Inc. Plant for generating electric current. (3/2/28, Germany.)
3 757 I. Jascourt and M. Steingold. Galvanic batteries.
3 613 W. J. Line. Electric plugs.
3 769 N. W. McLachlan and W. S. Smith. Thermionic amplifiers, etc. (22/12/27.)
3 760 G. C. D. Pfau. Apparatus for generation, etc., of electric oscillations. (2/2/28, Germany.)
3 678 Radiovisor Parent, Ltd. Forming light sensitive bridges, etc.
3 749 F. G. Robinson. Hand carrier for accumulators, etc.
3 751 S. M. Rutnagur. Electric traction for railways.
3 650 C. Scott-Snell. Means for utilising radiant heat.
3 746 Soc. Nouvelle de Constructions Téléphoniques Brevets Tchoubritch Derval. Automatic selecting circuits for telephony, etc. (21/3/28, France.)
3 691 C. S. Weyandt. Thermionic valves. (5/7/28, U.S.)
3 693 C. S. Weyandt. Electric motors. (18/7/28, U.S.)

February 5th

3 941 L. S. B. Alder, W. F. Rawlinson and J. S. C. Salmond. Amplifiers for wireless telegraphy, etc.
3 939 Anglo-American Chemical Co., Ltd., and R. M. Burlison. High tension batteries.
3 808 G. Armstrong. Electric batteries.
3 778 W. A. Carr. Apparatus for recording position of wireless stations.
3 820 Chloride Electrical Storage Co., Ltd., and H. Dean. Accumulators.
3 913 Eastern Telegraph Co., Ltd., H. V. Higgitt, W. C. Hubble and K. L. Wood. Telegraph transmitting apparatus, etc.
3 804 Electrical Apparatus Co., Ltd. Measuring instruments, etc.
3 852 Electrical Research Products, Inc. Television systems. (24/2/28, U.S.)
3 842, 3 843 W. E. Goodwin, and Siemens Bros. and Co., Ltd. Telephone instruments.
3 877, 3 878, 3 879 B. Hesketh. Wireless receiving apparatus.
3 880 B. Hesketh. Inductances.
3 881 B. Hesketh. Sound reproducing devices.
3 783 F. W. Miller, and Thermostatics, Ltd. Control for electric cigar, etc., lighters.
3 871 R. Newton. Electric switches.
3 921 M. B. Richter. Electric relays.
3 812 P. Saunders. Clockwork for actuating [illegible] switch.
3 922 Siemens-Electro-Osmose Ges. Electro[illegible] separation of latex, etc. (8/2/28, Germany.)
3 923 Siemens-Electro-Osmose Ges. Electro[illegible] separation of latex, etc. (17/3/28, Germany.)
3 776 W. L. Spence. Combination electromagnetic brakes.
3 876 P. D. Tyers. Printing telegraph systems.

February 6th.

3 952 B. Brammer. Contact preventing devices for incandescent lamps. (7/2/28, Austria.)
4 016 British Thomson-Houston Co., Ltd. Protection of electric systems. (9/2/28, U.S.)
4 017 British Thomson-Houston Co., Ltd., and L. Griffiths. Magneto-electric machines.
3 949 W. P. Digby and R. B. Fairthorne. High tension transmission systems.
4 014 Electroacustic Ges. Sound receiving apparatus. (7/2/28, Germany.)
3 998 Forges et Ateliers de Constructions Electriques de Jeumont. Electrical braking systems for vehicles. (7/2/28, France.)
3 991 A. H. Hunt. Electric torches.
3 993 A. Larco. Wireless, etc., cabinet. (6/2/28, France.)
4 033 J. G. Pellowe. Electrical connectors. (11/9/28, New Zealand.)
4 028 D. M. Phillips. Apparatus for disinfecting mouthpiece of telephone instruments.
3 994 J. H. Rayner. Inductances.
4 020 Siemens-Schuckertwerke A.G. Apparatus for regulation of motors in multiple motor drives. (10/2/28, Germany.)
4 049 Telefunken Ges fur Drahtlose Telegraphie. Radio receiving systems, etc. (13/2/28, Germany.)
4 025 Tyer and Co., Ltd. Polarised relay.
3 995 W. D. Verschoyle. Electric lamps for production of ultra-violet rays.

COMING EVENTS.

Tuesday, April 2nd.

Institution of Electrical Engineers (London Students' Section).—Visit to the North Metropolitan Electric Power Co.'s Supply station, Brimsdown. 2.30 *p.m.*

Institute of Transport (Bristol and District Section).—University, Bristol. Annual general meeting. 5.40 *p.m.*

Friday, April 5th.

Institute of Transport (Leeds and District Section).—Annual general meeting. 7 *p.m.*

Institution of Electrical Engineers (Meter and Instrument Section).—Institution, Savoy Place, Victoria Embankment, London. Paper by Mr. E. W. Hill on "Some Technical Considerations Concerning Power Factor in Relation to Tariffs." 7 *p.m.*

Institution of Electrical Engineers (North-Eastern Centre Student's Section—Lighting Service Bureau, Dial House, Northumberland Street, Newcastle-on-Tyne. Annual general meeting. 7.15 *p.m.*

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THE ELECTRICIAN

Established 1861. The Oldest Weekly Illustrated Journal of

Electrical Engineering, Industry, Science and Finance.

Bouverie House, 154, Fleet Street, London, E.C.4. Telegrams: "Benbrotric, Fleet, London."
Telephone: City 0244 (Ten lines).

[Closed on Saturdays in accordance with the "Five-Day Week" plan adopted by Benn Brothers, Ltd., and its associated organisations.]

No. 2653. [No. 14. Vol. CII.] Friday, April 5, 1929. Annual Subscription, 25s. Overseas, 30s.

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Current Topics.

The New Lamp Prices.

THE lamp price ons, foreshadowed in these columns last week, have now been announced by the E.L.M.A., and have, we believe, been received with general satisfaction in the trade. As will be seen from the detailed particulars given elsewhere in this issue, the present reductions —which form, by the way, the sixth decrease since the war—are based on the definite policy of encouraging the use of "pearl" and "opal" lamps and decreasing the number of types of lamp which the trade is expected to stock. Further, by offering additional price advantages for standard voltage lamps, E.L.M.A. has taken a definite commercial step to encourage supply authorities to adopt 230 V in place of the variety of pressures now adopted between 200 and 260 V, a move which will still further reduce the variety of lamps stocked. A particularly welcome feature of the announcement of these new prices is the leaflet which has been prepared to explain the reasons for the changes, not only to the reseller, but to the domestic consumer. "Glareless Light Preserves the Sight" is a slogan capable of profitable exploitation.

Steam at 1200 lb.

STATION engineers will follow with some interest the steam practice which is being adopted in the erection of the new Holland station of the General Gas and Electric Corporation, on the Delaware River, New Jersey. Local conditions led to comparisons being made between steam pressures of 400 lb., with no reheat, two- and three-stage extraction, with 550 lb. reheat and 1 200 lb. reheat, both with four-stage extraction. Consideration of the fixed charges, plus the production cost, showed that the 550 lb. reheat plant was less economical than the 400 lb. no reheat plant, because the saving in B.Th.U. consumption of the former was more than offset by the increase in fixed charges. The 550 lb. plant was also more expensive in both first cost and B.Th.U. consumption than the 1 200 lb. plant, so that the choice was narrowed down to the 400 lb. and 1 200 lb. pressures, and finally it was decided that the 1 200 lb. reheat cycle was the most economical. It is noteworthy that all previous 1 200 lb. installations have been arranged as an increment to an existing, fairly efficient station, thus allowing the high-pressure units to be operated under base load conditions. In the case of the Holland station, however, largely fluctuating load conditions were expected, and variable load operation was considered throughout the design of the station. A flat steam consumption curve on the high-pressure turbine being desirable, it was suggested to turbine manufacturers that this be obtained by several steam admission valves on the high-pressure machine instead of a single valve such as is used on the 1 200 lb. plants already in operation and turbines having four and five valves were designed. It is expected that the station will be put in commission next October.

Carrier Current on Power Systems.

ALTHOUGH carrier-current telephony is chiefly of academic interest to central station engineers in this country, the great distances covered by the systems of some of the American power companies have directed attention to the practical possibilities of this form of communication. After trying telephony mainly on separate pole lines adjacent to the power lines, and replacing this by radio, the Alabama Power Co., in 1925, seriously investigated the possibilities of carrier-current equipment, and after overcoming many initial difficulties, a satisfactory system was evolved. The conclusions to be drawn from the experience so obtained are that carrier-current communication is thoroughly practical for power lines, but operates better on radial lines than on networks. For long distances it has been found to be more reliable and economical than telephone lines, but it is desirable that short taps on lines used as carrier-current channels should be avoided or isolated. For satisfactory operation, a careful preliminary study of the power circuit characteristics, and careful, frequent and competent inspection, are regarded as essential.

The Mid-East England Scheme.

THE electricity scheme for Mid-East England, details of which were given in THE ELECTRICIAN in January last, has, in the main, been adopted in its original form by the Central Electricity Board. The chief alteration to the scheme as originally submitted by the Commissioners is that both the Chesterfield and Keighley stations have been transferred from the list of "selected" stations to "temporary arrangements," thus reducing the original eighteen "selected" stations to sixteen. The area of the scheme, embracing some 7 500 odd square miles, is one of the most important so far catered for under the Central Electricity Scheme, such industries as coal, iron and steel, engineering and textile, as well as large agricultural tracts of land all falling within its boundaries. No additional power stations are required to be built before the scheme can be put into

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operation, and no frequency difficulties will be met with, in that there is practically no non-standard frequency plant within the area. In any case where such exists it is to be allowed to remain in operation, as alteration of such systems is not regarded as essential. On account of the standard plant and capacity of the stations chosen as "selected" units, the capital expenditure required to bring the scheme into force is lower than that estimated for other adopted schemes, the total expenditure being as low as £4 616 750, representing £2 907 156 to be spent on transmission lines and transformer stations by the Central Electricity Board, and £1 709 594 by owners of selected stations on plant extensions, etc.

A "Light" Jest.

A CARTOONIST in the "Daily Mail" on Tuesday amusingly illustrated "the story of the light that wouldn't go out: an experiment in remote control." It depicted the adventures of a man who, before retiring to read in bed by the light of an electric lamp fixed over his bed, was at some pains to rig up a length of string from the dolly of the switch at the other end of the room to his bedside. Repeated tugs at the string, when the necessary degree of somnolence had been induced, only resulted in the breakage of the elementary remote control apparatus, and in the last resort the light was put out by a shoe well and truly aimed at the offending lamp. In this jest is a moral for electrical contractors, for the number of householders who try to make good a shortage of convenient switching points by "Heath Robinsonian" contraptions of string and staples is legion. The alternative only needs to be put to them in a suitable way.

Avoiding Opposition.

SUPPLY authorities who encounter local opposition when seeking to extend their areas of supply in rural districts might do worse than study the methods of the Western Electricity Supply Co., Ltd. In connection with the company's proposal to give a supply to Charlbury a public meeting was held, at which Mr. A. J. BRIDGE, the company's publicity and development manager, gave an interesting address in which he explained the national electricity scheme, the developments which are taking place in the Wessex area, the uses of electricity in the home, farm, and workshop, and the cost of wiring and energy. Judging by the questions asked at the close of the address it was obvious that the public can take an intelligent interest in these matters if only it is allowed to, and the meeting closed with assurances of unanimous support for the Charlbury project. If there were more of these frank and informative preliminary explanations there would be far fewer wayleave disputes and other obstructionist tactics.

Occasional Heating.

IN the dark and wholly cold days of the winter housewives who have not yet been converted to electrical homekeeping light their dust-producing fires as a matter of course. April is a month in which much deliberate dirt-production is avoided as far as possible, but when the sun has gone down considerations of temporary comfort outweigh those of house cleanliness, and warmth is secured by much the same methods as are employed by primitive uncivilised tribes. This, then, is the time for the electrical industry to get really busy advocating electricity as the ideal system for providing local heating during the brief but recurring chilly periods of an English Spring. The E.D.A. has definitely designed its publicity programme for April to assist selling on these lines, and has a very effective series of advertisements booked to appear in national newspapers, with the usual range of stereos for local Press advertising, by supply authorities and contractors. Two alternative window displays are available, employing part of the "cube" outfit used in previous months, and an appropriate new double-crown poster has also been prepared for use during April. With such backing the extension of business in occasional heating, including water heating, promises to be a comparatively easy proposition, and may in many cases prove to be the thin end of the wedge of a permanent electric heating installation for winter use.

"Killing Two Birds . . ."

THE temptation to present two papers on similar or related subjects for discussion at one time is difficult to resist, but the recent I.E.E. discussion in London on the papers on "Direct Generation of Alternating Current at High Voltages," and "Recent Developments in Turbo-Generators" stands as an illustration of the fact that such attempts to "kill two birds with one stone" usually fail to kill either. Each of the papers, alone, would probably have given rise to a full and lively discussion. In this case, as in many others, in the Institution and outside it, practically all the discussion was centred on one of the papers, and owing to the time occupied in presenting the two, no time was left for more than very brief replies to be made by the authors. If a full-length paper is sufficiently important to have separate form it should also have a separate discussion.

Atmospheric Pollution.

IT is difficult to regard in a temperate way the ridiculous agitation which has been engineered in London over the possibility of atmospheric pollution from the London Power Co.'s new Battersea station, for while amazing estimates have been put forward of the harmful effects of the products of combustion of the fuel to be used at this station, where the most modern methods and appliances for its combustion will naturally be employed, not a word is said about the stupendous quantities of soot which are daily deposited over the whole of London—and for that matter every city and town in the country—by domestic coal fires. Measured in terms of illness, death, and architectural deterioration, the toll taken by the coal fire is enormous, yet nobody seems very worried about it. A capital station in which every possible means will be taken to prevent evolution of oxides of sulphur will not add to the trouble. It will reduce it very considerably, and the extent of that improvement will only depend on the assiduity with which sales staffs cultivate the domestic electric heating load.

Utilising Waste Products.

ALTHOUGH our power stations are relatively guiltless in this matter of atmospheric pollution it is to be hoped that supply authorities will not be content to go on adding their quota, however small, to the desolation of our fair country, without taking energetic steps to reduce their contribution to an immeasurable quantity. It has long been the proud boast of all connected with the electrical industry that cleanliness is one of the outstanding virtues of electricity, but counter-propagandists are now indirectly attacking this strong point by the suggestion that the making of electricity is a dirt-producing process. It is, of course, a mischievous argument but one cannot deny its psychological value when skilfully used by those who do not pray for the successful development of electricity. The best way to counter this snowball half-truth is to deprive the allegations of the modicum of truth which they now possess, by evolving methods which will ensure that no noxious products are emitted. This is not easy, and would probably be expensive but for the possibility of making some effective use of the waste products which we shall in time withdraw from our chimney-stacks. As yet there is a paucity of suggested solutions of the problem, though we see that Mr. ALAN E. MUNBY has been advocating in "The Times" the injection into the chimney gases, at some appropriate stage of their progress, finely divided lime which, possibly with the aid of a steam jet, would result in fixing these gases by the formation of calcium sulphite and sulphate. The problem is an interesting one, in the solution of which the services of the chemical engineer might very usefully be enlisted.

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ELECTRICAL CIRCUIT THEORY BASED ON THE METHOD OF COMPLEX NUMBERS.

Historical Development—Some Possibilities of the Method in Simplifying the Mathematics of the Alternating Current Circuit—Advantages over Other Methods.

By G. WINDRED.

THE object of the present paper is to set forth, in its historical order of development, the theory of that part of pure mathematics dealing with the conception of two dimensional numbers, which theory has proved of great assistance to the pure mathematician in connection with the theory of equations, and a source of considerable difficulty and misunderstanding in its application to certain of the sciences. An attempt is also made to demonstrate the possibilities of the method as a means of simplifying the mathematics of the alternating current circuit.

An interesting fact, which will probably appeal to students of both mathematics and electricity, is that the existence of complex numbers has been known for nearly four hundred years, and it was only toward the close of last century that the conception came to be applied to electrical theory. During the intervening period only a comparatively few contributions to the subject have been made, mostly from the purely mathematical viewpoint. The contributions to the applications of the theory to analytical problems culminate in the researches of Schwarz * and Christoffel†. The observations of these investigators are confined, however, to the theory of conjugate functions, and have no immediate bearing on the present subject matter.

In the circumstances it is pardonable and in many ways desirable, to give a brief history of the subject, as there is no doubt that the clearest conceptions of such principles follow from an appreciation of the conditions giving rise to them. An historical study makes it evident that for a long time after their inception both imaginary and complex quantities were regarded as being entirely devoid of significance, and were, in consequence, very much neglected. In this connection it is interesting to note that even so late as the end of the eighteenth century certain scruples existed concerning the admission of negative roots.‡

Historical.

The conception of complex or imaginary numbers belongs essentially to the theory of equations, and although it is impossible to state the exact period of its introduction, the subject seems to have been first definitely established in the famous "Ars Magna," published by Cardan in 1545. This work represents a great improvement upon previous mathematical publications, although it is very much open to doubt whether certain parts of it were original. Since Cardan's concern was chiefly the theory of quadratic and cubic equations, and apart from establishing a proof that the complex solutions of these equations occur always in pairs, he did not develop the theory of these "sophistic" quantities, as he called them.

The next contributor to the science, who, incidentally, was the first writer to give a geometrical interpretation to the complex roots of a quadratic equation, was John Wallis, whose "Algebra," published at Oxford in 1685, contains some very careful demonstrations of the spatial meaning conveyed by the square root of a negative quantity. Although some of these demonstrations are not above criticism, the volume represents an important advance in the theory in this direction. It may also be noted that Wallis regarded the idea of negative quantities as absurd, and declined to accept any such idea.

Many years elapsed before the subject was again approached, this time by Heinrich Kühn, who in 1753 published his somewhat unsatisfactory paper, "*Meditationes de quantitatibus imaginariis construendis, et radicibus imaginariis exhibendis*," which, while displaying several interesting propositions, does not represent an appreciable advance in the fundamentals of the subject.

To Euler is due the highly important theorem, which we shall have occasion to use hereafter, which connects the trigonometrical and exponential functions in the form $\cos\theta+i\sin\theta=e^{i\theta}$, and to Gauss lays the credit of the discovery that every algebraical equation has a root of the form $a+bi$. This demonstration was published in 1799.

Wessel's Contribution.

We now come to what is probably the most important contribution to the subject from the present viewpoint. In the year 1797, Caspar Wessel presented to the Royal Danish Academy his interesting memoir "Om Directionens analytiske Betegning," which contains, among other things, a demonstration of the fact that $\sqrt{-1}$ may be regarded as representing perpendicularity in two-dimensional space, and an extension of this conception to vectors in three dimensions by a method foreshadowing that of Hamilton's quaternions, to which we shall later make specific reference. In view of the subsequent importance of this memoir it is strange to note that it had no evident influence on contemporary mathematics, and was neglected for exactly a century, being republished in French by Thiele and Valentiner at Copenhagen in 1897. The object of Wessel's memoir was primarily to develop a system of vector algebra, and in the pursuance of this object he gave many important demonstrations concerning the theory of complex numbers.

Among the abnormal number of memoirs published by Cauchy are to be found those dealing with the question of the circumstances governing the application of complex numbers; the determination of the number of real and imaginary roots of an equation; and the method of establishing a connection between different branches of a subject by assigning complex values to independent variables.

In the year 1806 was published the famous memoir by Argand, entitled "Essai sur une manière de représenter les quantités imaginaires dans les constructions géométriques." This memoir commences with a consideration of the complex number in its directive relation to positive and negative quantities, and shows its correspondence with vertical direction when considered in this manner. The rules of addition and multiplication of such directed or complex quantities are then considered; the subsequent procedure then being on the lines established by Wessel. The memoir also contains a number of trigonometrical identities which are somewhat indifferently developed.

The next important contributions to the subject are two publications in the year 1828. In this year the Rev. John Warren published at Cambridge "A Treatise on the Geometrical Representation of the Square Roots of Negative Quantities." This work comprises a thorough and carefully written examination of important parts of the theory, to the literature of which it forms an important addition.

Also in 1828 was published in Paris a work by C. V. Mourey, entitled "La vraie théorie des quantités négatives et des quantités prétendues imaginaires." In this work the theory of vectors is systematically studied, and certain theorems on vector operations are developed. The forms of notation employed by this writer have not survived, but several of the problems he discusses are of distinct mathematical value.

On April 15th, 1831, was presented to the Royal Society of Gottingen a notable memoir by Gauss, entitled "*Theoria residuorum biquadraticorum, commentatio secunda.*" In this paper the question of the significance of $\sqrt{-1}$ as an operator is discussed in its relation to co-ordinate systems by an ingenious demonstration based on the theory of transference between related series.

At this period of its somewhat chequered history the conception of a complex quantity begins to influence various branches of mathematics, and on this account it becomes difficult to trace further developments in the fundamentals of the theory. The second half of the nineteenth century saw many contributions to the theory, and it would be quite impossible even cursorily to mention them. They affect, in general, not the fundamentals, but the higher branches and developments of the subject. We find it difficult to take

* Crelle, 1869, tome 70.

† Annali di Matematica (2), 1867, tome 1.

‡ Maseres and Frend may be regarded as the last writers who objected to the use of negative roots. Maseres' objections are frequently found in his extensive writings, and those of Frend are contained in his "Principles of Algebra, 1796," and "True Theory of Equations," 1799.

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leave of this part of the subject without some slight reference to these developments, which have attained a very high standard of mathematical rigour, chiefly at the hands of the German school.

We may for the present purpose regard these developments as taking place in two different branches: the theory of geometry of the complex plane, and the algebraical theory of number pairs. To the latter we shall hereafter have occasion to refer. The former, though lying outside the scope of the present paper, warrants, in virtue of its analytical importance, at least a passing reference.

Geometry of Complex Plane.

The theory of geometry of the complex plane concerns itself with that geometry in which the co-ordinates of a point are complex quantities of the form $x+ix^1$, $y+iy^1$, $z+iz^1$. The use of complex quantities in this capacity affects such a geometry with three important conditions which occur when (1) x, y, z are zero, (2) x^1, y^1, z^1 are zero, (3) when only those points whose co-ordinates are real multiples of the same complex quantity, $a+ib$, are considered. Such conceptions render possible the deduction of the geometry of real points, having applications in both co-ordinate and projective geometry.

From this preliminary deviation, we now turn to a consideration of the applications of these methods to electrical theory, considering in the first instance the geometrical aspect of the problem, and in the second instance the application of algebraical methods. To prevent undue prolixity, it will be necessary to pre-suppose an acquaintance on the part of the reader with the usual *modus operandi* given in such mathematical books as contain reference to the theory of complex numbers.

If the vector representing alternating values such as are encountered in electrical theory is considered in the usual notation, it becomes subject to all the laws of vector analysis.

In this way, alternating current theory becomes amenable to the usual vectorial operations, and hence also to analysis by means of the theory of complex numbers.

In consequence, the advantages resulting from vectorial methods are extended to their logical conclusion, and when accurate computations, necessitating the use of algebraical methods, are required, the algebraical theory of complex numbers is available for the quantitative continuance of the preliminary spatial conceptions.

Thus the employment of the theory of complex numbers has the distinct advantage over ordinary methods in that it maintains a conceptual uniformity of operations. In the algebraical part of the theory, the operations are still related to the spatial properties of vectorial representation, and the transition from vectorial to algebraical theory becomes a natural one.

From the elementary theory of complex numbers we know that the vector quantity **A** may be expressed in any of the forms

$$\mathbf{A}=a+jb,$$
$$\mathbf{A}=A(\cos\theta+j\sin\theta),$$
$$\mathbf{A}=A\varepsilon^{j\theta},$$

or, if the "imaginary" lies in a negative quadrant of the cartesian co-ordinate system,

$$\mathbf{A}=a-jb,$$
$$\mathbf{A}=A(\cos\theta-j\sin\theta),$$
$$\mathbf{A}=A\varepsilon^{-j\theta}.$$

In what follows, we shall use the Clarendon type to indicate vectorial quantities and the ordinary type to indicate scalars. Thus **A** is a vector, and A a scalar. We assume that the vectorial theory of alternating currents is so well known as to require no elaboration here.

If an alternating voltage of instantaneous value e is applied to a circuit consisting of resistance R, and self-inductance L, the e.m.f. due to induction is represented by the expressio $-L\frac{di}{dt}$, in which i is the instantaneous value of the current, and the $-$ sign indicates that the e.m.f. of self-induction opposes the applied e.m.f. It follows therefore, that

$$i=\frac{e-L\frac{di}{dt}}{R}$$

$$e=Ri+L\frac{di}{dt} \quad . \quad . \quad . \quad . \quad . \quad (1)$$

Many mathematical operations may be simplified by using the operator D to represent $\frac{d}{dt}$, and by adopting this procedure, equation (1) becomes

$$e=(R+LD)i \quad . \quad . \quad . \quad . \quad . \quad . \quad (2),$$

and since the alternating value i may also be written as $I\sin\omega t$, where ω has the usual significance, it follows that

$$e=RI\sin\omega t+LDI\sin\omega t,$$

and since

$$DI\sin\omega t=-\omega I\cos\omega t,$$
$$e=RI\sin\omega t-\omega I\cos\omega t.$$

If we take the second differential, representing it by D^2, we obtain

$$D^2I\sin\omega t=-\omega^2I\sin\omega t,$$

from which

$$D^2=-\omega^2, \text{ or } (\sqrt{-1}.\omega)^2$$

and therefore

$$D=\sqrt{-1}.\omega=j\omega.$$

By substituting this value of D in equation (2) we obtain the relation

$$e=(R+j\omega L)i \quad . \quad . \quad . \quad . \quad . \quad . \quad (3),$$

from which it is apparent that

$$R+j\omega L=\frac{e}{i} \quad . \quad . \quad . \quad . \quad . \quad . \quad (4),$$

and consequently represents the total impedance of the circuit.

Thus, by means of the operator j, the impedance of the alternating current circuit may be expressed in the form of a complex number, consisting of a real quantity R in the axis of reals, and another quantity ωL in the quadrature, or imaginary axis.

It may be inferred from the foregoing considerations that both e and i may be regarded as complex quantities of the respective forms

$$e=e_r+je_x,$$
$$i=i_r+ji_x,$$

where e_r, i_r are the resistive components, and e_x, i_x the reactive components of the instantaneous values of voltage and current respectively.

Simpler Manipulation.

The manipulation of such complex terms, which we have shown to be subject to algebraical laws, is in general much more practicable than the corresponding operations with the usual algebraical forms. It has been shown elsewhere that the result of any mathematical operation with complex quantities is expressible in the form of a complex quantity. If real values of the result are required, this forms no objection, since the result may be arranged in the most appropriate form, depending upon whether the modulus, argument, or component values are required.

If the quantities e and i are both regarded as harmonic functions of the time, equation (3) may be written in the form

$$E\cos(\omega t+\alpha)=(R+j\omega L)I\cos(\omega t+\beta).$$

Differentiating both sides with respect to t gives

$$\frac{d}{dt}E\cos(\omega t+\alpha)=-\omega E\sin(\omega t+\alpha)$$

$$\frac{d}{dt}I\cos(\omega t+\beta)=-\omega I\sin(\omega t+\beta),$$

and therefore

$$-\omega E\sin(\omega t+\alpha)=(R+j\omega L)[-\omega I\sin(\omega t+\beta)].$$

Now multiplying both sides by $-\frac{j}{\omega}$ reduces the expression to

$$jE\sin(\omega t+\alpha)=(R+j\omega L)jI\sin(\omega t+\beta),$$

and if i be put into the complex form $I\cos\omega t+jI\sin\omega t$, we have

$$e=(R+j\omega L)(I\cos\omega t+jI\sin\omega t),$$

which, in exponential notation may be written

$$e=\sqrt{R^2+(\omega L)^2}.I\varepsilon^{j\alpha}.I\varepsilon^{j\omega t}$$
$$=\sqrt{R^2+(\omega L)^2}.I\varepsilon^{j(\omega t+\alpha)}$$

so that

$$ZI\varepsilon^{j(\omega t+\alpha)}=ZI[\cos(\omega t+\alpha)+j\sin(\omega t+\alpha)] \quad . \quad (5)$$

Again, taking the differential equation

$$Ri=-\frac{d}{dt}\left[Li+I(\cos\omega t+j\sin\omega t)\right] \quad . \quad . \quad . \quad (6)$$

and re-arranging in the exponential form, we have

$$Ri=-\frac{d}{dt}\left(Li+I\varepsilon^{j\omega t}\right) \quad . \quad . \quad . \quad . \quad . \quad . \quad (7),$$

the solution of which will clearly be proportional to $\varepsilon^{j\omega t}$. The operator $\frac{d}{dt}$ acts only on this term, and therefore corres-

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ponds to multiplication by $j\omega$. Therefore the equation (7) may be written

$$Ri = -j\omega (Li + I\varepsilon^{j\omega t}),$$

which gives as a solution

$$i = \frac{-j\omega I \varepsilon^{j\omega t}}{R + Lj\omega} \quad \ldots\ldots\ldots \quad (8)$$

Containing imaginary terms in both its parts, this equation may consequently be expressed in the form of a single complex quantity

$$\rho,\ \theta = \rho\ (\cos\theta + j \sin\theta).$$

Since the value of the modulus, ρ, of this expression, is evidently equal to the product of the moduli of the terms $-j\omega I \varepsilon^{j\omega t}$, and $R + Lj\omega$ in equation (8), and these moduli are the quantities ωI and $\sqrt{R^2 + (\omega L)^2}$ respectively, we have

$$\rho = \frac{\omega I}{Z}$$

The argument, θ, being equal to the sum of the arguments of the component terms, which have the respective values $-j$, $+\omega t$, and $\frac{\omega L}{R}$, is given by the expression

$$\theta = \omega t - j - \tan^{-1}\left(\frac{\omega L}{R}\right),$$

so that the real solution for i is

$$i = \rho \cos\theta$$
$$= \frac{\omega I}{Z} \sin\left[\omega t - \tan^{-1}\left(\frac{\omega L}{R}\right)\right]$$

(To be continued.)

BOOK REVIEWS.

Englische Elektrizitätswirkschaft. By Dr. Rer. Pol. Gunther Brandt. (Berlin: Julius Springer.) Pp. v + 112. 6 marks.

This is a remarkably thorough account of the organisation and legal and economic aspects of the electric supply industry in Great Britain. The whole history is surveyed from the beginning up to the 1926 Act, and the publication of the first four of the Commissioners' schemes.

The material is almost entirely drawn from official publications such as the various Electricity Supply Acts, the publications of the Electricity Commissioners, various official reports and a number of other publications. The author has succeeded in the difficult task of presenting this mass of material in a form which enables the reader to survey the whole situation and its development with comparative ease. The information given is accurate, and not overburdened with statistics, and the author has visualised his subject with a better perspective than could perhaps have been obtained by someone in this country more intimately concerned with the details. All this is done in 110 pages.

The story unfolded makes very clear what is, of course, common knowledge that from 1882 onwards restrictive legislation has most seriously hampered the healthy development of the electricity supply industry. Anxiety on the part of the legislator to safeguard the interests of the consumer first and foremost was, no doubt, the basis of the restrictive measures adopted. This anxiety, if not exaggerated, was at least badly misdirected, and, at best, governed by administrative considerations while entirely ignoring engineering ones. One realises very fully when surveying the whole field as presented in this book to what extent legislation made it impossible in the past for the electricity supply industry to place itself on a sound engineering basis.

The most conspicuous thing about electricity is the ease with which it can be transmitted and distributed over distances. The early Acts deliberately restricted the area of distribution. Another notable feature of electricity is that compared with most marketable commodities it is very easy to cost, and therefore easy to sell on the basis of a two-part tariff. Legislation discouraged any tariff but the flat rate.

During this century the two principal attempts before 1926 to improve the situation and to introduce some measure of order and engineering efficiency into the confusion that was fast becoming worse confounded were too half-hearted to have the necessary measure of success. The Acts of 1899 and 1909 attempted to make use of the suitability of electricity for long distance transmission and to abolish some of the previous restrictions; but legislation attempted, most unfortunately, to have it both ways, to achieve a unified supply over large areas and to prevent monopoly existing in these. The two things are incompatible, and the engineering and economic possibilities could not be properly developed because of the restrictions which took from the power companies with one hand what was given with the other. It is no doubt necessary to safeguard the consumer against monopolies, but it soon became evident that a compromise which results in wasteful and unsound engineering and a bad exploitation of transmission mains as well as uneconomic generation is ultimately to the disadvantage of the consumer. The 1919 Act renewed the attempts of 1899 and 1909, but it was even more of an attempt to reconcile incompatible aims, to compromise between divergent interests and prejudices and, apart from inaugurating the Electricity Commission, the value of which must not be underrated, it remains largely a dead letter.

All this history contains much of which we have no great cause to be proud, though the author does not rub this in. It may, however, be doubted whether the condition of electricity supply is much more rational in other parts of the world. Inevitably in every country people must be saying that they would manage these matters very differently if they could begin now with a clean sheet. So we may expect that a very similar skeleton to our own is locked away in the cupboards of electricity supply industries elsewhere. Too many stations, too many systems, too many frequencies, too much independence, and, occasionally, too little willingness to co-operate, lack of co-ordination, wasteful generation, unnecessary spare plant, competitive and unnecessary duplication of transmission mains are certainly not peculiar to Great Britain. But the very exhaustive statistics we possess, thanks to the Electricity Commissioners, may throw the door of our skeleton cupboard a little wider open than it is elsewhere.

The story of British electricity development is told in detail and without comment in the book under review, and until the last few pages are reached the reviewer can find little to disagree with in what the author has to say. One would expect that the final conclusion reached, as the result of a review of past history, would be that restrictive and half-hearted legislation is shown to have failed, that compromises are a mistake, that other and better means must be found for safeguarding the consumer than to limit the expansion of sound engineering undertakings, that individualism can go too far, that in view of the failure or partial failure of the 1919 Act it is proved beyond the capacity of human nature for a large number of people with conflicting views and interests to organise themselves without the help of an outside organiser vested with sufficient authority.

In short, the logical conclusion that seems to be reached from consideration of the developments outlined in this book would be that a radical break with our past bad ways, such as is constituted by the 1926 Act, is the only means of straightening out the present tangle. The author, however, draws the opposite conclusion, namely, that though a co-ordination of the whole electricity supply in the country is necessary, this should be left to grow out of the initiative of individual undertakings.

This reminds us of discussions that were very keen here up to the passing of the 1926 Act, but tended naturally to be treated as of smaller practical interest from the moment when we had burnt our boats.

Reginald O. Kapp.

Electric Drive Practice. By Gordon Fox. (London: McGraw Hill Publishing Co.) Pp. 420. 17s. 6d. net.

Pre-supposing a suitable knowledge of electric motors and control, the book, after dealing generally with the advantages of electric motor drive, enumerates factors governing the selection and application of motors and the selection of starting and control equipment. Chapters are devoted to the mechanical and electrical features of motor installation, and then detailed applications of motor drive are examined in a series of chapters, concerned successively with centrifugal fan and blowers and propeller fans; centrifugal compressors, positive-pressure rotary blowers, air and ammonia compressors, pumps, travelling cranes, elevating and conveying machinery, hoists, mine hoists, and machine tools. The elements of load are evaluated, and the factors affecting the load and the motor size determination for each kind of driven machine are presented, a proceeding which is obviously preferable to the mere listing of machines and motor sizes. Apart from the author's preference for a frequency of 60 cycles and similar Americana, the book should be of interest and value to readers on both sides of the Atlantic.

G. W. S.

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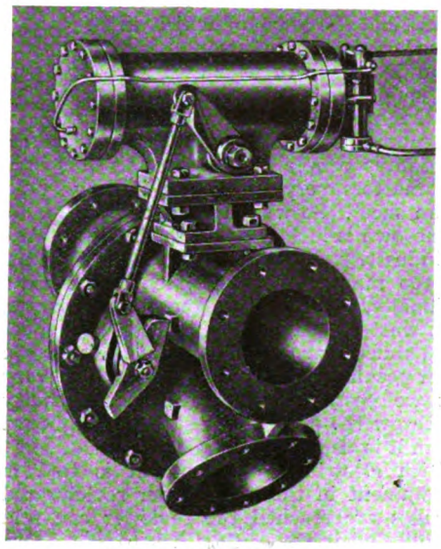
FEED CONTROL FOR PULVERISED FUEL.

Details of an Ingenious System at Brimsdown and Barton—Various Methods of Operation—Automatic Filling of Bins.

AN ingenious system for controlling the supply of pulverised fuel to the various feed bins of a battery of boilers was noticed by a representative of THE ELECTRICIAN when visiting the new Brimsdown power station of the North Metropolitan Electric Power Supply Co. Through the courtesy of Mr. R. C. Graseby and Venner Time Switches, Ltd., who are making the apparatus, we are able to describe and illustrate its salient features.

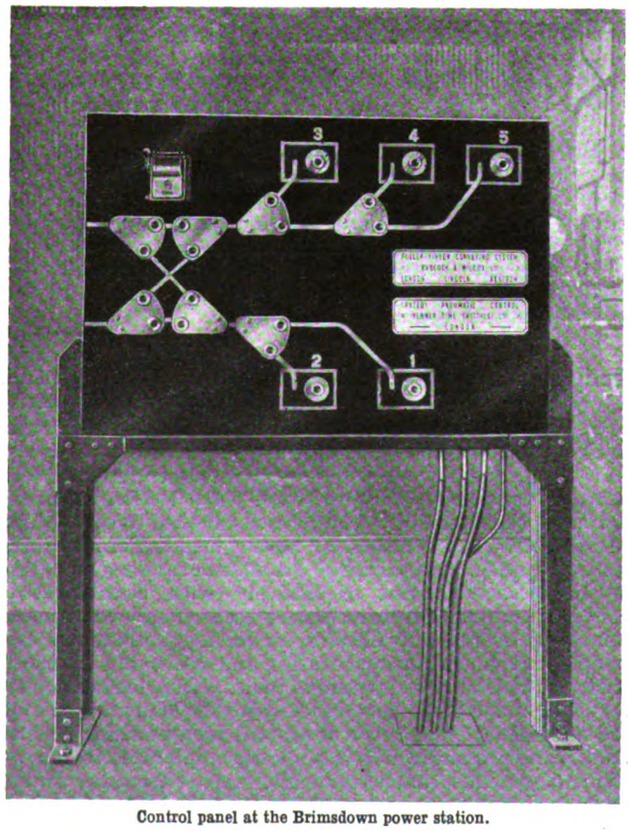


Air motor and 2-way fuel valve.

In this Venner-Graseby system of pneumatic control, two-way valves placed on the fuel feed lines are controlled pneumatically from a remote operating panel, and are actuated by compressed air from the general system used for blowing the fuel along the pipe lines. The control can be wholly or semi-automatic at will.

The three essentials of the apparatus are :—The air motors which operate the fuel valves ; the air-valve gears controlled by paddles suspended in each fuel bin and/or from the control board ; the remote control board and indicator from which the deflection of fuel to different bins is effected.

The air motor consists of a cylinder having a solid piston

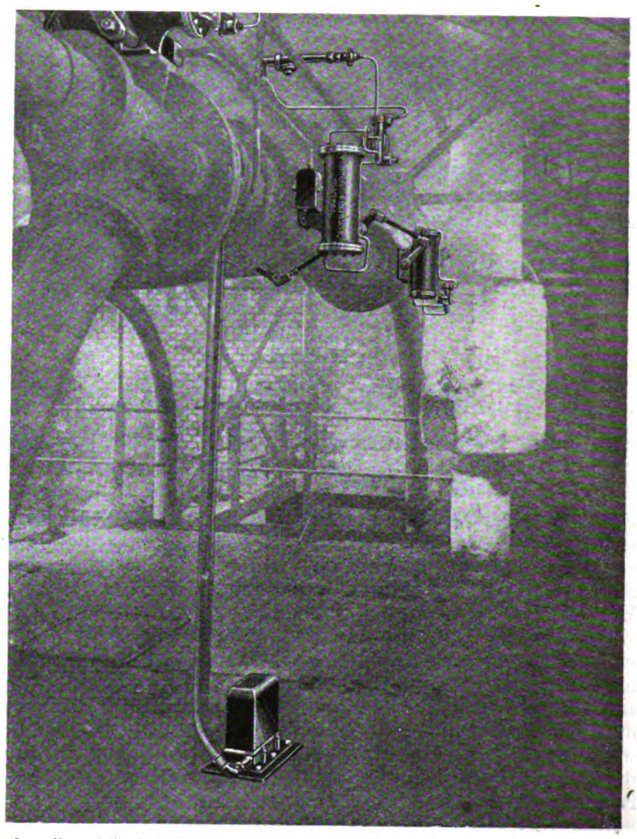


Control panel at the Brimsdown power station.

connected by a crank and connecting rod to the two-way fuel valve controlled by it on the feed line. Compressed air is admitted to one end or the other of the cylinder by the control-valve gear, and the piston pushed from one end of the cylinder to the other, thus moving the two-way fuel valve from one way to the other.

The control valve gear, worked either from the paddle in the fuel bin, or by control from the panel, is operated by the action of compressed air on a diaphragm, and admits compressed air to one end of the cylinder, and at the same time opens the other end to the atmosphere.

The control board has a number of hand-operated air valves



A portion of the fuel pipe line at Brimsdown showing the air motors and cover of paddle valve gear on top of the bin.

corresponding with the number of valves on the feed line. Each fuel bin is also represented by an indicator lamp, and each two-way fuel valve by two other indicator lamps, either of which lights up to show in which position the two-way fuel valve on the feed line is at the moment. White lines are painted on the control panel to represent the fuel feed lines, and by tracing along these lines via the lamps which are lit, it is possible to see which of the main fuel lines is open.

When the pulverised fuel rises in a bin to a predetermined distance from the top it pushes over the vane of the paddle which operates the air valves, admitting compressed air to the valve gear on the air motor actuating the fuel two-way valve feeding that bin. When the fuel falls again, having been drawn off to the boiler, the paddle also falls again and opens (by means of the air valves) the fuel valve, thus permitting more fuel to enter the bin. The electrical contacts on the paddle valve can be arranged to give visual or audible warnings of its operations.

There are several ways of operating the system. In one method (as used at the new Barton power station, Manchester) the valves on the control board are set to admit fuel to the desired bins. The pulverised fuel coming along the pipe line is then directed automatically into the first bin. When this bin is full the vane of its paddle valve is pushed over, thus operating the main two-way valve which shuts off the supply to the bin, and diverts the fuel along the pipe line to the next bin which it is desired to fill. This process is continued all along the line. When the level falls in the first bin owing to fuel being drawn off, its paddle valve goes back to the upright position and again operates the main two-way

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fuel valve back, diverting the fuel into this bin again. With this system the bins are automatically kept filled.

Another method of using the system (as employed at the new Brimsdown power station) is to set from the control board which bins are to receive fuel as before. When the first bin is full, its paddle valve goes over and deflects the fuel into the next bin, and so on. When the paddle valve falls in this method of operation, it does not operate the two-way fuel valve again, and when all the bins are full, the pulverising and blowing plant will shut down unless the valves are reset from the control board.

132 kV TRANSFORMERS.

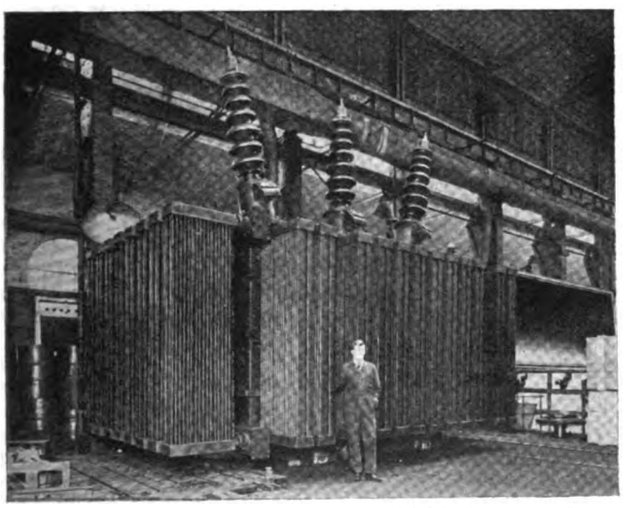
Construction of First Unit for Central Board Schemes.

APART from the primary object of developing the electricity supply industry of this country, the activities of the Central Electricity Board are conferring very great benefits upon British electrical manufacturers by giving them the opportunity to develop electrical apparatus for very high voltages and very great outputs comparable with the products of foreign manufacturers in point of magnitude. These developments will undoubtedly lead to the setting up of a whole series of records for products of British manufacture.

A landmark of this kind is shown in the illustration below, which represents not only the first 132 000 V, three-phase unit to be completed for the national schemes, but is also understood to be the largest unit of the type and voltage which has, so far, been produced in this country. It was constructed by the English Electric Co., which has in hand four 15 000 kVA units like the one illustrated, four 10 000 kVA units of a similar type, and four 5 000 kVA units for 33 000 V.

The high-voltage windings of the 132 kV transformers are star connected with the neutral solidly grounded, and advantage has been taken of this to use graded insulation, with considerable resultant economy. The low-voltage windings are connected in delta, and to provide a neutral a separate earthing reactor will be installed and used also to give a 440 V supply for operating auxiliary apparatus. Each transformer is equipped with on-load tap changing gear to give plus and minus 10% variation in steps of 1·43%. This gear is mounted directly on the side of the transformer tank, and is motor-operated with remote control.

The " English Electric " scheme for effecting tap-changing under load is one in which the auxiliary auto-transformer, with a middle point, enables the equivalent of twice as many tappings to be obtained, as there are actual tappings on the main transformer. The regulating winding is located towards the neutral end of the high-voltage winding, which, of course, is solidly grounded, but between this winding and the neutral is the reinforced portion of the high-voltage winding, which must necessarily be permanently in circuit.



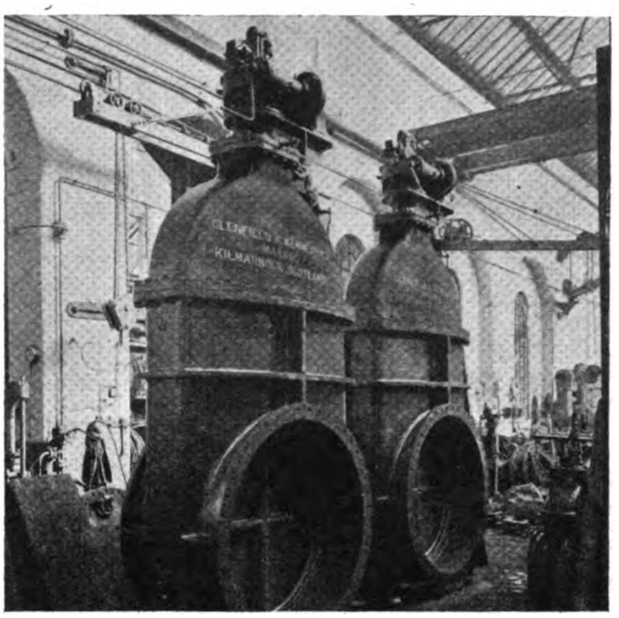
The first 132 kV three-phase transformer completed in this country for the Central Board schemes.

The 15 000 kVA units are arranged to operate with a mixed system of cooling. The transformers are of the five-limb core type, with the windings on the three central limbs.

ELECTRIC SLUICE VALVES.

Two Interesting Electrically-Operated Units for the Ottawa Waterworks.

RAPID progress is now being made in the field of electrically-operated valves, and the tendency in modern waterworks practice is to centralise the control of the main valves throughout the system, so as to save time and labour in operation and prevent dangerous flooding and loss of water in the event of a burst pipe. In this connection we are able to reproduce a photograph of two large self-contained electrically-operated sluice valves, designed for remote control, recently supplied by Messrs. Glenfield and Kennedy, Ltd., of Kilmarnock, to the Ottawa Corporation.



Two large self-contained electrically-operated sluice valves for remote control.

These units are of 60 in. dia., and operate under a head of 34 ft., the valve being operated by a small electric motor driving the screwed spindle through spur and worm reduction gears, the whole being neatly mounted on a headstock, bolted to the valve cover. Current for this motor is controlled by a set of push-button controllers situated in the engineer's office, the valve being automatically stopped at the extreme positions of its travel by either one or other of the limit switches situated on the indicator hood and operated by the pointer. Provision is also made for hand operation in the event of the failure of the electricity supply.

The methods of valve construction follow the firm's usual practice, the body being of the finest grey cast iron, moulded in dry sand, which produces a very smooth finish. Heavy gun-metal faces are fitted to the valve body and door, being securely held in position by screwed brass pins, and hand scraped to form a perfectly watertight joint, while the operating screw is accurately machined from a forging of high tensile manganese bronze, working in a gun-metal nut secured to the valve door.

Great attention has been paid to lubrication; the worm reduction gear, for instance, is housed in a totally enclosed cast iron casing which contains an oil bath. Lubricators are provided for all the headstock bearings, and the ball thrust washers are packed with grease.

The valves are manufactured in all sizes up to 108 in. dia., and for heads exceeding 800 ft., those for the higher pressures being constructed with cylindrical bodies, and equally suitable for controlling water in hydro-electric penstocks, towns' supplies, condensed water circulating systems, and also for exhaust, low and high pressure steam.

One of the latest additions to the equipment is an electrical distance indicator, which shows on a dial, situated in the control house or engineer's office, the exact amount of opening of the valve at any instant. The instrument consists of a transmitter operated by the valve gearing, and a receiver; the installation of this device relieves the operator of all anxiety as to the working of the distant valve, since the motion of the valve door can be followed during the operation of opening and closing.

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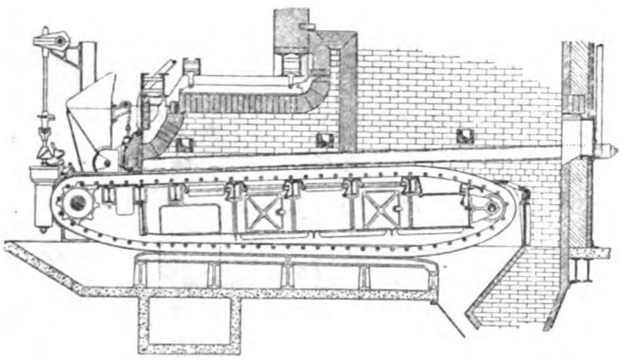
"LOUVRE" STOKERS.

Features of Design to Overcome Station Operating Troubles.

ONE of the main problems of the travelling grate stoker has been to obtain uniform air supply at every point of the stoker width, even up to 30 or 40 ft. wide, from compartments at each side. Again there has been the difficulty that the red-hot riddlings continuously fall down into the wind box between the links, causing all kinds of troubles in the way of

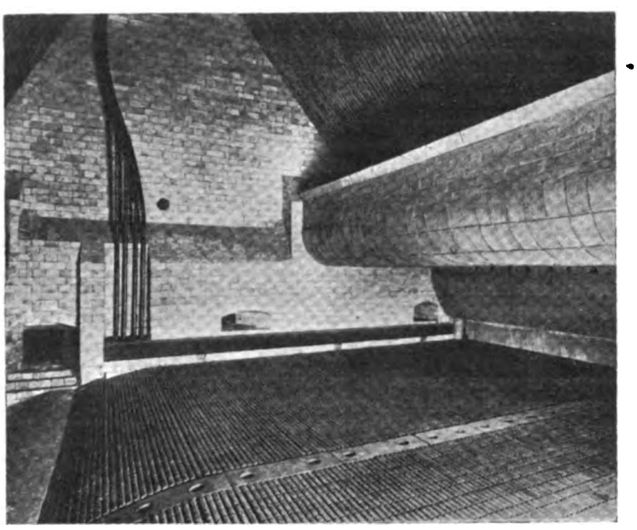


Sectional view of the "Louvre" stoker showing air valves in five transverse series, each separately controlled.

local wear and tear, as well as necessitating complicated mechanically operated riddlings discharge gear.

In the Underfeed "Louvre" type travelling grate stoker, which has been designed to overcome these problems, the bars of the grate are of cast iron as usual, but constructed on a new principle, consisting of a series of free swinging louvres, arranged transversely in sections the full width across the chains, to which they are attached by pivots engaging in small carrier bars. In forming the actual grate surface these transverse parallel links all lie back on one another at an angle of about 45 deg. to the horizontal, with air spaces formed between them, taking the coal as usual, which burns as it travels, the ash and clinker being delivered over the rear as the chain passes round the drum.

These swinging louvres are so designed that they carry the riddlings and dust in between them by means of projecting ridges, and as the chain travels down and round underneath at the rear all the links swing down on their pivots, hanging on the return travel quite free and vertical. The result is



The combustion chamber of one of the boilers at Barking power station.

that the riddlings are discharged, automatically and continuously, into a hopper arranged under the rear of the stoker and immediately adjacent to the ash hopper, and no solid material passes down into the wind box, so that specially mechanically operated riddlings discharge gear (particularly liable to breakdown) is eliminated altogether, the chain itself carrying out this function. It is further claimed that by the use of free swinging loose links, no partial burning out, distortion or other trouble will alter the air space, since the links merely lie up on each other at a different angle. Furthermore, ash and clinker cannot remain between because the links always swing wide open.

With regard to uniform air distribution the forced draught fan discharges, by means of two compartments at each side, direct into one very large and simple wind box, of ample height and capacity extended for the full width and almost the entire length of the chain. But underneath the chain the entire area is divided both longitudinally and transversely into a series of compartments, each serving with air its own section of the grate surface above.

Inside these compartments, close to the grate, are a number of small shutters, arranged in rows and operated together by common shafts projecting from one side of the setting with wheel controls. By operating these wheels the air supply valves are opened or closed accordingly.

For stokers over 15 ft. a characteristic feature is that the chain grate is made of two independent chains side by side within the same setting; since, with this arrangement, the span of the supporting beams is halved, a much lighter and more efficient type of construction can be used free from excessive bending or twisting stresses, while each chain functions as a separate and independent unit so far as front drum shaft driving sprockets and other mechanism is concerned. Further, the coal hopper functions in two parts, each with its own coal regulating shutter, cut-off grate and other equipment, and, if necessary, one chain may be operated when the other is stopped, with the air supply controlled accordingly, just as the method of working each chain may be altered slightly to suit variations in the quality of the coal in the two side bunkers generally employed for modern wide settings.

The stoker is designed to burn all kinds of fuels down to coke breeze and fine anthracite, in amounts up to 50 lb of coal per sq. ft. of grate area, and also operates easily with air heating. At the Barking power station, for example, the air is about 500 deg. F. as delivered to the stoker. In this case the boilers are 85 000 lb. per hour normal evaporation, with 127 500 lb. overload, the stokers being 19 ft. wide, and 332 sq. ft. in effective grate area; a special equipment fitted is a square weldless steel water cooling box, in circulation with the boiler, fitted along the combustion chamber just above the grate level, to prevent adhesion of clinker.

MODERNISING TURBINE PLANT.

IN view of the fact that the performance of modern plant is greatly superior to that of older units, even of fairly recent design, it often does not pay to keep the latter in service. The scrapping of the existing plant is, however, in some cases hardly justifiable, as the electrical equipment and the condensing plant are, as a rule, still in good condition, so that the boiler and steam turbine alone need to be replaced.

As the power developed with the same quantity of steam under modern conditions is considerably higher than in former days, the electrical plant is, consequently, too small for the new turbine; the latter has, therefore, to be built in two parts, the low-pressure portion being coupled to the existing generator and the high-pressure part to a new generator. As, however, it is more especially the high-pressure stages of old turbines that work with a low efficiency, a simple solution is to retain the existing turbine while transferring at least the first high-pressure stage to a back pressure turbine working in series with it—an arrangement adopted by Oerlikon, Ltd., and described in Bulletin No. 84/85, which they recently issued from 28–31, Essex Street, Strand, W.C.2.

As the generator coupled to the existing turbine would no longer be fully loaded if the quantity of steam remained the same as before, the back-pressure turbine is designed to supply an increasing quantity of steam to enable the existing turbine to develop its full output, although the high-pressure drop is cut out; the quantity of steam can be raised to that corresponding to the overload capacity of the old set, as the existing condenser is always dimensioned for such conditions.

With combined power plant of this description, for which the Oerlikon company have recently been granted a patent, it is claimed that it is possible to increase, in many cases, the continuous rating of existing plant by more than 25%, while at the same time obtaining a considerable improvement in steam consumption per kWh generated. On the other hand, the firm claims that capital expenditure is reduced to a minimum, as the original generating plant and condenser remain in service, the only addition to the installation being an h.p. back-pressure turbo-set with the necessary h.p. boilers.

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GENERATING PLANT PROGRESS.

Recent Developments in Turbo-Generators—Direct Generation of Alternating Current at High Voltages—Difficulties of Low Voltage Development.

TWO interesting papers dealing with generating plant design and operating problems were read at a meeting of the Institution of Electrical Engineers in London on March 21st. One, on the "Direct Generation of Alternating Current at High Voltages," was by Sir Charles A. Parsons, F.R.S., and Mr. J. Rosen, while Mr. J. A. Kuyser was responsible for "Recent Developments in Turbo-Generators."

In the first-named paper the authors began by pointing out, with the help of a mechanical analogy, the true place which the alternating-current transformer takes in the group of plant considered to-day to be standard for the generation transmission and distribution of electric power on a large scale.

They proposed the use of high-voltage alternators, and the partial abolition of transformers. In support of these proposals, the authors discussed the gradual growth of conditions favourable to the introduction of the high-voltage alternator, and described the obstacles in the way of further development at lower voltages.

This discussion led naturally to the advantages to modern alternator design to be derived from the acceptance of the principle of direct generation at high voltages.

Apart from the design of the alternator itself, including its cable leads, there were many ways in which the adoption of such an alternator would effect financial economy in capital outlay and running expenses, and these matters the authors proceeded to set out.

They then took a brief survey of what has already been done in the past in the field of direct generation at 30 000 V, and described in detail a 33 000 V, 25 000 kW, 3 000 r.p.m. alternator of unique design, built for the North Metropolitan Power Supply Co., for installation in the new power station at Brimsdown, North London. The operating experiences on site since the setting to work of the alternator in August, 1928, were stated.

As a matter of interest to those engineers and designers engaged in alternator construction and development, an outline was given of some of the experimental research carried out by the authors in the working out of the practical details of the new design, and of the tests made at works on the completed alternator.

The paper concluded with some reference to the future possibilities of the extended use of direct generation at high voltages, and the authors asked for a candid expression of opinion from their critics.

Mr. Kuyser first dealt in his paper with the subject of ventilation, the different systems used in the past, and recent developments, being reviewed. Radial, axial, radial-axial and multiple-inlet systems were referred to and internal and external fans were discussed.

The elimination of eddy currents was next considered, the various methods, past and present, being reviewed. These included: Twisted and transposed windings; twisted and transposed slot conductors; twisting and transposition of end-connections; combination of transposed slot conductors and end-connections.

Stator End-Connections.

The paper then dealt with the magnetic field of stator end-connections and discussed the following matters: Local heating produced in end of core, stator end-plate and stator end-connections; measurements by exploring coils under different load conditions, i.e., leading load, lagging load and short circuit; effect of squirrel cage located between stator winding and rotor coil-retaining rings of single-phase generator; neutralisation of end-field by copper screening plate.

In the next section the subject of insulation was treated, the following being considered: Vibration of conductors; swelling of insulation; smooth core design; expansion and contraction of armature conductors; crinkling of insulation; bakelised conductors; clamping of stator winding.

Rotor forgings were discussed, especially in connection with the relative advantages of oil-quenching and annealing.

Finally the subject of coil-retaining rings was dealt with, and the method of support, difficulties due to rigidly supported rings, and non-magnetic rings were discussed.

The author's conclusion was that the experience obtained with the large sets manufactured during recent years has been very satisfactory, and that the rate at which progress has taken place in the size of units manufactured has not been so rapid as to give rise to serious difficulties. Considerable further increase was to be expected in the maximum size of units which could be built for 3 000 r.p.m., whereas for 1 500 r.p.m., sizes were limited only by manufacturing and transport facilities. For 3 000 r.p.m. a desirable size of unit at present would be 50 000 or 60 000 kVA, whereas in a few years a unit of double this capacity could probably be produced, depending upon the progress made in rotor forgings and upon the maximum safe journal dimensions, both uncertain factors. It was added that sets of 50 000 kVA at 3 000 r.p.m. were actually tendered for two years ago.

THE DISCUSSION.

Capt. J. M. DONALDSON, called upon by the President as "the dog on which this 33 000 V alternator is being tried out," said that Messrs. Parsons had not done themselves justice in the paper in the reference that had been made to the enterprise of the North Metropolitan Electric Power Supply Co. Most of the big financial risk had been taken by Messrs. Parsons, and he felt it was right that the circumstances should be made known. The Power Company had ordered two 11 000 V machines, and Messrs. Parsons had suggested that they should build a third "buck-shee" machine for 33 000 V, which was to be interchangeable so far as the turbine was concerned, with the 11 000 V machines, but there was no obligation to take over the 33 000 V machine, even though it proved successful in operation, until the Power Company had the load for it. This showed that Messrs. Parsons had the greatest confidence in their work, because it had meant a large amount of capital lying idle for a long period, to say nothing of the development charges on such a machine, which must have been considerable.

Reference was made in the paper to the very serious gruelling which the machine had had in the matter of surges, and although he did not wish it to be supposed that the Power Co. was sufficiently altruistic to arrange these surges to suit the machine, he hoped, on the other hand, that it would not be supposed that the conditions mentioned were the common lot of people operating off the North Metropolitan system. It had happened by a remarkable run of ill-luck that there had been a most extraordinary series of difficulties on the company's 33 000 V system. It so happened that they had some 50 or 60 miles of 33 000 V overhead lines north of Brimsdown which were connected to mains of another system, and whilst there had been trouble on his own lines from insulators there had also been some trouble from the other lines with which the system was interconnected.

As regards the actual savings, these amounted in capital cost to £5 400, a figure arrived at by deducting the cost of the transformers from the cost of the 33 000 V generator, together with certain savings in cables by using the higher voltage and a small amount for the foundations of the transformers which were not required. Assuming the 33 000 V machine had not a less efficiency than the 11 000 V machine, then the losses in the transformers would have to be reckoned against the 11 000 V machine, and on the basis of the figures in the paper these would represent £763. Capitalising this in the way done in the paper, the amount was £7 630, making a total of a little over £13 000.

As to the operation of the machine, when people said they would like to see it, all he could say was that there was nothing to see except a very nice name plate. He had been rather alarmed on one occasion by smelling ozone, but the manufacturers appeared to be very confident that there was no danger of gases being given off in this way. If the ozone question became serious he believed it was a simple matter to bring it back to the allotropic form. Up to now, however, the machine had been running under hard conditions quite satisfactorily.

The PRESIDENT, in calling upon Mr. A. B. Field, congratulated him upon being awarded the Lamme medal by the American Institute of Electrical Engineers.

Mr. A. B. FIELD said that, given equal resources, he did not think there was any question but that a low voltage machine could be designed with better efficiency than a high voltage machine, of the same output. Moreover, on the

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question of reliability, conservatism would probably dictate a high insurance figure for the high voltage machine until more experience was gained. As regards insulation, the difficult part of the problem with the 33 000 V machine would appear to be in connection with that part of the winding external to the core. The fundamental issue in connection with the high voltage machine was getting the heat through the thick high voltage insulation, and it seemed to him that a much bolder attack than that made by the authors was justified.

Mr. Field advocated the oil-immersed stator, and said that if we could make up our minds to go in for oil immersion it would be possible to get the cooling medium practically in direct contact with the high voltage metal, or with only small thicknesses of solid insulating material. He had in mind high speed forced circulation such as was the case in condenser tubes. Even hollow conductors might be feasible with oil cooling. Of course, a large expenditure of money would be necessary to perfect the design, but there were no absolutely fundamental obstacles in the way which would make it absurd to investigate such ideas. Mr. Field exhibited some slides showing diagrammatically the ideas which he had in mind.

Question of Forgings.

Mr. H. W. TAYLOR, speaking with regard to the suggestion that the art of forging is at present preventing us going farther with machines of the type described in the paper by Sir Charles Parsons and Mr. Rosen, said that whilst electrical problems and mechanical design are well understood, we were waiting for the forging maker to make sound forgings from known materials and to produce materials which would have higher strengths than those now common; and when that was the case it would not be long before we had machines of a higher rating than that mentioned. At the same time he believed there would be a demand for some years for machines which were rather outside the accepted range of high speed. Incidentally, he wondered why designers of 1 500 r.p.m. machines had not considered the fabricated type of rotor more than they had done hitherto. One firm in America had specialised on these apparatus, and there was also one firm in England, but the design in the two cases was rather different.

Mr. G. W. PARTRIDGE spoke of the troubles experienced with the early 11 000 V system at Deptford. In those days, however, the oil transformer was not known, whereas to-day the oil transformer was probably the most reliable piece of apparatus on the system. Machines of the type described by Messrs. Parsons and Rosen were subject to a number of drawbacks. There was first the question of brush discharge. It was very difficult to design such a machine which was absolutely free from brush discharge, which, in some cases might take months or even years to deteriorate the insulation. Again, with such a machine there was no buffer between the machine winding and the high tension transmission system, with consequent risk of damage to the external portion of the stator. Further, another drawback was the actual cost of the failure of such a machine as compared with the failure of a transformer. There would be no comparison between the time taken to put a transformer that had failed back into service and the time taken to put such a high tension alternator into service again in similar circumstances. In the one case it would be a question of a few hours, whereas in the latter it might be three or four months—if there had been a burn out—and there would be the loss of the use of some thousands of pounds' worth of plant in turbines, condensers, etc. The use of auto-transformers was the right method to adopt with these machines because, if judiciously designed, they would halve the capital cost, the space required and the losses.

Mr. J. A. JUHLIN said that progress was never made without experiment, and a good deal more experiment was required with the 33 000 V machine. He would feel a little misgiving if there were a wholesale adoption of it at the present stage. He felt Messrs. Parsons and Rosen had painted a picture of the low voltage machine rather blacker than it deserved, because he had installed large machines of this type carrying almost the current mentioned by the authors. He suggested to the authors that it would be necessary solidly to earth the neutral, otherwise, if it were earthed through a resistance or by any other means, and a fault occurred near one of the terminals a voltage would be put upon the outer conductors very much higher than they were designed for, in the event of using the graded insulation mentioned by the authors, and auto-transformers as mentioned by Mr. Partridge. The results of the experiments upon insulation were interesting, but they were not complete, and there were indications from the study of the figures given that considerably better results could be obtained. His firm had for many years advocated the method of compressing the mica to such an extent as to get the maximum amount of mica into the space.

Mr. W. H. PATCHELL said that in December last he had the pleasure of sending a contribution to the National Electric Light Association Prime Movers Committee on foreign developments, and the particular 30 000 V machine described in the paper was the star turn for 1928 and would undoubtedly get into the American journals later on. He was very glad to think that, however big the Americans were making their machines, we did not allow them to trail every engineering improvement, and that the old country kept still just a little bit ahead. There had been an immense improvement in insulation during the last 25 years. He was glad to hear that his old competitor, Mr. Partridge, was still going strong at Deptford, because the first 10 000 V single-phase machine was installed there, whilst his own machines at Bow were the first 10 000 V three-phase machines, he believed, in the world at the time they were installed. He was not sure whether there was one at Buffalo at the same time.

When the Bow machines were described at the Institution everybody held up their hands in horror and said that they would be nitrogen factories. As a matter of fact, he believed Mr. Highfield, at Willesden, on other machines, had had this trouble, and the difficulty was to make solid insulation. Considerable advances had been made during the past 25 years, however, and the next 25 years might see similar developments. Sir Charles Parsons was sincerely to be congratulated on the real step in progress that he had made.

Mr. J. S. HIGHFIELD said Mr. Partridge had put his finger on a very practical and serious matter when he spoke of the expense of losing the service of one of these very large machines, and the designers and makers of these units would have to manufacture them so that there was no possibility of a breakdown. Mr. Patchell had said that the Bow machines did not produce nitric acid, whereas the Willesden machines did, but in the Willesden machines there were certain reasons for what took place. Nitric acid—really ozone—was made with nitrous oxide, and eventually sulphuric acid, because the coils were insulated with a gypsum soap coating, and burned themselves out in six months, the high tension windings going first. That failure, however, was really of the solid insulation for conductors, which was very important, as Mr. Patchell had said.

Mr. J. W. TOWNLEY spoke of the horrible arrangement of machines with an exciter's exciter, making a long machine still longer. No reference had been made to this matter in the paper by Mr. Kuyser. Another omission in that paper was the absence of any reference to temperature rise. A few years ago there was a heated controversy over temperature rise, and it was clear that many people did not know the temperatures in their machines. Therefore it would have been interesting to hear something as to whether the temperatures that machines were running at to-day were too high or too low.

Owing to lack of time, only brief replies were given to the discussion.

POST OFFICE ACCOUNTS.

Over £7 500 000 Surplus for Year Ended March 31st.

THE Post Office commercial accounts for the year ended March 31st, 1928, show a surplus of £7 570 348, after charging interest on capital, or £1 750 000 more than that for the previous year. The profit on the postal department was £8 843 786, while the surplus on telephones was £107 391, compared with £283 375, and the deficit on telegraphs was £1 380 829, or over £31 000 more than in the previous year. Cash receipts from wireless licences were £1 234 898, and after deducting £154 362, or 12½% for expenses of management and £1 427 as contributions to cost of conversion of spark stations, £1 079 109 was left. Of this £824 237 was paid to the British Broadcasting Corporation, the balance of £254 872 accruing to the Exchequer. The wireless telegraph services accounts now include the working of the wireless services recently established with the Dominions by means of the beam system. The Comptroller and Auditor-General points out that, although the account does not cover a full year's working for all four services—with Canada, Australia, South Africa and India—it appears that the operation of the beam services showed a net surplus of £89 473 in the year. The Imperial Cable Service accounts show a deficit of £77 122, against a deficit of £40 789 in 1926.

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MARINE ELECTRICITY.

Electricity and its Uses in and on Small Ships—Why not Electric Lightships?—An Important Small Motorship, Electric in Everything but Propulsion, with a 330 kW Auxiliary Load—Use of the Storage Battery.

By A. C. HARDY, B.Sc., A.M.I.M.E. (Author of "Motor Shipping," "Merchant Ship Types," etc.)

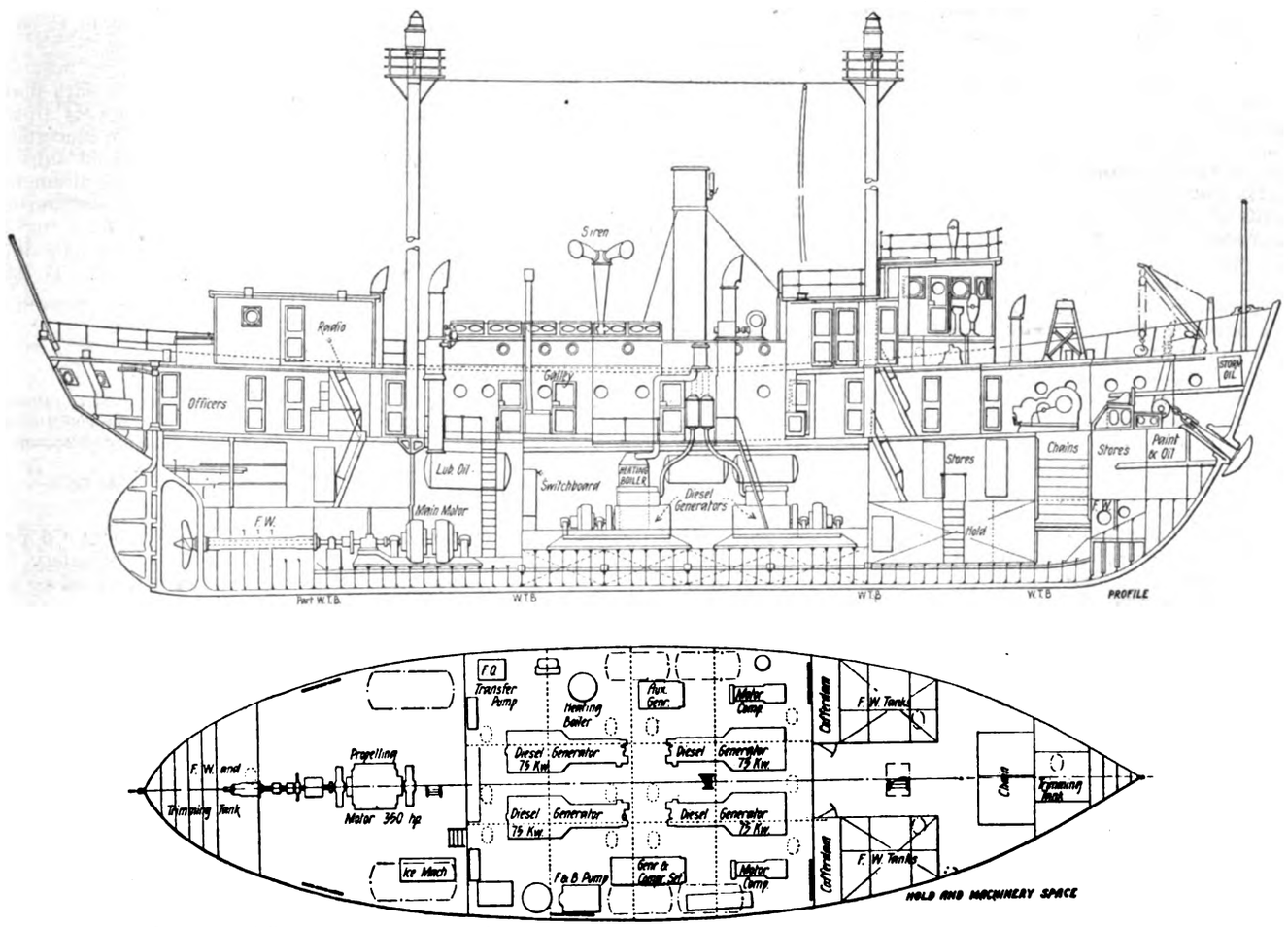
THE recent sinking of the Gull Lightship in a severe fog by an inward-bound liner, sailing from Calcutta, serves to recall that many of the lightships round our coasts are among the oldest ships now in commission. It serves, too, as a useful opportunity for the suggestion that the possibilities of marine electricity be taken into account by Trinity House when designing new ships of this type. We have a precedent, too, to plead in this case because it is just a year ago that the U.S. Bureau of Lighthouses ordered a batch of modern steel light vessels in which the whole of the power required for lighting and propulsion was obtained from electric generators driven by small Diesel engines. These ships were unique in that they were the first of their kind in the world.

The requirements of British lightships are somewhat different, but the root idea is the same and well worth consideration. Because, after all, whether or not a lightship is self-propelled she needs power for a number of important duties—duties to which propulsion is actually secondary. These include the provision of compressed air for operating fog syrens, power for pumping out the various compartments into which the ship is divided, and in certain modern vessels for the lanterns themselves. In American waters, it has always been thought good practice to fit lightships with self-propelling machinery, partly because the ships in many cases ride to their cables in very exposed positions and power enables them to take the strain a little on the cable in heavy weather and partly because, if they break adrift, they can take care of themselves without becoming a danger to navigation. Then, too, power within the hull enables lightships to proceed to and from their station without the aid of tugs.

There is much to be said in favour of this for British lightships, many of which are in positions almost as exposed as American lightships. Outside of British ships, the practice of fitting power to lightships is followed a good deal, but invariably with direct drive; which is a mistake, because obviously, the main propulsion machinery is idle for the greater part of the ship's active career. An electric motor, on the other hand, is a much smaller piece of machinery, always available when wanted, while the main prime movers driving generators to supply current for other important duties on the ship are practically in continuous use.

The thought is an interesting one to develop, and this may be done by a consideration of the power plant of the ship illustrated herewith. The ship has a waterline length of 108·75 ft., a moulded beam of 30 ft., a depth of 15 ft., and a displacement of 630 tons. Inside this small seaworthy hull is locked up quite a well-arranged power plant, as will be seen. In a power room amidships there are four generator sets. Each generator is direct-connected to a 112 B.H.P. four-cycle single-acting trunk piston Diesel engine turning at 450 r.p.m. The generators are of open direct current type, compound wound for auxiliary power and shunt wound for propulsion. Each generator develops 75 kW at 125 V and 450 r.p.m.; full power is not generated at speeds below 450 r.p.m. The engines driving the generators have governors which regulate their speed from no load to full load within 3 % of normal.

These generator sets provide power for the whole of the services on the ships, including two powerful electric lanterns on steel masts. There are also an electrically-driven fire, deck, and bilge pump, an electrically-driven fuel oil transfer pump, a high pressure air compressor for starting air for the main Diesels, two low pressure compressors for the fog signal, a powerful electric windlass, a boat hoist, and an electric refrigerating plant. For actual propulsion purposes there is—in a separate compartment at the aft end of the ship—a 350 H.P. double armature motor. It is of open, direct-current, shunt



The recent sinking of the Gull lightship suggests the possibilities of a more extensive use of electricity on ships of this class. Above is an example of a modern all-electric self-propelling lightship.

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wound type, separately excited from the 125 V excitation bus. It develops its power with both armatures in series, at 300 r.p.m.

It will thus be apparent that these lightships are small electric ships closely comparable in size with certain tugs—also of electric type. The comparison is interesting and may well be considered at a time like this when a British tug owner is currently reported to be considering the construction of a Diesel-electric tug in the near future. This would be the first of its kind in this country, although in America electric tugs have been in successful operation for some time. On the score of first cost, we must perhaps confess that the Diesel-electric tug would not be as attractive a proposition as a steam tug. It may be taken as a truism that any modern improvement costs more than the item over which it is an improvement. It is, however, on the operating cost that the saving is made. This statement is interesting and instructive to convert into figures. A certain 650 H.P. electric tug owned by a railway company costs, when new, £28 000. A steam vessel of the same power and performance costs £23 600, or £4 400 less. But the annual fuel cost for the steam tug amounted to £5 114 for the first year, and a comparison of the total annual operating costs, including interest and depreciation shows a saving of £4 200 in favour of the electric vessel. In other words, owing to the economy of operation, the extra cost is—with the exception of £200—paid off as a result of the first year's working.

These figures are important because they are a definite answer to the criticism that the Diesel-electric tug is expensive to build, and to operate. Operating bills naturally depend upon the type of prime mover selected to drive the generating sets and upon the class of operating crew selected. The point should here be made, however, that in a Diesel-electric ship of small type the duties of the operating crew are extremely light, being confined mainly to attending to the simple needs of the single-acting non-reversing, trunk piston type main engines. All manœuvring is done from the bridge, so that here again the man on duty in the engine room it not bothered with the continual jangling of signal bells from the pilot house. The pilot, or captain, on the other hand, is secure in the knowledge that his vessel will answer as swiftly as a tramcar or an electric train answers the control handle.

Tugs are not Ships.

As I have pointed out previously in these articles, tugs and ferry-boats cannot, and should not be considered as an ordinary ship powering problem. They are floating tramcars or shunting engines—whichever you will. The point should be again emphasised because it does not appear to be generally recognised. The electric motor at the end of a propeller is almost ideal for this purpose. It is actually better for towing work than a direct-coupled Diesel engine because the latter turns at a rate of revolutions which is rather high for certain types of towing work. Then, too, with a Diesel-electric vessel the engines can be of short stroke, high speed, lightweight type. Furthermore, they are non-reversing and hence all manœuvring air compressors and a great deal of piping and manœuvring air tank storage are eliminated. The electric arrangement makes for compactness.

As showing the difference in propeller dimensions with different types of propulsion for tugs, it may be mentioned that a direct drive motor tug had a propeller of 7 ft. 6 in. diameter and 5 ft. 9 in. pitch, while a corresponding steam tug had a propeller 9 ft. in diameter and 12 ft. 3 in. pitch. The corresponding electric tug had a propeller 9 ft. 6 in. in diameter and 9 ft. 4 in. pitch. The propeller of the direct drive motor tug is evidently designed for much faster running than either of the other two. The electric motor propeller operates at 125 r.p.m. The motor itself develops 575 S.H.P. A corresponding direct drive internal combustion engine turns at about 275 r.p.m. Comparison of different small electric ship particulars on a basis of length of ship shows some interesting ranges of sizes and outputs. They may be conveniently arranged in tabular form.

ELECTRICAL OUTPUT ON VARIOUS SMALL SHIPS.

Type of Ship.	Tug.	Light-ship.	Tug.	Tug.	Yacht.	Passenger ship.
Length of ship ..	105 ft.	108·7 ft.	108 ft.	97 ft.	210 ft.	345 ft.
Number of generator sets ..	2	4	2	2	4	4
Diesel power per unit ..	400	112	400	225	Various	Various
Generator output ..	235 kW	300 kW	270 kW	—	129 kW	337·5kW
Main motor power ..	575	350	650	370	—	—
R.p.m. (shaft) ..	125	300	120	120	—	—

It may be noted, as an instance of the way in which the speed of rotation in a marine electric motor can be absolutely fitted to the duties required of it, that the main propelling motor in the lightship develops its total (350) horse power at 300 r.p.m., while the tug which has 370 S.H.P. develops its power at 120 r.p.m. In the latter, the propeller is an important part of the whole, whereas in the former the propeller is merely fitted as a convenience in order to get the vessel to and from her station at just about sufficient speed to give her steerage way. Propelling requirements are definitely secondary to main propelling requirements in this case.

The first four ships are electrically propelled. The second two are modern electric ships, in which the whole of the auxiliary services, except the main propulsion services, are carried out by electricity. Comparison of the electrical output, therefore, is not without interest either as showing how powerful are the tugs or how completely catered for electrically are the yacht and the cross-channel passenger ship. Both of these two latter ships, it should be mentioned, have storage batteries fitted for various auxiliary duties. On the yacht, batteries are arranged to run lights, fans, and small plant with everything shut down when the ship is in port. Another interesting feature of the ship is the adoption, in connection with these (Edison) battery sets of what amounts to a train lighting set, because there is a 13 kW Crompton Parkinson generator driven by chain and clutch from the starboard shaft, which rotates normally at about 160 r.p.m.

Emergency Batteries.

On the big cross-channel vessel, an emergency battery set is arranged to operate the electric-hydraulic steering gear in the event of a complete breakdown of the normal sources of supply on the ship, in which electricity is used extensively for heating, lighting, cooking, and auxiliary machinery requirements both on deck and in the engine room. For comparatively small-sized ships the auxiliary generator equipment is a large one, there being three 160 kW generator sets, each driven by a six-cylinder airless injection four-cycle Diesel and one 7·5 kW emergency generator set on deck. In addition to the electric steering gear, deck winches, and windlass (controlled, incidentally, on the Ward-Leonard system), electrically operated watertight doors are fitted. There are also electric helm indicators, revolution indicators for the main engines, and even electrically operated syrens. Electric pyrometers measure the exhaust gas temperatures from the main engines, a telephone service is fitted throughout the ship, and connection can also be made with the land line systems ashore at each of the two terminal ports at which the ship touches.

The question of electricity on shipboard, then, we may see very clearly, is one which neither begins nor ends with main propulsion, although this is a field which is as yet largely unexplored as far as small craft, in this country, are concerned. It is abundantly clear, however, that a small-sized ship of modern type has to-day purely for her auxiliary requirements an electrical power station which in output is greater than that required for the electrical propulsion of an up-to-date tug or for the complete power requirements of a modern lightship. Ten years ago this would not have been the case. To-day electricity is literally 90% of the ship.

CORRESPONDENCE.

The Editor welcomes the free expression in these columns of genuine opinion on matters of public interest, although he disclaims responsibility alike for the opinions themselves and the manner of their expression.

"The Factor of Safety of Overhead Lines."

[TO THE EDITOR.]

SIR,—Under the above heading Mr. W. Fordham Cooper, in your issue of March 22nd, discussed factors of safety for the conductor material and touched on factors of safety for supports.

As regards the wood pole, it is unfortunate that its strength is referred to as the strength of its foundation. Haphazardly made foundations have no doubt been too common a practice for the ordinary wood pole, and there is much evidence that, as we reach out to the massive steel structure, precautions aim at over-strengthening the foundations. The *real* strength of a support is not the strength of the foundation, although the strength of the latter (by error or otherwise) too often places a limit on the actual available strength of the pole. There would seem to be little need for a tornado, blizzard, or the like, while we under-estimate the strength of foundations yet build the above-ground parts according to loading conditions and rules. And, seeing that the ordinary wood pole covers almost the same below-ground area (for equal depth) as a compound pole, there would seem to exist less reason for allowing a weakness of the former, while full strength is

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made, at much greater cost, for the latter (assuming that Mr. Cooper is really alluding to Mr. Woodhouse's paper read before a meeting of the I.E.E.). If we earnestly intend to test and obtain the real and available strength of anything (say, a single or compound wood-pole), why fail " to make the whole chain " strong enough to produce the just and truly available strength of the thing tested ?

With reference to steel for overhead lines, *three* different factors of safety have been adopted, namely, 2·0 for steel conductors, 2·5 for all-steel structures, and 3·5 for steel-reinforced concrete poles.

On this point the writer takes the opportunity of completing his recent suggestions (see THE ELECTRICIAN of February 8th, 1929, page 166) for factor of safety of reinforced-concrete poles. Why provide 3·5 when 2·5 is considered ample for unsupported steel ? In a well-designed reinforced-concrete pole the steel is braced for the bending moment, and the factor L for ratio L/R is made very short indeed. The steel and concrete are such that following rupture there is still a substantial factor of safety left. Certainly, of the two materials, concrete is the most inconsistent and may be of relatively little strength value for certain shell-type (hollow) poles, yet be of very great strength value for solid poles of the " I," rectangular, elliptical, square, and certain other shapes ; the three former shapes permitting of very great strength and offering low resistance to winds.

The writer suggests that the values already allowed as British Standards for steel and concrete be substituted for reinforced-concrete in the place of 3·5 ; that is to say : ·

Factor of safety for the steel	2·5
Factor of safety for the concrete.....	4·5

The former is strong in tension but weak in compression, and the latter is strong in compression but weak in tension. The two factors should be separated and a greater strength factor provided for the concrete, the strength of which is more variable than the strength of steel.

The strength of concrete for poles varies with the types and methods of making, and whether formed and cast *in the actual final positions in the line*, or, formed and cast far from the sites, method of handling, transport, haulage, erection, etc. The factor of safety of the pole may in many cases quite reasonably be increased by 2·0 to allow for weakness from handling, transport, haulage and erection. What we have long desired is a competitively cheap and sound reinforced-concrete pole, formed and cast right in the final position it is to take up in the line.

For such a pole the writer has succeeded in making a close study, the merits for which are summarised as follows :—

(1) A steel reinforcement and disposition for pole, fixtures and foundation, to most economically balance or level-up the pole strength on parallel faces, independent of the pole shape, and always with much greater strength in the direction of the greatest stress whether for transverse or longitudinal directional forces. This provides not only the most economical amount of steel exactly where it should go for highest strength requirements, but it also provides a levelling-up of the steel to afford maximum economy with maximum strength.

(2) The erection of the form (complete or in part) and the casting of the pole, frame or structure, or/and fixtures (arms and so forth) or/and foundation, *all* in the actual final positions on the line, and so done that no scaffolding nor superstructure is required for any of the operations. The ever present danger of fracture or weakness as well as the excessive costs by transport, haulage, handling, and erection, all have been cancelled out. These dangers and high costs cripple the more extensive use of reinforced-concrete poles from a competitive standpoint, and, by a cancelling out of the ever present danger of fracture or damage, a more favourable factor of safety is allowable. Apart from this, a solid and much stronger and reliable pole is possible at less cost, and, the concrete will attain a greater density and strength (particularly at those points where the greatest strength is most required) than the same pole cast horizontally ; it is puddled or/and tamped in the process of erection, and the concrete is pressed tight and weighted downward so that it hardens and possesses less moisture-content due to the heavy vertical concrete mass. The pole is further strengthened by casting its foundation directly against undisturbed natural ground without any filling-in or falling-in of earth because the foundation forms the first operation, and not the last as with practically all other methods.

(3) The arms for insulators are metallically bonded internally to the steel of the pole and the foundation. They are of a form permitting of the three chief requirements, namely : *total* freedom from bird troubles ; the *lowest* possible reduction in calculated height of load application (which allows of a relatively slight reduction in the factor of safety) for *highest* possible elevation of insulator-base above ground-level ; use of single, or double insulators in parallel (required for main roads and crossings) or in series, or both. The entire steel reinforcement (fixtures, pole and its foundation) is bonded and is well earthed, and sealed outlets are provided (as desired for plugging-in) for earthing any line-equipment without the necessity of exposed or encased wires running over any part of the pole.

The above explanations (1), (2) and (3) define this reinforced-concrete composite construction which merits a study by all intending to build, extend or re-model existing wood-pole lines.

As regards the conclusion (4) by Mr. Cooper : Compared with a line or lines, which usually are in some remote area or crossing private grounds, would Mr. Cooper consider the danger and loss conditions anywhere near equal to those from h.t. crosses with secondaries ? For all weather conditions and for every second in the year and all years would Mr. Cooper recommend that the millions of secondary connections to lamps and devices in houses and factories, etc., be exposed to the possibility of the same kinds of h.t. crosses ?

As regards the first question, it is obvious we cannot design lines to stand up to such conditions referred to by him ; as regards the second, we cannot with truth say it is impossible for such a thing to happen on any overhead network where h.t. and l.t. run on the same poles, or where h.t. lines cross service leads, or where transformations are used. In order to obviate or reduce the possibility of hazard to life, and, not have " the lay Press hold him responsible for manslaughter " what step should be taken ? Why are we not doing it ? It is necessary to forget entirely about comparing communication interference with life—there is no comparison. Must we leave it until someone dear to us is electrocuted and have it recorded that we who are paid to know and act were responsible ? Life comes first, and " *enough* " protection must be enough, or we, as engineers, fail in our task and duties.—I am, etc.,

WILLIAM T. TAYLOR.

London.
March 27th.

" Glass Insulators."

[TO THE EDITOR.]

SIR,—With reference to the letter on this subject in your issue of March 22nd, I have already had occasion to observe that the methods of reasoning followed by Mr. North are, to say the least of it, peculiar. I would not, however, have anticipated that Mr. North could have construed my statement regarding the deleterious effects of partial arcs, into an argument emphasising the value of a polished and glazed surface for insulators.

Without wishing to decry glass insulators, I am nevertheless compelled to point out that any damage done by the discharges referred to is almost entirely the results of intense local heating, which is notoriously more dangerous to glass than to porcelain. With apologies for extending this correspondence.—I am, etc.,

B. L. GOODLET.
High Voltage Laboratory, Research Department,
Metropolitan-Vickers Electrical Co., Ltd.

Trafford Park,
Manchester.
March 28th.

" Electrical Firms and the B.I.F."

[TO THE EDITOR.]

SIR,—While I agree with most of the suggestions put forward on your correspondence page last week, I think your correspondent is unduly " Hopeful " to expect such radical changes to be made in time for next year's Fair.

In any event, he has omitted the most important of all the desired changes—i.e., that of date, though possibly he is not so hopeful about obtaining this eminently desirable alteration as he is about the comparatively minor details which he enumerates.

For several years past electrical firms have pointed out the futility of expecting to attract many foreign buyers in February. These criticisms have usually been met with a promise to take a referendum of exhibitors, but I do not recollect having seen any detailed results of such a questionnaire. I therefore suggest that this date question should be settled once and for all by a ballot of the electrical firms concerned, and that the results should be published.—I am, etc.,

" DOUBTFUL."

Liverpool.
April 2nd.

[Other letters are unavoidably held over.—ED.]

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NEWS IN BRIEF.

Railways and Electric Lighting—Mr. Lloyd George and the P.M.G.—Fire at Paignton Electricity Works—Hull and Assisted Wiring.

THE fourteenth Guthrie lecture will be given before the Physical Society on April 19th by Prof. P. W. Bridgman, the title being "Elements under High Pressure."

The Mid-Gloucestershire Branch of the Electrical Association for Women held a meeting on March 22nd, when Mr. R. A. Parson gave a lecture entitled "Bells and Batteries."

The recent electrical exhibition at Preston was attended by 11 000 persons.

Electrical goods and apparatus will be shown at the Zagreb Trade Fair, Yugoslavia, which will be open from April 20th to 28th.

Battersea (London) Housing Committee recommends that the gas fires fixed by the Council in the bedrooms of the tenements on the Latchmere, Heathwall and Savona Street assisted housing estates should be replaced by electric radiators.

At last week's meeting of the directors of the Glasgow Chamber of Commerce, Major John Colville, Convener of the Advisory Committee on Telephones and Telegraphs, stated that there had been a satisfactory increase in the number of residential telephones in the Glasgow area, but an unusual falling off in business telephones.

At a recent meeting of the Lighting Committee of Brighton Corporation the Engineer submitted a drawing showing the control kiosk for the new semaphore signalling arrangements at the foot of New England Road. It is proposed to erect a lattice mast, in place of the heavy cast iron post which was embodied in the original design, on the grounds of lightness and strength, and to fit five lamps in all, one at the top of the post with four around and beneath it.

A meeting of the Institute of Fuel will be held at the Chemical Society on April 10th, when Major W. Gregson will give a lecture, entitled "Some Notes on Waste Heat Recovery." Mr. Frank Hodges will be in the chair.

The last of the evening lectures of the Electrical Association for Women, for this session, was given on March 19th by Mr. F. Bourne, his subject being "Some Electrical Facts Concerning Electric Motors." Miss Dorothy Vaughan was in the chair.

The Great Western Railway has decided to convert the existing gas service at 24 stations in the Newport and Cardiff division to electricity; the station at Gobowen and the locomotive shops and yard at Oswestry are to be similarly converted.

At the annual meeting of the West Lewisham (London) Chamber of Commerce, last week, Mr. E. J. Ward, assistant secretary, said he was co-operating with Sir Philip Dawson, M.P., with a view to securing a reduction in the price of electricity for power and light in parts of West Lewisham.

Speaking at Alderley Edge last week, the Postmaster-General denied Mr. Lloyd George's statements that the leeway in telephone development resulting from the war was not being made up, and that the growth of the telephone organisation had been retarded by any restriction by the Government on funds available for development. Last year plant was provided on the basis of an increase of 140 000 subscribers, whereas the net increase, although a record, did not exceed 125 000.

Torquay Corporation invites applications for the position of borough electrical engineer.

On March 22nd a rotary converter, valued at £1 000, at the Paignton electricity works, was destroyed by fire.

For the convenience of visitors, a through telephone circuit between London and the Paris Plage was provided during the Easter holidays.

Wimbledon Electricity Committee has accepted a tender amounting to £405 18s. for the erection of a sub-station in Franks Avenue.

At a recent meeting of the Association of Mining Electrical Engineers, at Cardiff, Mr. C. L. James, a student member, read a paper on "Power Factor: Its Cause and Effect."

Chorley Gas Committee has approved an estimate submitted by the Gas Engineer for the supply and erection of a 30 cwt. electric crane, operated on a maximum radius of 35 ft., with derricking, slewing and travelling gear, complete with automatic skip, etc.

In connection with the advertising of the forthcoming electrical exhibition, Brighton Lighting Committee has decided to ask the principal of the School of Art to have competitive designs prepared by his pupils, and that prizes of £10, £5 and £3 be offered for the best designs.

Tynemouth Electricity Committee has received from the Electrical Engineer a report with regard to the urgent need for a demonstration house in connection with the electricity department. The matter has been referred to the Chairman, the Deputy Chairman, and the Electrical Engineer for consideration and report.

During the last three months 609 applications for assisted wiring have been secured by Hull Electricity Committee. The number of agreements which have been completed total 259.

Glasgow Electricity Committee has authorised the Manager of the electricity department to purchase 50 electric washing machines to be supplied to consumers on the hire-purchase systems.

Beckenham U.D.C. has decided to erect offices and showrooms for the electricity department on the Rectory site, with frontage to High Street. The designs of Messrs. Lanchester, Lucas and Lodge have been referred to the Electricity Committee.

At a recent joint meeting of the Association of Mining Electrical Engineers with the Institution of Electrical Engineers (East Midland sub-centre), the Nottingham Society of Engineers, and the Newark Engineering Society, at Nottingham, Mr. A. H. Law and Mr. J. P. Chittenden, of the English Electric Co., read a paper on "Some Unusual Power Plants."

A one-day conference of the Electrical Association for Women will take place on April 16th at the Hotel Cecil, London, where, on the same day, a luncheon and a ball organised by the Association will be held, and a cabaret show will also be given during the evening. In the afternoon a party will visit the works of Belling and Co. The charge for tickets for the luncheon (exclusive of wines) is 6s., tickets for the ball (including supper and cabaret) 21s., and combined tickets for the luncheon and ball, 25s. Tickets can be obtained from Mr. Bernard C. Holding, editor of THE ELECTRICIAN, or from the Director of the Association.

LOOKING BACKWARD.

FIFTY years ago, according to THE ELECTRICIAN *of April 5th, 1879:—*

German railways were experimenting with the use of the telephone on their lines.

There was jubilation at the feat of disposing, within one hour, of 215 telegraphic messages averaging 30 words each on a single wire between London and Birmingham, by quadruplex. The achievement was "unprecedented in the history of telegraphy."

Reporting on the lighting plant used to expedite construction of the Severn Bridge, Mr. W. Brain stated that two dynamo machines were used. One, of Siemens' small size, running at 1 050 to 1 100 r.p.m. was working remarkably well, keeping perfectly cool, and showing scarcely any fire on the brushes of the commutators. The other, a Gramme A size, made by the India Rubber and Gutta Percha Co., was giving equally good results. Both were driven by a small portable engine of 8 H.P. fitted with a very sensitive governor. Two lamps were lighted by this apparatus, one a Serrin and the other a Siemens.

* * *

TWENTY-FIVE years ago THE ELECTRICIAN *of April 8th, 1904, reported that:—*

Lord Kelvin was elected Chancellor of the University of Glasgow.

Heston and Isleworth Council, announcing the inauguration of its public supply, offered consumers a free supply for the first month. A free-wiring scheme was also offered.

Mr. J. S. Forbes, president of the National Telephone Co., and a former chairman of the Edison and Swan United Electric Light Co., died at the age of 81 years. He was prominently associated with the development of electricity on railways, and was chairman of the Metropolitan District Railway Co.

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BUSINESS ITEMS.

EINSTEIN'S Electro-Chemical Process, Ltd. have taken premises for a factory on the Trading Estate, at Slough.

The ELECTRIC HEATING CO., of George Street, Croydon, has secured a large contract for the supply of soldering irons for the Admiralty.

As from to-morrow (Saturday) the address of the GREENWICH CABLE WORKS, LTD., is Mitcham Road, Croydon. 'Phone: Thornton Heath 2882.

Mr. S. DICKINSON, electrical contractor, 70, Newton Street, Manchester, has taken over additional premises at 104, Oldham Road, Manchester. All correspondence should be sent to the latter address.

In connection with the series of village exhibitions which the WESTERN ELECTRICITY SUPPLY CO., LTD., is holding in their West Wilts Area, exhibitions have recently been held at Holt and Lacock.

The BRITISH THOMSON-HOUSTON CO., LTD., Rugby, has received an order from the Metropolitan Electric Tramways Co., Ltd., for 140 type 509 lightweight traction motors. With this repeat order the total number of B.T.H. motors of this type ordered by the Metropolitan Tramway Co. is 354.

The HART ACCUMULATOR CO., LTD., Marshgate Lane, Stratford, London, E.15, announces that "Hart" batteries were used in connection with the recent official demonstrations of the Baird television system which were attended by the Postmaster-General and officials of the British Broadcasting Corporation.

The new turbo-electric P. & O. Liner, the "Viceroy of India," which sailed on March 28th on her maiden voyage to Bombay, is, in addition to carrying main and auxiliary machinery constructed and erected by the BRITISH THOMSON-HOUSTON CO., LTD., fitted throughout with "Mazda" lamps. The sizes of these range from 40 to 300 W.

The EDISON SWAN ELECTRIC CO., LTD., 123, Queen Victoria Street, London, E.C.4, has been advised by Anley and Co., of Fulham, London, that when the collision between a fire engine and omnibus occurred on March 13th, an electric pendant in the shop was shattered but the lamp which had been in use over two years, is still doing useful work.

The SHROPSHIRE, WORCESTERSHIRE AND STAFFORDSHIRE ELECTRIC POWER CO. has this year already held demonstration exhibitions at Bewdley, Bridgnorth, Ledbury, Winchcombe, Ludlow, Broadway, and we are advised that the next is arranged to take place in the Town Hall, Oldbury, from April 16th-20th. These exhibitions are supported by electrical installation contractors of the particular district and who are members of the Area Circle.

In connection with the claims for Brush-Ljungström turbo-alternators, the BRUSH ELECTRICAL ENGINEERING CO., LTD., has received through Coulston and Co. Pty., Ltd., of Melbourne, from Mr. P. J. Pringle, the chief engineer and general manager of the Electric Supply Co. of Victoria, Ltd., at Ballarat, a letter to the effect that the 1 500 kW Brush-Ljungström turbo-alternators supplied over four years ago have not, beyond opening up one of them two or three months after it was started up, been examined internally since their erection. Steam consumption figures are still from ½% to 1% better than the original guarantees.

The Birmingham Area, which has been served hitherto entirely by manual exchanges, is now to have automatic telephones. Orders for three automatic exchanges (Northern, Victoria, and Harborne) and also for a tandem exchange, have been placed with the GENERAL ELECTRIC CO., LTD. The initial equipment to be provided on the automatic exchanges is for a total of 9 700 lines, the ultimate capacity being 20 200. The tandem exchange will provide for routing all junction traffic in the area, and will be equipped with keysender positions for use during the change-over. It is anticipated that the exchanges will be brought into operation during 1931.

A replica of the central electric lighting electrolier at the Drury Lane theatre, London, has been ordered by a Chinese Towkay of Kuala Lumpur for installation in his official residence in the East. This fitting, fashioned on classic Empire lines, has a main band 6 ft. in diameter with eight three-light arm clusters, supporting flambeau shades accommodating 60 W gasfilled lamps. The metal work is of cast bronze, polished, and tones down to a dark colour, and it weighs over a ton. The bent glass panels and lower bowl are in satin finish with clear-cut relief. Sixteen inverted reflectors, each designed to house 500 W lamps, are also arranged inside the fitting, and these are supplemented by four 500 W and five 60 W lamps without reflectors. In addition, a number of other electric lighting fittings have been ordered, for which an initial contract exceeding £2 000 in value has been placed with the Kuala Lumpur Branch of the GENERAL ELECTRIC CO., LTD. The whole of the fittings referred to will be manufactured in the Birmingham works of the company.

The electrical effects for the Mayor's reception and ball at the Leyton Town Hall last month were carried out by the Corporation Electricity Department under the supervision of Mr. Wetherell, borough electrical engineer. The awning at the entrance to the Town Hall was picked out with multi-coloured strip lighting, the entrance and main staircase were provided with suitable shades and modern floodlighting. The main hall had streamers of fairy lights intermingled with autumn leaves run in festoons, the general lighting being carried out in colour-sprayed amber lamps. Spot lights were introduced with coloured screens giving changing colours and floodlights for general effect, while in addition special apparatus was provided which gave various effects, such as snow, fire, clouds, waves, moon, etc. In the centre of the hall a large electrically-driven mirror bowl was suspended and while a concert was being given various coloured flood and spot lights were provided. Much of the apparatus employed in this scheme such as the spotlights, orchestra lights, coloured strips and reflector lighting, as well as the Osram amber colour sprayed lamps and the exterior floodlights were supplied by the GENERAL ELECTRIC CO., LTD.

PERSONAL.

MR. A. Beith, chief electrician at Buckingham Palace, Windsor Castle, etc., has retired after forty-three years' service under the Office of Works.

We are pleased to learn that Mr. Victor Dale, who is now recuperating on the South Coast after a long and serious illness, will probably return to his duties with the E.D.A. in the early part of next week.

Mr. J. A. Forde, engineer and manager of the Isle of Thanet Electric Tramways and Lighting Co., Ltd., has been re-elected a member of the Broadstairs Urban Council, of which body he is the present chairman.

The Department of Overseas Trade has decided to establish a Trade Commissioner (Grade I) in the Irish Free State with headquarters at Dublin, and to appoint Mr. W. Peters to the new post.

The Ministry of Transport announces that Col. Sir John W. Pringle, chief inspecting officer of railways, will retire on May 23rd under the age limit, and that the Minister of Transport has appointed Lt.-Col. A. H. L. Mount, who has been employed as an inspecting officer of railways for the past nine years, to succeed him.

Sir James Devonshire, having reached the retiring age, has resigned the position of chairman and managing director of the North Metropolitan Electric Power Supply Company but retains his seat on the board. Lord Ashfield has been appointed chairman of the company and Sir James Devonshire deputy chairman.

From a list of 56 applicants for the post of tramways manager, Aberdeen Tramways Committee has drawn up a short list comprising Mr. John A. Baker, general manager, South Shields; Mr. G. A. Carr, assistant traffic superintendent, Newcastle; Mr. William M. Clark, engineer and manager, Nottingham; Mr. James L. Gunn, manager, Greenock and Port Glasgow Tramways Company; Mr. R. B. Herbert, operating superintendent, United Automobile Services, York; Mr. Hodgson H. Lancaster, traffic manager, Blackpool; Mr. Alfred Smith, chief clerk and accountant, Aberdeen; Mr. Charles Symon, outside assistant in charge of traffic department, Aberdeen. The salary is £750, rising to £900 by annual increments of £50.

Obituary.

MR. JOHN WILFRED LEWSLEY, on March 22nd, aged 50 years.

MR. CHARLES EDWIN BENHAM, on Monday, aged 68 years. He was the author of a book on Dr. Wm. Gilberd (or Gilbert), an electrical pioneer.

MR. THOMAS HENRY PLOWRIGHT, as the result of an accident through being knocked down by a runaway horse, aged 58 years. He had for 27 years been on the staff of the Windsor Electrical Installation Co. and was chief assistant engineer to Mr. A. E. Farrow, until the recent change of management.

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IN PARLIAMENT.

Further Consideration of the London Traffic Bills of the "Underground" and L.C.C.

SIR John Gatti, L.C.C., in cross-examination, before the House of Commons Committee which is considering the London Traffic Bills of the Underground Group and London County Council, said the rights of Middlesex County Council in regard to their tramway system (at present leased to Metropolitan Electric Tramways, Ltd.) under the L.C.C. Bill were preserved just as they were before. The L.C.C. had just authorised the construction of 300 new tramcars. Their 1928-29 deficit of £43 000 would, in 1929-30, be turned into a surplus of over £40 000. He agreed with Lord Ashfield that if money was going to be raised on the strength of the common fund it must be a permanent institution, with any variations that might be necessary. The minimum period in which he contemplated that the agreements should be terminable was about forty years. He agreed that the proposed tramway board would not have absolute control of the tramways. Any dispute between the parties would be submitted to arbitration. The L.C.C. would, of course, be represented on the tramways board if it were set up.

The Chairman (Sir Henry Cautley) referring to the report of the Minister of Transport on the Bills, asked Mr. R. E. Hill, assistant secretary in the Financial and Statistical Department of the Ministry, what had influenced the Minister when he suggested that the subject of the reasonable return on ranking capital should be considered by a public inquiry if he thought fit.

Mr. Hill said he thought that it was generally recognised that this was a duty which the Bill would impose upon the Minister, and that it would involve matters of very considerable public importance. The reasonable return which was settled would have to be a factor in determining what the level of fares to be paid by the travelling public should be, and it would also be a factor in establishing the balance which would be available to the common fund for improving services, reducing fares, or for the other purposes set out in the Bill. Therefore his decision in this matter was going to react through the operation of the scheme. In view of that far-reaching effect, the Minister felt that it might be desirable that the views of the various public authorities who would have powers under the Bill to make representation to the Minister about fares and about services should also have the opportunity of expressing their views at a public inquiry on the question of the return on the ranking capital.

West Highland Water Power Bill.

The proceedings of the House of Lords Committee on the West Highland Water Power Bill were concluded on March 26th. Mr. F. J. Wrottesley, K.C., for the Investment and Estates Control, said the promoters were to deliver their electricity, after a journey of 120 miles, right on top of one of Scotland's coalfields in the Falmouth and Stirling districts, where cheap electricity could be produced.

Mr. Carmont, K.C. for certain landowners, described various Scottish estates which, he said, would be ruined by the scheme.

Mr. Graham Robertson, for the promoters, admitted that they had no definite market for the current, but said it was necessary to have the Bill passed before the Central Electricity Board would make a contract.

The Committee found the preamble of the Bill not proved.

Pacific Cable Board Bill.

This Bill, promoted by the Pacific Cable Board to protect the pension rights of the staff, was passed for second reading in the House of Commons on March 25th. Mr. A. M. Samuel, Financial Secretary to the Treasury, said the terms had been settled by the Communications Company. The partner Governments were parties to them, and until the Government received their reply it was not in his power to state those terms.

Railway Companies and Road Traffic.

In the House of Commons on March 26th, the Great Western Railway, London and North Eastern Railway, London, Midland and Scottish Railway, and Southern Railway Bills were read the third time.

Derbyshire and Nottinghamshire Bill.

On March 26th the Derbyshire and Nottinghamshire Electric Power Co.'s Bill was passed by the Unopposed Bills Committee of the House of Lords. Under this Bill the company is empowered to raise £400 000 additional capital and its borrowing powers are increased to £1 014 000.

LEGAL INTELLIGENCE.

Dispute Concerning Clutches for Electric Motors at Cold Roll Mills.

MR. Justice Talbot, in the King's Bench Division, on March 27th, concluded the hearing of a case which concerned the merits of certain friction clutches which were used in connection with electrically driven machinery at cold roll mills and other works in South Wales and other places.

The plaintiffs in the action were the Cooper Roller Bearings Co., Ltd., of King's Lynn, Norfolk, who sued the Power Plant Co., Ltd., of West Drayton, Middlesex, for £833 in respect of the price of goods sold and delivered and for work and labour done. The question in dispute was whether certain friction clutches supplied by the plaintiffs for use in connection with the machinery at rolling and other mills were in accordance with contract or not. Plaintiffs supplied the clutches at the order of the defendants and installed them, and they said they afterwards maintained the plant at the request of the defendants. It was for this maintenance work that they made their claim of £833.

The contention of the defendants was that the clutches supplied by the plaintiffs were unsuitable for the purpose for which they were required and that plaintiffs had committed breaches of contract and warranty. The defendants alleged that they had been put to considerable expense in consequence of the plaintiffs' breaches, and they counter-claimed £1 500 odd as damage for the expenses to which they had been put.

The main allegation of the defendants was that though they gave the plaintiffs all the information necessary, and for which they asked, so as to enable them to design and supply clutches which would be suitable for the duty they would be required to perform, the clutches actually supplied were in fact too small, and as a result a good deal of trouble was caused when the mills at which they were installed were being started up. The clutches overheated and the plates cracked and broke, and in many cases it was found very difficult to start up at all. The whole fault for this was, the defendants said, that of the plaintiffs, who designed inefficient clutches.

The reply of the plaintiffs was that, while admitting there had been a good deal of trouble at some works, it was entirely due to the lack of adequate electric power supply. The result of this was, it was said, that when attempts were made to start up, especially on Monday mornings, the clutches could not get the mills away without them being slipped for an abnormal length of time. This long period of slipping generated the heat which caused the plates to fail.

A considerable body of evidence was called on either side, and several electrical engineers dealt with the power question. Plaintiffs' witnesses concluded that there was a lack of power, and defendants' witnesses were equally confident that the power supply was ample.

At the conclusion of the case Mr. Justice Talbot reserved judgment.

Welding Patents.

The Court of Appeal, consisting of the Master of the Rolls and Lords Justices Lawrence and Russell, on March 12th, allowed the appeal of the India Rubber Gutta Percha Telegraph Works Co., Ltd., from the judgment of Mr. Justice Eve, in the Chancery Division (see THE ELECTRICIAN of August 10th, 1928), holding that they had infringed the letters patent of the plaintiff, the Rose Street Foundry and Engineering Co., Ltd., of Inverness, for a welding machine.

Lamp Patents Infringement.

An action by the British Thomson-Houston Co., Ltd., against Uneedus Electrical Service was before Mr. Justive Eve in the Chancery Division on March 8, on a motion by the plaintiffs for an injunction to restrain infringement of the plaintiffs' letters patent. Counsel said the defendants were W. R. Bradley and his son, who were partners in the business.

His lordship made the order and said defendant must pay the costs.

The G.E.C. 2nd XI association football team beat Oxford Circus in the third round of the West End Business Houses Junior Challenge Cup. Each of the first three G.E.C. teams are now semi-finalists in challenge cup competitions. Two netball teams have lost to Venesta and Mayfair respectively. G.E.C. succumbed to Park at badminton, but defeated Guaranty Trust. They, however, lost to L.N.E.R. at table tennis. The rowing teams indulging in good pulls to beyond Mortlake and back are fast getting into form.

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LAMP PRICES.

Further Price Reductions of Gasfilled and Vacuum Type Standard Lamps.

THE Electric Lamp Manufacturers' Association has announced that prices of certain vacuum and gasfilled lamps have been reduced, including the following makes :— " Bell," " Cossor," " Cosmos," " Cryselco," " Royal Ediswan," " Elasta," " F," " Mazda," " Neron," " Orion," " Osram," " Philips," " Siemens," " Stearn," " Stella," " Tungsram," and " Z."

The new prices came into force on Tuesday, and details of the lamps affected are given below :—

Type.	Watts.	Volts. 100 105 110 115 120 125 130 Old Price.	New Price.	Volts. 200 210 220 230 250 260 Old Price.	New Price.	Volts. 230 Old Price.	New Price.
Vacuum :							
Pearl	15	—	—	2/2	2/–	2/2	1/11
,, ...	25	—	—	2/2	2/–	2/2	1/11
Sprayed ..	15	—	—	2/5	2/3	—	—
,, ..	25	—	—	2/5	2/3	—	—
Gasfilled :							
Pearl	25	2/1	2/–	—	—	—	—
,, ...	40	2/1	2/–	2/3	2/–	2/3	1/11
,, ...	60	2/3	2/–	2/3	2/–	2/3	1/11
,, ...	100	4/3	3/6	4/3	3/6	4/3	3/5
Gasfilled :							
Sprayed ..	40	—	—	2/5	2/3	2/5	2/3
,, ..	60	2/5	2/3	2/5	2/3	2/5	2/3
,, ..	100	4/8	4/–	4/8	4/–	4/8	4/–
Gasfilled :							
Clear	100	4/3	4 –	4/3	4/–	4/3	4/–
Gasfilled :							
Opal	40	—	—	2/6	2/4½	2/6	2/3½
,, ...	60	2/6	2/4½	2/6	2/4½	2/6	2/3½
,, ...	100	4/10	4/3	4/10	4/3	4/10	4/2
Special Service Lamps.							
Vacuum :							
Plain Candle ..	20	—	—	3/8	3/–	3/8	3/–
,,	40	—	—	4/3	3/6	4/3	3/6
Vacuum :							
Twisted Candle	20	—	—	4/2	3/6	4/2	3/6
,,	40	—	—	4/9	4/–	4/9	4/–
Vacuum :							
Tubular Single Cap	20	—	—	3/8	3/–	3/8	3/–
Vacuum :							
Tubular Double Cap	30	4/9	4/6	5/3	4/6	5/3	4/6

These reductions constitute the sixth downward price movement in lamps since the close of the war.

MID-EAST ENGLAND ELECTRICITY.

Commissioners' Scheme Adopted by Central Electricity Board Without Serious Alteration.

THE Mid-East England Electricity Scheme, as submitted by the Electricity Commissioners to the Central Electricity Board, was given in detail in THE ELECTRICIAN of January 25th last. The scheme has now, with few amendments, been adopted by the Central Electricity Board.

The scheme, as originally submitted, allowed for eighteen stations to be chosen from the forty now existing to be " selected " stations, and in this connection, a total of sixteen such stations has been decided upon. The stations omitted from the approved list are Chesterfield (Chesterfield Corporation), and Keighley (Keighley Corporation), both of which stations appear under " Temporary Arrangements." The routes to be followed by the principal main and secondary main transmission lines are much the same as suggested by the Commissioners, while the area covered by the scheme is also the same.

The number of transforming stations for both principal and secondary lines remains the same, with the omission of Barton-on-Humber as a secondary line station.

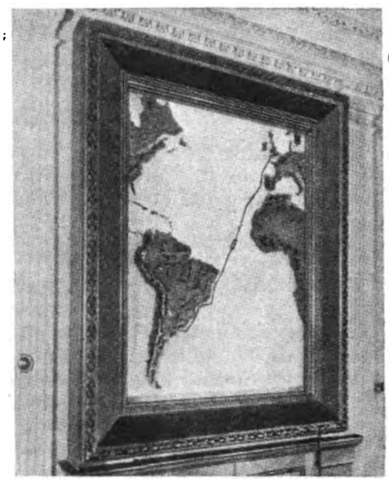
The additions and alterations to existing stations are not dealt with in the scheme as published by the Central Board, but the suggestions, as made by the Commissioners, were given in our issue of January 25th.

The cost of the scheme is estimated to be £4 616 750, of which £2 907 156 will be spent by the Central Board, on transmission lines and transforming stations, and £1 709 594 by owners of selected stations. The capital expenditure required to develop the area to the same extent by individual undertakings was stated by the Commissioners to be £5 406 584. The scheme allows for those cases in the area where non-standard frequencies are used, and since the alteration of these systems was not essential to the operation of the main scheme, such frequencies are permitted.

ELECTRIC CLOCKS.

Special Impulse Transmitters for Marine Use —An Interesting Progress Indicator.

A COMPREHENSIVE range of electric impulse clocks for marine use has been developed by GENT AND CO., LTD., of Faraday Works, Leicester. These clocks, known under the trade name of "Pul-syn-etic," differ from those designed for land use, in that the transmitter is operated by a balance wheel, instead of a pendulum, while a larger current than the 0·22 A usually employed is sent round the ship's clock circuit. The clock fittings are made more robust, when, as is generally the case, the system is driven by the ship's electricity supply mains—in such cases the current is standardised at 0·38A. The transmitter is generally fitted with an arrangement consisting of an operating key-lever and a dial, engraved with minutes, by which all the ship's clocks can be automatically advanced or retarded as the ship sails east or west into a different meridian. The transmitting apparatus consists of a half-minute impulse mechanism, together with automatic advance and retard apparatus all mounted within a cabinet, and provided with 9 in. " pilot " dial to show the time indicated by the ship's impulse clocks. The half minute impulse mechanism is mounted on a cast iron base, upon which is also assembled a jewelled lever escapement with chronometer balance. For advancing the clocks when sailing eastward, the automatic self-controlling contact is employed. This contact is controlled by a fly-action which allows it to " make " approximately once per second instead of the more normal half minute.



The apparatus, by Gent and Co., which indicates the progress made of a ship at sea.

To advance the ship's time, say, 35 minutes, the pointer on the setting dial is turned to figure 35. The " advance " lever is then depressed, and 70 contacts are automatically made by the transmitter, one for each half minute, and the pilot dial and the impulse clocks are thus set to the required time. To retard the clocks, it is necessary to set the pointer to the desired number of minutes and press the " retard lever," and the impulse clocks remain " held " until the desired number of minutes have elapsed, when the pilot dial and the electric impulse clocks throughout the ship automatically re-start.

The " retard " mechanism brings in a resistance, when operated, equal to that of the impulse clock circuit of the vessel.

Gent and Co. also manufacture an automatic ship's progress and position indicator, which, made in the form of a large coloured relief map in ornamental frame, is generally fixed in the main entrance to the 1st class saloon. The map covers the recognised route that the vessel is in the habit of taking, and, in the illustration above, both hemispheres are covered by a ship sailing from England to Buenos Aires, touching at various ports of call. A model ship, representing the liner, is moved along the route by concealed electric clockwork operated by the time system of the ship, and the rate of travel of the model is arranged proportionate to the actual speed of the vessel, so that its position on the ocean may be seen by the passengers at any time, and the vessel's progress noted day by day. Lighting effects, in the form of rising and falling coloured lights, are provided to illuminate and to give " life " to the relief map. The lights simulate sun-rise and sun-set effect on the model and across the hills, and cast shadows in the valleys. By means of a switch moved at the commencement of the return journey, the model automatically reverses and indicates the return journey.

Obviously the progress indicator is only suitable for liners passing over a special route.

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BUSINESS OPENINGS.

Latest Particulars of Electrical Engineering and Wiring Installation Contracts for which Tenders are being Invited at Home and Abroad.

WE give below the latest particulars of contracts for which tenders are invited. The closing date is given, when available.

WEST MIDLANDS JOINT ELECTRICITY AUTHORITY, April 5th.—Supply and erection of three single-phase, 4 000 kVA transformers, to form a 12 000 kVA three-phase bank, at the Authority's West Bromwich generating station. Specification, etc., from Mr. E. F. Hetherington, chief engineer and manager, Phœnix Buildings, Dudley Road, Wolverhampton; deposit £2 2s.

BIRMINGHAM CORPORATION, April 6th.—Manufacture and supply of 1 000 tons of tramway rails, with fishplates. Specifications, etc., from Mr. A. C. Baker, Council House, Birmingham.

33 000 V Switchgear.

MANCHESTER CORPORATION, April 8th.—Supply and erection of two 33 000 V metal clad switch units. Specification (No. 234) from Mr. H. C. Lamb, Electricity Department, Town Hall, Manchester; deposit, £1 1s.

WESTHOUGHTON URBAN DISTRICT COUNCIL, April 8th.—One year's supply of stores, including metallic filament lamps, etc. Forms of tender, etc., from the Surveyor.

GREAT WESTERN RAILWAY, April 9th.—Supply of electrical wires and cables (list 20), telegraph ironwork (list 21), and wire-iron and steel for telegraph work, etc. (list 28). Forms of tender can be obtained from the Stores Superintendent, Swindon.

ALDERLEY EDGE AND WILMSLOW ELECTRICITY BOARD, April 10th.—(1) Two transformer kiosks and switchgear (specification A.W.1); (2) e.h.t. and l.t. cables (A.W.2); (3) swtichgear and transformers (A.W.3). Specifications, etc., from Mr. A. J. Robertson, 20, Brazennose Street, Manchester; deposit £2 2s. for each.

DUNDEE CORPORATION, April 10th.—Supply of d.c. and a.c. house service meters and 30 000 pairs of 8 mm. by 15 in. arc lamp carbons for use in Angold magazine flame arc lamps. Specification, etc., from the General Manager and Engineer, Electricity Supply Department, Dudhope Crescent Road, Dundee.

HULL CORPORATION, April 10th.—Electric light and bell installation, at Maternity Home and Infants' Hospital, Hedon Road, Hull. Plans, etc., from the City Architect, Guildhall, Hull; deposit £2 2s.

MIDDLESBROUGH CORPORATION, April 10th.—Twelve months' supply of cables and meters. Specifications, etc., from Mr. R. H. Scotson, borough electrical engineer, Snowdon Road, Middlesbrough.

STOKE-ON-TRENT CORPORATION, April 10th.—Supply and erection of e.h.t. and l.t. overhead transmission lines. Specification, etc., from the City Electrical Engineer, St. George's Chambers, Kingsway, Stoke-on-Trent; deposit £2.

STOKE-ON-TRENT CORPORATION, April 12th.—Supply and erection of 22/24 H.P. heavy oil engine at Stallington Hall, near Stoke-on-Trent (contract 2 915). Specification, etc., from the City Electrical Engineer, St. George's Chambers, Kingsway, Stoke-on-Trent; deposit £2.

PRESTWICH URBAN DISTRICT COUNCIL, April 13th.—Supply of electric lamps, etc. Form of tender from the Surveyor, Town Hall, Prestwich, Lancs.

BATLEY CORPORATION, April 15th.—Supply of l.t. cable. Forms of tender from the Borough Electrical Engineer, Electricity Works, Batley.

BRIDPORT CORPORATION, April 15th.—Complete installation of three-phase cables, h. and l.t. underground and overhead sub-stations, street lighting and services. Specification, etc., from the Town Clerk; deposit £2 2s.

SUDBURY CORPORATION, April 15th.—Supply of electric fittings, etc., for one year. Forms of tender from the Borough Surveyor, Town Hall, Sudbury, Suffolk.

CENTRAL ELECTRICITY BOARD, April 15th.—Supply and erection of 33 000 V overhead transmission lines, in connection with the North-West England and North Wales Electricity Scheme. Specification (No. N.W.E.-S.L.2) from Mr. R. H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

BIRKENHEAD CORPORATION, April 16th.—Twelve months' supply of stores to the electricity generating station, including house service and mains boxes, insulating tapes, electrical engineering sundries, etc. Specification, etc., from Mr. F. E. Spencer, borough electrical engineer, Craven Street, Birkenhead.

DUMFRIES CORPORATION, April 17th.—Supply and erection of one water cooling tower, for the Electricity Department. Specification, etc., from Mr. W. S. Johnston, engineer and manager, Electricity works, Leafield Road, Dumfries; deposit, £1 1s.

LEEDS GUARDIANS, April 17th.—Supply and erection of steam driven generating sets, boiler feed pumps, etc.; and supply and erection of switchboard and mains, at the Institution, Rothwell, near Leeds. Specifications, etc., from Mr. E. Griffiths, 44d, The Temple, Dale Street, Liverpool, until April 9th.

WEST RIDING EDUCATION COMMITTEE, April 17th.—Electric light installation at Edlinton New Middle and Elementary Schools and caretaker's house. Specifications, etc., until April 10th, from the Education Officer, County Hall, Wakefield.

BIRMINGHAM GUARDIANS, April 18th.—Installation of call lighting system, at Dudley Road Hospital, Birmingham. Conditions, etc., may be seen at the Union Offices, Edmund Street, Birmingham.

CENTRAL ELECTRICITY BOARD, April 22nd.—Supply and erection of 33 000 V and lower voltage transformers. Specification (No. N.W.E.-S.T.2) and form of tender from Mr. R. H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

DUNDEE CORPORATION, April 24th.—One year's supply of stores to transport department, including armature and field coils, carbon brushes, etc. Specifications from Mr. D. P. Morrison, Transport Office, Dundee.

DUNDEE HARBOUR TRUSTEES, April 27th.—Supply and erection of two 3-ton electric travelling jibs, portal cranes at King George V. Wharf, Dundee Harbour. Specifications, etc., from the General Manager and Engineer, Harbour Chambers, Dundee.

CENTRAL ELECTRICITY BOARD, April 29th.—Supply and erection of electricity meters, in connection with the Central) Scotland Electricity Scheme. Specification (No. C.S.-S.S. 141 and form of tender from Mr. R. H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

SOUTHAMPTON CORPORATION, April 30th.—(1) Steel-framed building, platform for fans, overhead bunkers, etc.; (2) two water-tube boilers with superheaters, economisers, stokers, fans, soot blowers, etc.; (3) steam, feed water and other piping etc.; and (4) water softener, at Electricity Works, Western Esplanade, Southampton. Specification, etc., from Mr. W. G. Turner, borough electrical engineer; deposit, £2 2s.

WEST MIDLANDS JOINT ELECTRICITY AUTHORITY, May 10th.—(a) Main 33 000 V switchgear, each circuit-breaker having rupturing capacity of not less than 1 500 000 kVA; (b) auxiliary 33 000 V switchgear, each circuit breaker having rupturing capacity of not less than 500 000 kVA, with group feeder reactors, for Ironbridge power station. Specification (No. 4) and form of tender from Mr. E. F. Hetherington, chief engineer and manager, Phœnix Buildings, Dudley Road, Wolverhampton; deposit, £2 2s.

WEST MIDLANDS JOINT ELECTRICITY AUTHORITY, May 10th.—(1) One 50 000 kW turbo-alternator, with step-up transformers, etc.; (2) condensing plant, boiler-feed pumps, evaporators, etc.; (3) circulating water pumps, etc., for Ironbridge power station. Specifications (No. 2) and form of tender from Mr. E. F. Hetherington, chief engineer and manager, Phœnix Buildings, Dudley Road, Wolverhampton; deposit, £2 2s.

Overseas.

UNLESS otherwise stated, particulars of overseas contracts are to be had from the Department of Overseas Trade (Room 52), 35, Old Queen Street, Westminster, London, S.W.1. *Note.—An asterisk denotes that local representation is, in practice, essential.*

INDIA STORE DEPARTMENT, April 5th.—Hospital steam laundry equipment, with Lancashire boiler, electric motors, piping, etc. Form of tender (5s.) from the Director-General, Belvedere Road, London, S.E.1.

SOUTH INDIAN RAILWAY CO., LTD., April 5th.—Supply

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of electrical materials and fittings. Specifications, etc. (5s.), from the Company's Offices, 91, Petty France, Westminster, S.W.1.

VICTORIAN RAILWAY COMMISSION, April 5th.—Supply of rectifiers and storage batteries, for power signalling purposes (contract No. 42 549). (Reference B.X. 5 166.)

VICTORIAN ELECTRICITY COMMISSION, April 8th.—Galvanised steel transmission lines towers (specification 29/13). (Reference A.X. 7 401.)

VICTORIAN ELECTRICITY COMMISSION, April 8th.—Supply of 22 000 V transformers (specification No. 29/17). (Reference B.X. 5 101.)

DUBLIN BOROUGH COMMISSIONERS, April 9th.—Supply and erection of electrically-driven pumping plant on site adjacent to service reservoir at Stillorgan, co. Dublin. Specification, etc., from the City Treasurer; deposit £1.

NEW ZEALAND PUBLIC WORKS DEPARTMENT, April 9th.—Supply of induction voltage regulators, for Lake Coleridge scheme (section 21). (Reference B.X. 5 018.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, April 15th.—Conductor cords (No. P. and T., 151/1 319). (Reference B.X. 5 098.)

INDIAN STORES DEPARTMENT, April 16th (extension of time).—Supply of 30 kW steam engine driven generator set (order No. N. 9 538). (Reference B.X. 5 167.)

INDIAN STORES DEPARTMENT, April 16th.—Supply and erection of one 5-ton overhead electric three-motor gantry crane (order No. N. 9 536). (Reference A.X. 7 652.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, April 17th.—Supply of copper earthplates (specification 133). (Reference A.X. 7 556.)

UMTALI MUNICIPALITY, April 18th.—Supply of line sundries switchgear and transformers, in connection with extensions of electricity undertaking. (Reference B.X. 5 142.)

UMTALI MUNICIPALITY, April 18th.—Supply of 1 000 kW turbo-alternators, spray cooling plant, switchgear and crane (contract B). (Reference B.X. 5 145.)

LOURENCO MARQUES PORT AND RAILWAYS BOARD, April 22nd.—Supply of electric hanging and ordinary lamps. (Reference B.X. 5 188.)

DUBLIN PORT AND DOCKS BOARD, April 23rd.—Supply and erection of three electric, overhead, travelling cranes and gantries, at new tobacco warehouse, Custom House Docks, Dublin. Specification, etc., from the Engineer, East Wall, Dublin.

PORT ELIZABETH MUNICIPALITY, April 25th.—Supply and erection of 22 000 V switchgear, h.t. and l.t. switchboards (specification No. 20). (Reference B.X. 5 194.)

PORT ELIZABETH MUNICIPALITY, April 25th.—Supply of 200 kVA transformer, earth resistance and various lamps (specification No. 22). (Reference B.X. 5 195.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, April 25th.—Supply of three electrically-driven wheel lathes (tender No. 1 410). (Reference A.X. 7 621.)

VICTORIAN ELECTRICITY COMMISSION, April 29th.—Supply of two or three steam turbo generator sets, with condensers, etc., for Yallourn power station extension (specification 29/7). (Reference B.X. 5 062.)

VICTORIAN ELECTRICITY COMMISSION, April 29th.—Supply of two swing hammer mills with electric motors, for brown coal (specification 29/9). (Reference A.X. 7 434.)

CAPETOWN MUNICIPALITY, May 1st.—Supply of 30 ft. steel poles, cross-arms, insulators, fly fuses, etc. (specification 459/1929). (Reference A.X. 7 697.)

Cables and Accessories.

STATE ELECTRICITY WORKS, MONTEVIDEO, May 6th.—Supply of electric cables and accessories. (Reference B.X. 5 178.)

EGYPTIAN MINISTRY OF PUBLIC WORKS, May 15th.—Supply and erection at Government Printing Office, Cairo, of 120 kW d.c. Diesel electric generating set, with foundations, artesian well, electrically-driven water cooling pump, etc. Forms of tender, etc. (10s. 6d.), from Chief Inspecting Engineer, 41, Tothill Street, London, S.W.1.

VICTORIAN RAILWAY COMMISSION, May 15th.—Supply of one geared three-phase electric winding engine (contract No. C.M. 778). (Reference A.X. 760.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, May 16th.—Supply and installation of electric signalling apparatus at Johannesburg. (Reference B.X. 5 165.)

BLOEMFONTEIN MUNICIPALITY, May 18th.—Supply and erection of (*a*) turbine and generator, condensing plant and auxiliaries and switchgear and cables; (*b*) cooling spray pond equipment, or cooling tower (contract No. 1). (Reference B.X. 5 192.)

PLOVDIFF (BULGARIA) PROVINCIAL COUNCIL, May 20th.—Supply of two Francis turbines, two 5 000 kVA generators, two 5 000 kVA, two 1 000 kVA and two 150 kVA transformers, for Votscha-Kricim power station.

TANGANYIKA GOVERNMENT, June 1st.—Concession for utilisation of Pangani River Falls for the development of electric power. Copies of the draft concession may be obtained from the Crown Agents for the Colonies, 4, Millbank, London, S.W.1.

STATE ELECTRICITY WORKS, MONTEVIDEO, July 8th.—Construction and equipment of 50 000 kW power station.

Tenders Accepted.

TYNEMOUTH CORPORATION.—Macintosh Cable Co., Ltd., supply of cables for 12 months.

GLOSSOP CORPORATION.—Urban Electric Supply Co., Ltd., wiring Hadfield Library for lighting.

FYLDE GUARDIANS.—P. J. Frampton, electric light wiring and fitting of the Institution, £2 239.

MAIDENHEAD CORPORATION.—W. Lucy and Co., provision of kiosk for Punt Hill sub-station, £244.

GLASGOW CORPORATION.—E. Allen and Co., Ltd., manganese steel rails; British Insulated Cables, Ltd., 28 in. copper bends.

ADMIRALTY.—Edison Swan Electric Co., Ltd., operating keys and key combinations, accumulators and cells, and terminal and bearing blocks.

SPENBOROUGH URBAN DISTRICT COUNCIL.—Butler and Horn, electric light installation in 40 houses, £303; Hepworth and England, 96 houses, £706 16s.

UXBRIDGE URBAN DISTRICT COUNCIL.—Watford Electric Manufacturing Co., automatic starter, contactor and relay instrument, for fire siren, £34 5s. (Recommended.)

BERMONDSEY (LONDON) BOROUGH COUNCIL.—Standard Telephones and Cables, Ltd., provision of loud-speaker apparatus at central baths, £52 4s. (Recommended.)

HORNSEY CORPORATION.—Doulton and Co., Ltd., troughs and bridges, and Standard Telephones and Cables, Ltd., and Pirelli-General Cable Works, Ltd., cables. (Recommended for renewal for 12 months.)

LONDON COUNTY COUNCIL.—Clarke, Chapman and Co., Ltd., three boilers, £77 950; John Spencer, Ltd., pipework, £8 418 10s.; J. P. Hall and Sons, Ltd., feed pump, £651 10s., for Greenwich power station.

ILFORD CORPORATION.—Metropolitan-Vickers Electrical Co., Ltd., supply of two switch pillars, for Gants Hill sub-station, £605; Crompton, Parkinson, Ltd., supply of transformer and switch kiosk, £497 10s. (Both recommended.)

ROTTERDAM MUNICIPALITY.—British Thomson-Houston Co., Ltd., supply of 25 000 V, three-phase, 50 cycle switchgear. The contract includes 39 B.T.H. isolated phase equipments with oil circuit breakers having interrupting capacity of 1 500 000 kVA. See page 428.

SOUTHEND CORPORATION.—Richard Garrett and Sons, three double-deck trackless vehicles, £1 969 5s. each; British Mannesman Tube Co., Ltd., 50 medium poles, £9 2s. 6d.; Union Cable Co., Ltd., two miles of overhead trolley wire, 1s. 1d. per lb. (subject to market fluctuations).

WIMBLEDON CORPORATION.—Sub-station transformers: Foster Engineering Co., Ltd., eight 200 kVA (indoor), £840; Hackbridge Electric Construction Co., Ltd., nine 200 kVA (indoor), £945; two 200 kVA (outdoor), £240; one 100 kVA (outdoor), £86; Johnson and Phillips, Ltd., five 1 000 kVA (outdoor), £1 755.

LIVERPOOL CORPORATION.—Cargo Fleet Iron Co., Ltd. 1 800 tons Sandberg tram rails, £11 per ton; Cammell, Laird and Co., Ltd., 100 tons steel fishplates, £12 10s. per ton; Soc. Anon. des Usines et Acieries Allard, 20 tons of mild steel fishbolts, £12 per ton and 90 tons of steel tie-bars, £11 9s. per ton. (All recommended.) Rowe Bros. and Co., Ltd., St. Helens Cable and Rubber Co., Ltd., General Electric Co., Ltd., Baxendale and Co., Ltd., and Perrin Hughes and Co., Ltd., electric fittings. (All recommended.)

STEPNEY (LONDON) BOROUGH COUNCIL.—W. T. Henley's Telegraph Works Co., Ltd., supply of cables for two years, £18 192 7s. 3d. Also tendered: Hackbridge Cable Co., Ltd., £18 293 4s. 4d.; Macintosh Cable Co., Ltd., £18 433 8s. 4d.; W. T. Glover and Co., Ltd., £18 750 9s.; Siemens Bros. and Co., Ltd., £18 802 15s. 11d.; Pirelli-General Cable Works, Ltd., £18 829 18s. 9d.; British Insulated Cables, Ltd., £18 844 16s. 5d.; Standard Telephones and Cables, Ltd., £18 931 16s. 7d.; Callender's Cable and Construction Co., Ltd., £18 977 18s. 3d.

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ELECTRICITY SUPPLY.

Bolton and Assisted Wiring—Proposed Extensions at Brighton—Croydon and the Central Board—Plant Replacement at Coventry—New Mains and Feeders for York—Further Extensions at Portsmouth—Tynemouth, Assisted Wiring, and Contractors.

STEVENTON, Berks, P.C. is asking for electricity to be brought to the village.

Maidenhead T.C. has applied for a loan of £3 800 for a sub-station in Bridge Road.

Portsmouth Electricity Committee is to extend extra h.t. mains at a cost of £9 500.

Bexhill Electricity Committee recommends cable and plant extensions at a cost of £1 647.

Bampton (Oxfordshire) P.C. is to discuss the possibility of using electricity for street lighting.

Coventry Electricity Committee seeks sanction for a loan of £16 635 for the replacement of plant.

The Commissioners have made an Order for the supply of electricity to Pleasington by Blackburn Corporation.

The Thames Valley Electricity Supply Co. has obtained a contract for street lighting at Henley, to supersede gas lighting.

Eynsham P.C. has asked the Wessex Electricity Co. for a tender for street lighting, which it is proposed to inaugurate next winter.

Cheltenham Electricity Committee has asked the Borough Engineer to prepare plans for the erection of a sub-station on the Promenade.

Brighton Lighting Committee has authorised mains extensions at a cost of £1 185, for the supply of electricity to the Bevendean Valley housing estate.

Oundle U.D.C., after discussing the question of a supply of electricity for the town, has referred the matter to the Highways Committee for consideration.

The Chiswick Electricity Supply Corporation, Ltd., proposes to lay a new cable to the works of Whitbread and Co., Brentford, and to erect a new feeder pillar in Essex Square.

Aylesbury has received sanction to the following loans for prospective expenditure: Mains and services, £24 271; sub-station equipment, £699; and domestic apparatus for hire, £9 412.

York Corporation has voted the following estimates:—Boiler plant for generating station, £5 400; h.t. mains, feeders, etc., £35 747; mains and services, £30 000 and Linton Lock station, £1 000.

Guildford Electricity Committee is to extend mains, at a cost of £1 719, to supply the Longdown Road and Warren Road districts.—Mains are to be extended, at a cost of £1 658, to supply the Worplesdon Road district.

Chelmsford Corporation is to apply to the Electricity Commissioners for an inquiry to be held with a view to obtaining a reduction in the price, at present charged, for electricity for lighting and power, and to make representations to the alleged inadequate supply of electricity in the borough.

Morecambe Electricity Committee is to make representations to Lancaster Corporation with a view to the White Lunn estate and a surrounding area within the parish of Heaton-with-Oxcliffe being excluded from its application to the Electricity Commissioners for a Special Order to increase its area of supply.

Southend T.C. has adopted a scheme prepared by the Electrical Engineer providing for h.t. ring mains to permit of a.c. distribution in the North Eastern, North Western and Western areas of the borough. The scheme comprises the laying of 11 000 V mains, with transformers, kiosks, and section boxes, and the estimated cost is £48 516.

Droxford R.D.C. has decided to oppose an application by the West Hampshire Electricity Co. for an Order to supply electricity in the rural area, on the ground that the Committee has not made sufficient provision for covering the district, and that the price of 10d. per kWh is exorbitant. Portsmouth Corporation has already offered to supply Hambledon, and the Rural Council has consented to this proposal, and has invited the Corporation to include Soberton.

Bolton Electricity Committee has received a report of the Borough Electrical Engineer upon a suggested assisted wiring scheme, and it has been referred to a sub-committee.—The Borough Electrical Engineer having reported that the open cellular type e.h.t. switchgear at Spa Road sub-station has become obsolete, and requires renewing, it has been decided that such switchgear be replaced during the forthcoming summer season by switchgear of larger capacity and modern type.

Stoke-on-Trent Electricity Committee reports that considerable economies have been shown in generation at the central power house during the winter, and congratulates the Engineer and his staff thereon. Coal used per kWh generated was 1·762 lb., against 2·063 lb. in the previous winter; works costs were 0·308d. per kWh, against 0·388d.; maximum load was 12 952 kW, against 10 354, and output was 4 401 501kWh, against 3 292 192.—The Committee has accepted a tender amounting to £619 for the erection of a sub-station at Sneyd Hill.

Brighton Lighting Committee is to make application to the Electricity Commissioners for sanction to borrow £10 000 for h.t. and l.t. overhead mains, buildings, switchgear, etc., in connection with the proposed sub-station at Warren Farm schools.—The Committee seeks sanction to borrow £50 000 for extensions of mains and house services, and £15 000 for cable connections in relation to the extension of the buildings and plant at Southwick works.—Sanction to borrow £9 317 for the lighting of London Road, Dyke Road, and Lewis Road has been received.

Tynemouth Electricity Department has been asked to submit terms for a supply of current for the New Cinema to be erected near the railway station.—The Electrical Engineer reports that arrangements have been made that for future orders for assisted wiring the contractors must supply lamps to consumers, without extra charge, two of which (one for living room and one for kitchen) must be E.L.M.A. lamps and others of a make approved by the Electrical Engineer.—The Electricity Committee is negotiating for a site for a sub-station on the Ingleside estate.

At Cape Town the street lamps are not lit during moonlight nights. The Electricity Committee now recommends that the lighting of all street lamps in the city be maintained during moonlight nights. To do this will entail an extra cost, in lamp renewals and coal consumed, of approximately £400 per annum. The Committee recommends that the Electrical Engineer be granted three months' vacation leave as from June 7th next, and that thereafter he proceed on service overseas for a visit to America and to attend the World Engineering Conference in Tokio in October and November.—The Committee recommends the acceptance of a tender amounting to £815 for the erection of a sub-station at Wynberg.

Plymouth Committee has adopted a scheme for the hire purchase of radiators on the terms and conditions now in operation in respect of electric cookers, but, for the present, the scheme is to apply only to hotels and boarding houses. It has also been resolved to vary the terms of payment for electrical installations for domestic purposes on the quarterly system spread over seven years, so that if consumers pay for their installations outright after the first year they will be allowed a reduction of 20% on the balance, after the second year's payment 15%, after the third year's payment 10%, or after the fourth year's payment 5%.—The Electricity Committee estimates an expenditure for the year of £155 000 on mains and plant.

The Chairman of the Croydon Electricity Committee and the Borough Electrical Engineer have had an interview with one of the chief officers of the Central Electricity Board and obtained a promise that within two months the Board will either undertake to give the supply required by the Corporation from the grid in the winter 1930-1 or sanction an immediate extension of the Corporation's generating plant. The Engineer reports that to meet the demand on the station for the coming winter, it is necessary to provide further cooling towers equal to three of the existing towers. In the event of the station being extended either in 1930-1, or at a later date, it would be necessary to provide additional towers equivalent to fourteen of the existing towers. The Engineer states that a new type of tower built of ferro-concrete, of which he had had favourable reports, is now being built at some stations, one of these concrete towers doing the work of three or four wooden towers, and having at least double the life of a wooden tower. The Committee recommends obtaining alternative tenders for three wooden towers and one concrete tower, and will, when the tenders have been obtained, further consider the question and report to the Council as to which type should be adopted.

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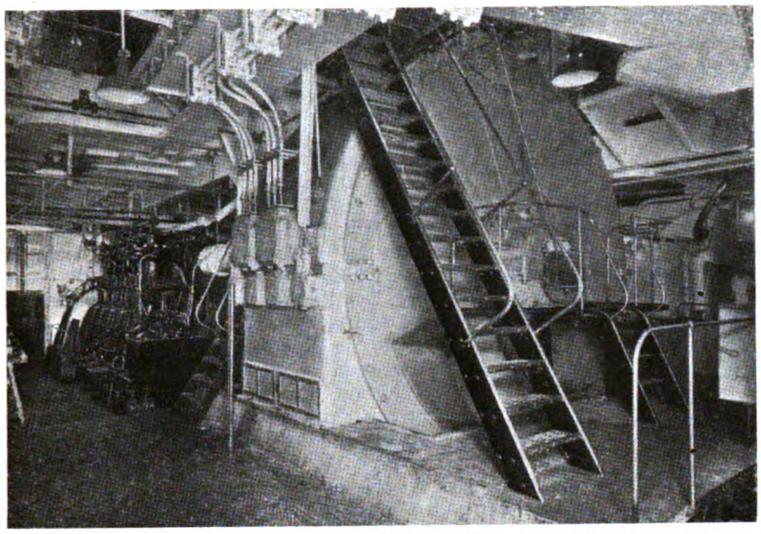
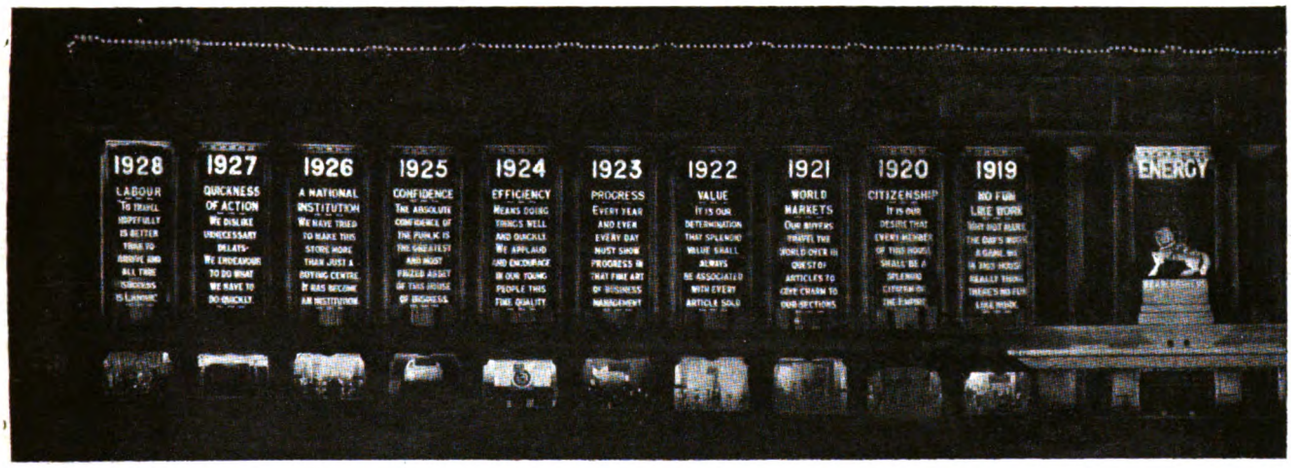
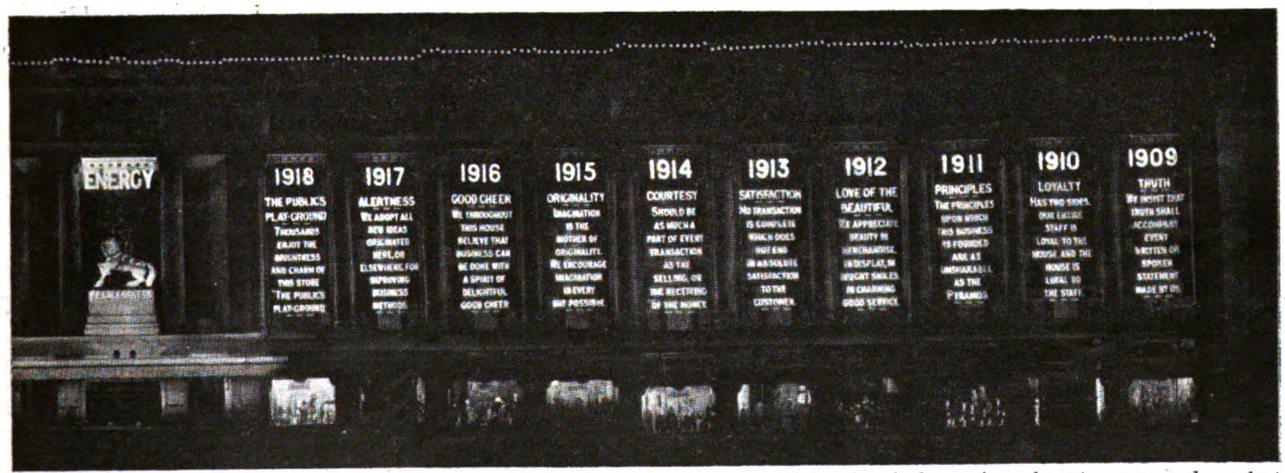
ELECTRICAL NEWS OF THE WEEK IN PICTURES.



A view of one of the propellor motors on the "Viceroy of India," with one of the Diesel engine-driven auxiliary d.c. generators in the background. The installation of this turbo-electric vessel was constructed and erected by the British Thomson-Houston Co., Ltd., and her performance during trials was described at length in our issue of February 22nd, by a representative of THE ELECTRICIAN, who was on board. The vessel is now well on her way to India, having sailed on her maiden voyage on March 28th.

Mr. J. C. Denison-Pender, who, as announced in THE ELECTRICIAN last week, has been elected chairman of the Eastern Telegraph Co., the Eastern Extension, Australasia and China Telegraph Co., and the Western Telegraph Co.





The decorating of buildings with electrical illuminations on occasions for celebration is becoming almost commonplace, but rarely have we seen so good a display as that shown at Selfridges, London, during "Birthday Week." The decorations at this store during its anniversary week have become an annual event, and though in previous years the illuminations have been excellent, never before have they approached so spectacular a display as was the case this year. The illuminations, of which the above are pictures, stretched across the whole front of the building, the length of which has necessitated our reproducing the photograph in two sections. That on the top shows the left hand portion, while that below shows the right; the mounted figure appearing in both illustrations was a centrepiece. Each letter contained on the average 12 lamps, and each message consisted of nine lines. On the Oxford Street front there were 21 bays, while in Duke Street there were two, with one in Orchard Street.

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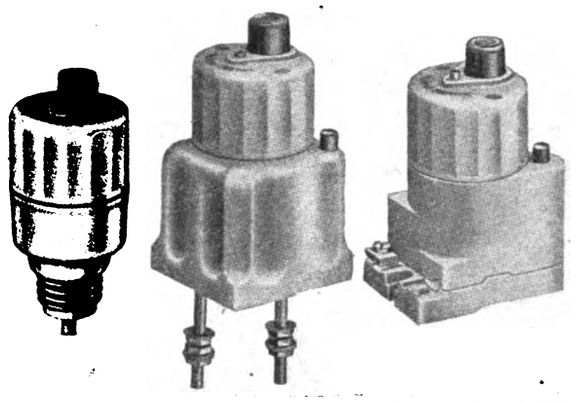
A NEW CIRCUIT BREAKER.

WE have received from the A.E.G. ELECTRIC CO., LTD., 131, Victoria Street, London, S.W.1, particulars of the new "Elfa" automatic circuit breaker. This device has been designed to protect circuits of all current ratings, without interruption so long as the duration of the overload is not such as



The three types of "Elfa" cut-out: left, the screw type; centre and right the switchboard and built-in types respectively.

to injure the circuit, as, for instance, peak loads of short duration. The makers also claim the unit avoids the necessity of employing an extra set of fuses in motor circuits, for starting purposes. It is also useful for locating faults. The device is constructed with two independently acting components which release the cut-out by magnetic release, and thermal release. A current flowing in the magnetic coil develops a magnetic flux, which flows through the divided iron core. The lower part of the core is movable and is attracted by the upper fixed part, towards which it is drawn if the magnetic pulling force exerted by the current flowing in the coil is greater than the pull of the adjustable spring. The thermal release consists of a bow comprising two strips of nickel steel alloy of different composition, which are hot-rolled together. On sufficient current flowing through this bow, the change of shape arising in consequence of the unequal expansion trips the cut-out. The forces arising out of these two methods of release act on a double lever locked by a pawl with the contact bridge. After the pawl has disengaged, the current circuit is broken, since the contact bridge is raised from the contacts by a spring. The magnetic release consists of a coil enclosing a two-part core, the upper part of which is stationary and fixed to the coil support and the lower part movable. The movable part of the core is held by an adjustable spring acting in the opposite sense to the magnetic pull. The mechanical pull of the spring is not overcome by the magnetic pull, until a current of six to eight times the rated current of the automatic cut-out flows through the coil. The thermal release is shaped like a bent pen-nib and its temperature is maintained at the same value with cut-outs for different ratings by altering the cross-section. The nickel steel of the thermostat is known as bimetal. The contacts, across which occurs the arc on the interruption of the circuit carrying an overload or short circuit, are bridged in the on position by a rigid contact piece separated from the parts of the switching mechanism by fire-proof insulation. This insulation also prevents the two springs provided from becoming over heated. One spring effects the breaking of contact, whilst the other exerts the contact pressure in the on position. If it is desired to trip the cut-out by hand a push button is arranged at one side of the unit. The cut-out is made in three types, namely, screw type, switchboard type, and button type. The first of these is manufactured for d.c. of 250 V. and a.c. of 380 V and for current strengths of 1, 1·5, 2, 2·5, 3, 3·5, 4, 5, 6, 7, 8, 9, 10, 12·5, and 15 A. The switchboard type with back-of-board connections is illustrated above, and dimensions of this cut-out are chosen so that the base and arrangement correspond to the standard 25 A switchboard fuse. Mounted fuses can be replaced by Elfa switchboard cut-outs where desired. In the built-in type in order to diminish the space requirement, the width of the base is made the same as the E 16 wall type fuse. Switchboard and built-in cut-outs are manufactured for a.c. up to 380 V to have the same current ratings as the type screw cut-outs, while the inner construction of all three is for the most part the same.

SWITCHGEAR FOR HOLLAND.

Large Dutch Contract Awarded to British Thomson-Houston Co., Ltd.

A CONTRACT has been awarded to the BRITISH THOMSON-HOUSTON CO., LTD., Rugby, by the Municipal Council of Rotterdam for 25 000 V three-phase, 50 cycle switchgear required in connection with the new power station three miles nearer the mouth of the Maas than the existing Schiehaven power station, which has reached maximum capacity. This switchgear contract is for 39 isolated phase equipments incorporating oil circuit breakers having an interrupting capacity of 1 500 000 kVA. The ultimate capacity of the station is to be 252 000 kW and the switchgear will be so arranged that the equipment for each phase is housed in a separate gas-proof building. Duplicate busbars are provided, these being divided into three sections which are inter-connected by reactors to a star busbar, and, by the provision of feeder series reactors, the magnitude of faults external to the station is limited, while, by reason of the isolated phase principle, the possibility of faults between phases in the switch-house is reduced. The oil circuit breakers have explosion chamber contacts and a pressure diaphragm in the top cover to relieve gas pressure in the event of sustained arcing taking place. As this diaphragm is piped to a gravel catch pit in the basement the oil fire risk is considerably reduced. Rotating blade busbar selectors are provided, these being remote mechanically operated from a passage way external to the switch-house, and as the inter-phase operating rods for both the isolating switch mechanism and oil circuit breaker mechanism are fitted with stuffing boxes where they pass through the phase dividing walls, the escape of hot gases from one phase compartment to another is prevented. All current transformers are of the bushing type, being fitted with oil circuit breaker terminal bushings, and the voltage transformers are of the single-phase type fitted with internally mounted limiting resistance and protective fuse.

The receipt of this order is particularly interesting as it follows closely on the order for two 42 000 kW turbo-alternators secured by another British firm, the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester. In this case the turbines are provided with "Metrovick" central flow condensers and the steam conditions are 25 atmospheres at 400° C. Each set is rated 42 000 kW maximum continuous, three-phase, 50 cycles, 5 500/5 800 V, 87·5% power factor.

FREQUENCY GRAMOPHONE RECORDS.

Interesting Recordings for Use in Electrical Laboratories—Checking Constancy of Motor Speeds.

IN the electrical experimental department of the Gramophone Co., at Hayes, "His Master's Voice" constant frequency records have been specially cut and calibrated so as to produce a series of pure tones ranging over about 8½ octaves on the musical scale. The set consists of 15 double-sided 12-inch red label records, giving 100 different frequencies of 50 seconds' duration each. The waves are sinusoidal in form, and provided that the turntable runs exactly 78 revolutions per minute, the frequencies are correct to within 1% of those stated upon the labels, so that they form an excellent source of alternating oscillations over a wide range. The frequencies range from 25·5 to 8 460 cycles. The double amplitudes in inches and the maximum velocities of needle point in a direction perpendicular to the normal line of groove in inches per second have been calibrated, and are printed upon the labels. These records have been cut so as to produce a substantially constant output of a.c. energy from 250 cycles upwards, whilst below 250 cycles there is a gradual decrease of energy. The exact amount of energy has been calibrated, and is given on the labels in the form of transmission units above or below the energy of the 993 cycle note, the transmission unit or T.U. being a well-known standard of measurement in telephony practice. These records will be found to be useful for experimental laboratories. If used with an electrical pick-up and amplifier they give electrical alternating currents of good wave form and known frequency, and the generated power may easily be measured, so that various pick-ups, amplifiers, loud speakers, or other telephone and wireless apparatus, may be calibrated under normal conditions. For ordinary laboratory and experimental tests these records form a substitute for an electrical oscillation generator and, in addition, will form a means of checking the speed of rotating apparatus.

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WIRELESS NOTES.

Increasing Membership of the Radio Manufacturers' Association.

IT will be remembered that at the time of the annual meeting of the Radio Manufacturers' Association last December, the total membership had reached 100. The total now stands at 120, the new members being the Ashley Wireless Telephone Co. (1925), Ltd., Liverpool; Burgoyne Wireless, Ltd., London; Colvern, Ltd., Romford; Messrs. C. S. Dunham, London; the Europhone Radio Co., Birmingham; Gilophone, Ltd., Manchester; Gramo-Radio, Ltd., Church, Lancs; Messrs. Holt and Crompton, London; Messrs. Jackson Bros., London; O. and S. Oilless Bearing Co., Ltd., London; Perfectavox, Ltd., Yeadon, near Leeds; Phantestra (Renn's Gramophone and Wireless), Ltd., London; Philipson and Co., Ltd., Bolton; Radielle Co., Ltd., London; Reproduction, Ltd., London; the Standard Wet Battery Co., Ltd., London; the Tulsemere Manufacturing Co., Ltd., London; Ultra Electric, Ltd., London; Universal Gramophone and Radio, Ltd., London; and the Westinghouse Brake and Saxby Signal Co., Ltd., London.

A novel loud speaker has found its way to the market under the trade name of "Radioshade." This instrument is made by BROADCASTING LAMPSHADES, LTD., of 9, Alfred Place, Tottenham Court Road, London, W.1, and consists, as the name implies, of a standard lamp shade, with a loud speaker unit fitted below that portion of the shade which when in use appears immediately above the lamp. The unit is fitted with a cone, the whole being enclosed within the lamp shade. The device can be used with any standard lighting fitting of the table or floor type, and a number of designs and colourings are available. The operation of the lighting circuit is, of course, independent of the loud speaker.

The increasing sales of portable wireless receivers have encouraged the GENERAL ELECTRIC CO., LTD., to introduce a new screen-grid four-valve model for both long and short wave lengths. This takes the conventional style, being made in two sections for housing the batteries and receiver, and loud speaker and frame aerial. Two tuning controls are provided, as well as a thumb control for reaction. The same company has also marketed a new non-spillable type accumulator of the two-volt class, with a capacity of 20 Ah. The electrolite is solid, and substantial brass terminals are provided. The accumulator, when sold, is fully charged.

The Air Route to India.

The wireless organisation for the air mail service to India, which opened on March 30th, has been completed so that the aircraft engaged will be in touch with aerodrome ground stations throughout the 4 700 air miles of the journey. All the aircraft are equipped with Marconi wireless apparatus, and an intercommunicating chain of ground stations has been arranged. The first section of the route, London–Basle, consists of the aerodrome station at Croydon, French stations at Le Bourget and other intermediate places on the route, and Basle. The machines operating this section of the route are fitted with 150 W Marine type AD6 sets. For the second section of the air route, Genoa to Alexandria, the three "Calcutta" flying boats are fitted with Marconi type AD8 sets. These sets are also adaptable for telegraphy or telephony. Imperial Airways, Ltd., have stationed a depot ship at a point in the Greek Archipelago and this is fitted with a 1½ kW valve transmitter (type U) and a Marconi type RG19 receiver. The machines on the third and final section of the route, through Basrah and over the Persian Gulf to Karachi, are De Havilland aircraft fitted with Marconi AD6 apparatus and communicate with R.A.F. stations and a ½ kW station at Rutbah Wells, which was supplied by the Marconi Company to the Iraq Posts and Telegraphs Department. The terminal wireless station at Karachi is a 6 kW transmitter with direction finder receiving apparatus.

TURBINE BLADING.

The B.E.S.A. has recently issued a British Standard Specification for phosphor bronze turbine blading. The requirements specified include the chemical composition of the phosphor bronze, the method of selecting bars for the preparation of test pieces, the form of the test pieces, and the mechanical tests to be complied with: the dimensions of the bars are not standardised. Copies of the Specification No. 352-1929 may be obtained from the Publications Department of the British Engineering Standards Association, 20, Victoria Street, S.W.1, price 2s. 2d., post free.

TRADE PUBLICATIONS.

AS was to be expected at this time of the year METROPOLITAN-VICKERS ELECTRICAL CO., LTD., has sent us a further "Girl" calendar, making the fifteenth in the series. This year's calendar is, as in past years, a thoroughly artistic production, brown in tone and sharp in its definition. The subject this year is Miss Joan Lockton who, it may be remembered, appeared recently in "Lumber Love." The illustration which we give on this page shows that both Miss Lockton and the Metropolitan-Vickers Electrical Co. are to be congratulated on a very pleasing publication.

The latest edition to the series of "Girl" calendars of the Metropolitan-Vickers Electrical Co.

With regard to the recent issue by the SUN ELECTRICAL CO., LTD., 118/120, Charing Cross Road, London, W.C.2, of a catalogue of electrical supplies, apparatus and appliances, it has been found that some stockists are only interested in portions of this list. The company has, therefore, issued a complete set of sections, individually bound in stiff paper covers. The sections cover domestic electrical appliances, signs and flashers, display and industrial lighting equipment, electric fires, lamps, general accessories, switch and fuse gear, fans, motors, charging plant and instruments, electrically operated tools, conduit, fittings, cables, flexibles, wiring systems, line material, bells, bell material, and telephones.

Bulletin No. G577 by STANDARD TELEPHONE AND CABLES, LTD., deals with the cathode ray and oscillograph.

Brochure No. 1 002 E. covering centrifugal pumps has been received from the A.C.E.C., 56, Victoria Street, London, S.W.1.

Booklet No. 201, by PHILIPS' LAMPS, LTD., 145, Charing Cross Road, London, W.C.2, deals with dark room accessories.

TURNER BROTHERS ASBESTOS CO., LTD., Rochdale, have issued a new folder relating to "Sindanyo" insulating board.

MR. ALAN WRIGHT, 142, Chancery Lane, London, W.C.2, has sent a list, No. C1/29, dealing with "Inventum" water heaters.

"Belting from a Single Strand" is the title given to a new brochure by JAMES HENDRY, LTD., of 252, Main Street, Bridgeton, Glasgow.

The BRITISH THOMSON-HOUSTON CO., LTD., Rugby, has published list No. 3 305, dealing with metal clad vertical plugging switchgear, Class Z.

Individual light control is the subject of a new leaflet by J. A. CRABTREE AND CO., LTD., Lincoln Works, Walsall. The reference is No. 1 053.

Booklet 201 by PHILIPS LAMPS, LTD., 145, Charing Cross Road, London, W.C.2, describes and illustrates "Metalix-Portable" X-ray apparatus.

The DRAYTON REGULATOR AND INSTRUMENT CO., LTD., West Drayton, Middlesex, has published a special issue entitled "A Book about Steam Traps."

The MARTINDALE ELECTRIC CO., LTD., The Hyde, Hendon, London, N.W.9, has sent us a leaflet embodying a chart on carbon brush and commutator troubles, together with particulars of "Martindale" commstores.

A coloured poster drawing attention to the price reduction of the C.2 model loudspeaker, has been published by the BRITISH THOMSON-HOUSTON CO., LTD. The same company has issued booklet L.451 dealing with floodlighting.

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COMPANY NEWS.

Easter Holiday Makes Market Dull—General Electric Activity—Cable Manufacturing Descriptions Unsteady—Marconi Wireless Holdings Improve—Company Reports and Meetings—New Companies Registered.

WITH the Easter holidays intervening, little activity was to be looked for in share markets and there are consequently but few alterations in our usual table of prices. The only outstanding feature is a recovery in General Electric shares. Although, at the time of writing, the discussions between American and English interests with regard to the proposed new share issue are without definite result, the company's shares have been in demand and last week's fall has been partially recovered. Johnson and Phillips and British Insulateds have both fallen, 2s. 6d. and 1s. 3d respectively. Marconi's Wireless have improved 1s. 3d.

Last Annl. Divd.	Description.	This Week.	Last Week.	1926 to 1928. Highest	Lowest.
%	**Electricity Supply.**				
(d)	Brompton & Kensington Ord. ..	27/-	27/-	35/6	23/9
4	Central Elec. Sup. 4% Deb. ..	94	94	95½	88½
(a)	Charing Cross Elec. Ord. (£1) ..	26/-	26/-	51/-	24/3
4½	,, ,, ,, 4½% C.P. (£1)	17/6	17/6	18/3	16/6
(b)	Chelsea Elec. Sup. Ord.	27/-	27/-	45/3	24/-
10	City of Lond. Elec. L'ting Ord. ..	31/10½	31/10½	52/10½	26/-
6	,, ,, ,, ,, 6% C.P.	23/-	23/-	24/3	21/6
7½	County Lon. Elec. Sup. Ord. ..	53/6	53/-	68/6	25/9
6	,, ,, ,, ,, 6% C.P. ..	23/-	23/-	24/-	21/3
(c)	Kensington & K'bridge Ord. (£1)	26/6	26/6	27/6	23/9
1/9⅜	Lon. Elec. Sup. Ord. (£1)	27/-	27/-	37/6	23/-
1/9½	Metro. Elec. Sup. Ord.	41/3	42/6	53/-	24/9
4½	,, ,, ,, 4½% C.P.	17/6	17/6	18/3	16/3
7½	N'castle & Dis. Elec. Ltg. Ord. ..	28/1½	28/1½	31/9	17/6
1/2½	N'castle-upon-Tyne Elec.Sup.Ord.	25/-	25/-	30/3	19/3
6	N. Metro. Elec. 6% C.P.	23/-	23/-	23/9	20/10
6	Notting Hill 6% C.P. (£10) ..	10½	10½	11½	9½
(c)	St. James & P.M. Ord. (£1) ..	27/6	27/6	28/6	23/6
1/4½	Shrops. Worcs. & Staffs. Power B.Ord.	37/6	37/6	37/6	21/4
1/9½	W'minster Elec. Sup.Ord. (£1) ..	26/-	26/-	52/9	24/-
4½	,, ,, ,, 4½% C.P. (£1)	17/6	17/6	17/10½	16/7½
8	Yorks. Elec. Power Ord.	34/-	34/-	38/9	24/6
6	,, ,, ,, 6% C.P. ..	24/-	24/-	26/9	20/7
	Railways and Tramways.				
8	Brit. Elec. Trac. Pfd.Ord. Stk ..	128	128	152	117
6	,, ,, ,, 6% Pf. Stk.	128½	128½	133	103½
4	Cent. Lon. Ry. Ord. Stk. (asstd.)	72	72	72	54
4	,, ,, ,, 4% Deb.	80	80	83	77½
4	City & S. Lon. 4% Perp. Deb. ..	79½	79½	81	76½
5	Lon. Elec. Rly. Cons. Ord. Stk. ..	73½	73½	75½	42½
4	,, ,, ,, ,, 4% Pf. Stk.	73	73	77	68
4	,, ,, ,, ,, 4% Deb. ..	80	80	83	76½
5	Lon. & Sub. Trac. A. Deb. ..	97½	97½	97½	74
4	Lon. Un. Trams, 1st Deb. ..	61	61	63	39
4½	Met. Elec. Trams, 4½% Deb. ..	72	72	73½	62
5	,, ,, ,, 5% Deb. ..	67½	67½	70½	65½
3½	Met. Rly. Cons. Ord. Stk. ..	60½	60	81	54½
3½	,, ,, ,, 3½% Pf. Stk. ..	63	63	67	60½
3½	,, ,, ,, 3½% Deb. ..	70	70	73½	67½
5	Met. Dis. Rly. Ord. Stk.	76½	76½	77½	52½
4½	,, ,, ,, 4½% 1st Pref. ..	80½	80½	84	74½
6	,, ,, ,, 6% Perp. Deb. ..	116½	116½	118½	110
4	S. Met. Elec. Trams, 4% Deb. ..	70	70	70	64½
7	Uudergrouud Electric Rlys. Ord.	24/-	23/6	28/2	11/-
—	Yorks. (W.R.) Trams, Ord. ..	5/-	5/-	16/-	3/-
4½	,, ,, ,, 1st. Deb. ..	59	59	78	60
	Electrical Manufacturing.				
7	Brit. Elec. Transformer 7% C.P. ..	15/-	15/-	19/10	4/6
15	Brit. Insulated Cables Ord. ..	92/6	93/9	86/3	56/-
6	,, ,, ,, 6% C.P. ..	22/6	22/6	23/10	21/-
7	British Thomson-Houston Pref. ..	23/9	23/9	24/9	19/7
7	,, ,, ,, 7% Deb.	104½	104½	109½	102½
10	Brush Electrical Ord.	27/6	27/6	30/9	24/-
15	Callender's Cable Ord.	87/6	87/6	91/3	66/-
6½	,, ,, ,, 6½% C.P. ..	25/-	25/-	25/9	22/-
7½	,, ,, ,, 7½% B. Pref. ..	27/6	27/6	28/3	25/-
8	Crompton-Parkinson 8% Cum. Pf.	25/-*	25/-	27/-	14/-
6	,, ,, 6% Cum. 2nd Pf.	18/-	18/-	19/6	9/7
7½	Edison Swan Elec. 1st Pref. ..	25/7½	25/7½	13/-	7/4½
5	,, ,, ,, 1st Deb. Stk.	86½	86½	92	81½
7½	Elec. Construction Ord.	20/-	20/-	32/6	23/6
7	,, ,, 7% C.P. ..	22/6	22/6	22/9	21/-
—	English Elec. Ord.	7/6	7/6	15/9	5/-
—	,, ,, 6% C.P. ..	9/4½	9/4½	18/9	7/-
7	Ericsson Telephones 7% Pref. ..	20/-	20/-	22/7½	17/6
35	Ever Ready (Gt. Britain) Ord. ..	22/6	22/6	92/3	18/1
6	Ferranti 6% Pref.	18/-	18/-	19/4½	16/9
7	,, 7% 2nd Pref.	21/3	21/3	19/3	13/9
10	General Elec. Ord.	58/9	55/-	46/6	26/6
‡25	W. T. Henley's Ord.	120/-	120/-	120/-	69/3
12½	Johnson & Phillips Ord.	36/3	38/9	67/11	34/-
7½	Lon. Elec. Wire. & Smith's Pref ..	23/9	23/9	25/-	22/3
7½	Siemens Bros. & Co. Ord. ..	27/6	27/6	36/6	24/9
10	Telegraph Const. Ord. (£12) ..	25½	25½	30½	20
	Telegraph.				
3½	Anglo-Am. Tele. Ord. Stk. ..	61½	61½	63½	56½
10	Eastern Ord. Stk.	267½	269½	273	135
3½	,, 3½% Pref. Stk.	68½	68½	70½	59
4	,, 4% Deb.	79½	79½	81½	74
10	Eastern Extension Ord. (£10) ..	26½	27	27½	14
22	Gt. Northern Telegraph (£10) ..	32	32½	43½	26
10	Indo-European (£25)	55½	55½	48½	30
20	Marconi's Wireless T. Ord. ..	83/9	82/6	84/4	12/-
15	,, Int. Mar.	62/6	65/-	90/-	16/6
10	Western Tel. Ord. (£1)	26½	26½	27½	12½

(a) 19 ½d. per share. (b) 1s. 9·3d. per share. (c) 1s. 6·949d. per share.
(d) 1s. 8·706d. per share. (e) 1s. 7·223d. per share. ‡ Including 1s. bonus.
*Ex dividend.

WARD AND GOLDSTONE, LTD.—Intm. div. of 3½% is announced.

RADIO CORPORATION OF AMERICA.—Gross inc. 1928, $101 861 603, agst. $65 418 620; net inc. $23 661 989, agst. $11 799 650.

CANADIAN GENERAL ELECTRIC CO., LTD.—Qrtrly. div. 1¾% for 3 months endg. March 31, being at rate of 7% p. a., payable April 1.

TRANSMUTOGRAPH, LTD.—This co., which has been formed to manufacture and supply electric luminous devices for showing advertisements and news by day and night, invited subscriptions on March 22 for an issue of 830 000 ord. shs. of 2s. each, at par.

BELL TELEPHONE CO. OF CANADA.—Long distance rev. for 1928 was $8 968 387, agst. $7 950 318, and miscellaneous revs. were $1 336 716, agst. $1 150 520. After provisn. for divs. and placing $250 000 to employees' pension fund, blce. carried to surplus is $931 744.

BRAZILIAN TRACTION, LIGHT AND POWER CO., LTD.—Net earnings for the twelve months are: Earngs. in 1928, $24 869 330, compared with $22 054 622 in 1927. Gross earnings at $42 774 813, increase $4 454 824. Operating exes. $17 905 483, compared with $16 265 367.

OFFICIAL QUOTATIONS.—Stock Exchange Committee granted official quotations to £50 000 5½% 1st mgte. sinkg. fund deb. stk. of the West Gloucestershire Power Co., 897 000 £1, fully pd., ord. shs. and 20 000, fully paid, 6% cum. pref. shs. of Yorkshire Electric Power Co., $12 045 500 cap. stk. of the American Telephone and Telegraph Co., and 43 307 £1, fully pd., ord. shs. of the Underground Electric Railways Co. of London, Ltd.

BRITISH ALUMINIUM CO., LTD.—Net pft. for 1928, £441 383, agst. £432 176. Taxatn. and proportn. of profits payable to directors, £54 096, agst. £49 584; prior lien deb. service, £60 000 (same as last year); deb. stk. service, £43 224 (the same); to res. for depreciatn., £50 000 (the same); res., £100 000 (the same); to staff benefit fund, £10 000 (the same). Div. for year on ord. shs., 10% (the same); fwd., £33 843, agst. £27 858.

CHELSEA ELECTRICITY SUPPLY CO., LTD.—Net pft. for 1928, £82 227. Intm. div. on pref. shs. at rate of 6% p.a. absorbed £900, and intm. div. at rate of 10d. p. sh. on ord. shs. £16 479. Fin. div. on pref. shs. at rate of 6% p.a., makg. 6% for year, and fin. div. on ord. shs. of 11·3d. p. sh. completing standard div. of 8⅞% for year. To special res. fund (ord. shhldrs' proportn. of consumers' benefit for 1926, 1927 and 1928), £5 069; to pensn. fund, £16 220; fwd. £24 039. Electricity sold was 9 465 940 kWh, increase 653 692.

AMERICAN WATER WORKS AND ELECTRIC CO.—Earngs. in 1928, $51 044 689, agst. $48 727 401; exes., maintenance and taxes, $26 027 657, agst. $25 856 535. Int. and amortisatn. of disct. of subsidiaries, $8 084 495, agst. $8 434 592, pfd. divs. of subsidiaries, $5 138 779, agst. $4 665 140; minority interests, $38 339, agst. $71 730; int. and amortisatn. of disct. of co., $1 298 913, agst. $1 215 908; res. for renewals, retirements and depletion, $4 249 009, agst. $3 653 339. Blce. for divs. and surplus, $6 209 495, agst. $2 860 140.

RADIO CORPORATION.—Gross income of Radio Corporation of America and subsidiary cos. for 1928, $101 851 603, agst. $65 418 621, and deductg. total exes. and depreciatn. left net income $23 661 990, agst. $11 799 650. To reserves for amortisatn. of patents, income tax and employees' pension fund and res. agst. foreign investmts., $3 827 191, compared with $3 321 330 for 1927, includg. $750 000 to gen. res. Transferred to surplus, $19 834 799, agst. $8 478 320. Qrtrly. divs. were paid on A pfd. stk. at rate of 7% p.a., and ann. div. of 7% for year was paid on all shs. of original pfd. stk. not yet exchanged for A pfd. stk.

AMERICAN TELEPHONE AND TELEGRAPH CO.—Rev. for 1928, $235 781 978, agst. $216 524 824, Exes., including depreciatn. and taxes, $70 513 928. Net earngs., $165 268 049, agst. $150 383 894. Int. on bonds, debs., etc., $22 097 557, leavg. $143 170 491, agst. $128 614 910. Divs. at rate of $9 p. sh. p. a. on cap. stk. were paid. Surplus for year, $39 349 051, agst. $31 234 976. Total rev. of Bell system, incorporatg. results of American Telephone and Telegraph and its twenty-four associated operatg. cos., exclusive of

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inter-co. duplicatns., amtd. to $975 426 823, agst. $894 699 173. At December 31, 1928 total surplus of system amtd. to $373 797 847, increase $76 844 578.

AMERICAN RADIO AND TELEGRAPH MERGER NEGOTIATIONS.—The Radio Corporation and the International Telephone and Telegraph Co. announce that the agreement reported to have been reached between them was merely an accord as to the desirability of a consolidation of their communications interests and a tentative plan under which this might be accomplished when the law so permitted. The managements are aware of what has taken place in the British Empire, France, Germany and Italy in the unification of communications, and believe that it would be to the interest of the United States to have a corresponding unification. In the annual report of the Western Union Telegraph Co. (which discussed similar proposals with the Radio Corporation recently), Mr. Newcomb Carlton, the president, declares in favour of wires in preference to the air as a means of communication. He says, however, that the company is waiting with an open mind for a demonstration of a comprehensive system by radio.

GENERAL ELECTRIC CO., LTD.—At an extraordinary gen. mtg. on March 28, the shhldrs. confirmed the resolutn. passed at a mtg. on March 13, altering the articles of associatn. so as to provide that of the 4 000 000 ord. shs., 1 600 000 are called British ord. shs., and that such British ord. shs. shall not be issued or registered in the name of any foreigner, foreign corporatn., or corporatn. under foreign control, that no transfer of British ord. shs. shall be made to any foreigner, foreign corporatn., or corporatn. under foreign control, and that the directors shall refuse to register any such transfer. At the mtg. on March 28, Sir Hugo Hirst (chn.) said prior to the mtg. of March 13 the co. had entered into an agreement with the British Foreign and Colonial Corporation for the sale of 1 500 000 British ord. shs. for £3 000 000 sterling. The directors had requested the B.F.C. to do what they could in mtg. the objectns. which had been raised by the holders of shs. in America. Two representatives of the committee of American shhldrs. were on their way from America, and the B.F.C. had submitted to them, and to the board, a scheme which appeared to be fair and reasonable to all interests concerned. The scheme was explained in a telegram which the B.F.C. had forwarded to the American representatives then on board the "Aquitania," and of which they had sent the co. a copy. In the telegram the suggestn. was made that arrangemt. be made for the co. to issue 140 853 shs. in the proportn. of one to 16 to existg. shhldrs. at a price to be agreed upon, but not being more than 40s., makg. the issued ord. sh. cap. 2 394 498; that the co. offered two British shs. in respect of every three shs. then held by shhldrs., irrespective of nationality or residence, which wd. absorb 1 596 332 British shs.; and the three Stock Exchange accts. terminatg. say, at the end of May next, be allowed for shhldrs. desiring, or by reason of nationality required to dispose of their rights, to do so. Any rights not sold by, say, the end of May, the Corporation would be prepared to purchase at a price to be agreed. By this method all but 9 170 shs out of the total authorised issue of four million shs. would be absorbed, and these shs. should be left available for issue to co.'s staff at discretion of managemt. The American representatives, Mr. Thos. L. Chadbourne and Mr. H. B. Swope, arrived in London at the end of last week, and had an interview with Sir Hugo Hirst and Mr. M. J. Railing on Tuesday, when the definition of principles was discussed. The company announces that the conversations are to continue on a date not yet fixed.

Company Meetings.

ELGIN ELECTRIC SUPPLY CO., LTD.—Lord Provost Wittet presiding at the recent annual meeting, said they were now in a flourishing, solvent and happy condition. Their plant and buildings were a model for undertakings of that size. The profit for the past year was £2 701. A dividend of 5% was declared, and it was decided to reduce the charge for electricity from 1s. to 10d. per kWh.

FOLKESTONE ELECTRICITY SUPPLY CO., LTD.—Ald. George Spurgeon, presiding at the meeting on March 22nd, said the maximum output of the station was 3 078 kW (in December, 1928), representing an additional 138 kW over 1927, affirming his previous statement that the demand had not reached anything like saturation point. Receipts during the past year were £92 960, an increase of £3 157, although reductions in prices equal to £5 000 were made. The directors recommended a dividend of 6%, tax free, on the ordinary shares, making 10% for the year. Rates and taxes averaged no less than 0·935d. per kWh sold. They had not been able to accept without protest an increase of some 350% in their Folkestone assessment, compared with a general average increase for the town of about 20%, and the board had lodged an appeal.

ENFIELD CABLE WORKS, LTD.—Under the name of the Enfield Cable Works, Ltd., on page 401 of our issue of March 29th, we published, by mistake, particulars of a meeting of another company. At the meeting of the Enfield Cable Works, Ltd., on March 20th, the Earl of Verulam, who presided, dealt with the figures in the accounts. In the course of his remarks, he stated that the profit in the 18 months covered by the accounts was £162 000, equal to £108 000 in 12 months, compared with £102 000 for the year to June, 1927. To complete the dividend of 20% per annum for the 18 months, the board recommended a final dividend of 10%, and they suggested putting £40 000 to reserve and carrying forward £31 649. The report and accounts were adopted, and at a subsequent extraordinary general meeting a resolution was passed to increase the capital to £800 000 by the creation of 350 000 new £1 ordinary shares.

Road Competition.

ISLE OF THANET ELECTRIC SUPPLY CO., LTD.—At the meeting on March 13th, Mr. A. R. Monks, chairman, said owing to increasing competition from motor buses during 1928 the company augmented its tramway services and reduced its fares, and the financial results were, therefore, less favourable than those for the previous year. Their lighting and power business continued to develop, although there had recently been a slight falling off in applications from new consumers. Gross profits were £73 416, an increase of £862. After provision for debenture stock interest and sinking fund, reserve and depreciation accounts, dividend on preference shares, etc., a dividend of 4% on the ordinary shares was proposed. With regard to reports in the Press relative to that company being acquired by one of the larger lighting and power companies, the board had no knowledge of any such proposal. The report and dividends were approved.

LLANELLY AND DISTRICT ELECTRIC SUPPLY CO., LTD.—Mr. A. H. Beatty, presiding at the meeting on March 26th, said the accounts showed a substantial improvement in the trading results, the balance carried to net revenue account being £52 425, an increase of nearly £10 000. The new power plant had been in continuous service since it was put on load in November last, and was operating satisfactorily. During the year 498 new consumers were added and a total of 21 843 400 kWh was sold, compared with 18 300 201. The traction side of the business was affected by motor 'bus competition, but showed some improvement. Although the results of the year were satisfactory, the time had not quite arrived when they could recommend the resumption of dividends on the ordinary shares. If the improvement in trade continued, he thought they could hold out hopes of a resumption of ordinary share dividends at an early date.

PINCHIN, JOHNSON AND CO., LTD.—Mr. Edward Robson, presiding at the meeting last week, moved the adoption of the report and accounts, and that a final dividend on the ordinary shares of 20%, making 30% for the year 1928, less tax, be declared. The net profit, he said, amounted to £422 796, a further record. In every department of the undertaking they were able to record improved results. In practically every market, at home and abroad, further advances had been made in sales, and their manufacturing, marketing and distributing arrangements in the various markets had been further developed and consolidated. After the adoption of the report and the approval of the dividend, the chairman moved that the sum of £344 989, part of the sum standing to reserve, be applied in paying up in full 344 989 £1 ordinary shares, and that such shares be allotted, credited as fully paid, to the ordinary shareholders in proportion to the number of shares held by them. The resolution was passed, and, at a subsequent extraordinary meeting, it was resolved that the £1 ordinary shares be divided into ordinary shares of 10s. each.

INTERNATIONAL AUTOMATIC TELEPHONE CO., LTD.—Sir Alexander Roger, presiding at the meeting on March 27th, said the profit for the past year was £130 823, compared with £124 369. After paying for preference dividend and interim dividend on the ordinary shares, it was proposed to transfer £10 000 to reserve and to pay a final dividend of 6¼%, less tax, on the ordinary shares, making 10% for the year, a bonus of 2½%, less tax, on the ordinary shares, and a dividend of 10%, with a bonus of 2½%, less tax, on the deferred shares, leaving £69 735 to carry forward, against

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£59 292. Competition in their field, which lay overseas entirely, continued to be keen, and changes and developments were constantly taking place. By reason of the excellence of the products of Automatic Telephone Manufacturing Co., and the standing which the Strowger system had secured throughout the world, they had hitherto secured their fair share of the business available, and with the resources at their disposal, both technical and financial, they hoped to continue to secure their share.

The N.E. Coast Exhibition and Electricity.

NEWCASTLE AND DISTRICT ELECTRIC LIGHTING CO., LTD.—Col. F. R. Simpson, presiding at the recent annual meeting, said the steady increase in the demand for electricity continued, its advantages for 'cooking and heating being more widely recognised. The cost of wages, salaries, coal and repairs during the past year was £47 048, an increase of £337; rent, rates, taxes and insurance amounted to £21 962, increase £2 481. The amount paid in local rates was £10 090, and he regretted that, owing to the company being a public utility company, no relief could be obtained under the new Rating Act. The total receipts for energy supplied and for rents increased £3 599. Electricity sold showed an increase of 8%. The directors had decided to make some reduction in the price charge for lighting, but they fully anticipated that it would lead to an increased consumption, and, in addition, it was contemplated that more current would be used this summer on account of the exhibition. The net profit for the year was £17 906, which, added to £15 658, brought forward, made an available balance of £33 564, which the directors recommended should be dealt with in the payment of a dividend at the rate of 7½%, less tax, for the year, carrying forward £15 564.

EINSTEIN ELECTRO-CHEMICAL PROCESS, LTD.—At the statutory meeting last week, Col. the Master of Sempill (chairman) said the process to be practised by the company was the result of some 20 years' research, and constituted a number of improvements on existing practice, and enabled the art of electro deposition to be greatly extended on a commercial scale. There was a big field for the extension of the process, not only in present methods of manufacture, but in new ideas, and opening fresh possibilities to industries. They had taken on lease a factory at Slough, and it was hoped that production would commence in about three months' time. Mr. Einstein, at his own request, had been relieved of the routine duties of managing director, and was, at present, concentrating, with the other technical staff, on the lay-out and equipment of the factory. The company had secured the services, as general manager, of Mr. H. Kerr Thomas, who had been for ten years in charge of the Pierce-Arrow automobile factory in the U.S.A. Negotiations for the sale of foreign rights and the granting of licences to important firms were proceeding. The company had actually received 1 107 trade inquiries from the United Kingdom, 40 trade inquiries from foreign countries, 58 applications for the granting of licences in the United Kingdom and 105 applications for the sale of patent rights and the grant of foreign licences.

RADIOVISOR FOREIGN AND COLONIAL, LTD.—At the statutory meeting last week, the Duke of Atholl (chairman) said no time had been lost in starting negotiations for the sale of their rights to the chief electrical manufacturers on the Continent. During the last four weeks their managing director and general manager had been almost continuously on the Continent, assisting with the testing of their products by the distinguished scientists appointed by the concerns with whom they were in negotiation. According to the reports received from the manufacturers concerned, the tests had shown that the company's light-sensitive bridge had properties which, for certain purposes, made it superior to any other device of a like nature. In the course of a few days they anticipated being able to make a satisfactory agreement for the manufacture and distribution of their devices throughout the Continent of Europe by one of the most powerful firms of electrical engineers in the world. The patent position had been greatly strengthened by the grant of letters patent for their basic invention, corresponding to British Letters Patent No. 284 942 of 1927, in Belgium, France, South Africa and Spain, and acceptances in Denmark, Canada, India, Japan, Russia, Yugoslavia, and New Zealand. They intended to send a demonstration plant to New York.

BRITISH ALUMINIUM CO., LTD.—Lt.-Col. S. H. Pollen, presiding at the meeting on March 27th, said the net profit for the past year was £441 383, against £432 176 for the previous year. In the field of electrical industry a most striking expansion of the use of the metal had occurred in recent years, and the year 1928 showed a considerable advance in this direction over its predecessors. Stranded aluminium cables with a core of steel had established themselves still more firmly as serious rivals to copper cables for power transmission, because, for equal conducting capacity, they were stronger, lighter and considerably cheaper. These conductors had been adopted for the British national grid of high voltage lines which were being erected under schemes approved by the Central Electricity Board. For the first two sections of the grid a total of some 3 500 miles of conductor was required, and the metal for these conductors had been ordered from the company. With regard to the Lochaber water power works, the concrete lining of the tunnel had progressed at an increasing rate throughout the year, and at the present date approximately seven miles out of the total length of fifteen had been lined. The board had every hope that the contract would be completed and that the factory would be in operation in the course of the current year. The report and accounts were adopted.

AUTOMATIC TELEPHONE MANUFACTURING CO., LTD.—Sir Alexander Roger, presiding at the meeting last week, said, after dealing with the directors' report (abstracted in our issue of March 22nd), the position to-day was that there were 72 000 lines of Strowger equipment completed by, and on order, with the company, of which nearly 35 000 lines were already in service. To this total they should add the Coder call indicator equipment, averaging three positions at each of some 80 manual exchanges and mechanical tandem exchanges, equipped by them for inter-communication during the transition period. They were now engaged in the manufacture of the equipment for the main Strowger automatic exchange at Blackfriars, Manchester. Development and research continued an all-important part of their work, since it represented a protective measure ensuring that the company kept in the forefront of the art. Within the period under review the company had shipped additional apparatus for extending eleven exchanges in the Buenos Ayres (Argentine) network. Australian orders included equipments for three new Strowger exchanges, while an equipment for Mansoura marked the introduction of Strowger automatic telephones into Egypt. The "Xcel" domestic appliances branch of their business, centred at the Broadgreen factory, continued to expand in spite of a highly competitive market, and their sales of these appliances were up by 80%. The report was adopted, and the dividend of 6¼%, making 10% for the year, and a bonus of 2½%, less tax, were approved.

Trade Difficulties in the North.

NEWCASTLE-UPON-TYNE ELECTRIC SUPPLY CO., LTD.—At the annual meeting on March 26th, Mr. R. P. Sloan, chairman, said last year proved to be one of the worst periods experienced by the coal trade in Northumberland and Durham, excluding the strike year, 1926, and no great improvement was shown in shipbuilding and engineering. The year's profit showed an improvement of £35 963, which he thought satisfactory, bearing in mind the unsatisfactory condition of trade generally. The transfer to general reserve was the same as in the previous year, £150 000, but the transfer to renewals and improvements reserve had been increased to £60 000, against £50 000. The directors recommended a dividend at the same rate as that paid in the previous year, viz., 6%, and that the balance of profit be carried forward, which would make the total sum to be carried forward to the current year £80 653. The expenditure on capital account during the year amounted to £318 811. Additions to reserve for special depreciation and contingencies amounted to £319 890, made up of £150 000 from profit, £8 159 contributions from consumers towards cost of connections, and £161 731 premiums received on account of issue of ordinary shares. After provision for items on the debit side, including the balance of the item representing discount on and expenses of issue of debenture stocks, which totalled £409 074, they were still left with the substantial balance of £761 359 in this reserve. They were continuing to develop their domestic business, principally concentrating on the filling up of networks already laid. The Derating Act, in effect, put a premium on privately owned stations, which would be an inducement to the continuance of those now in operation and might also prove an inducement to installing new private plants. The report was adopted, and dividends of 3½% on the 7% cumulative preference shares, making 7% for the year, 2½% on the 5% preference shares, making 5% for the year, and 3½% on the ordinary shares, making 6% for the year, all less tax, were approved.

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NEW COMPANIES.

EROS (DUNDEE), LTD.—Cap., £2 000. Electricians, electrical engineers, etc. Reg. Office: 27, Crichton Street, Dundee.

G. F. BILLING & Co., LTD.—Cap., £100. Electricians, wireless engineers, etc. Reg. Office: 41, Cheapside, London, E.C.2.

AUTOCAR ELECTRICAL CO., LTD.—Cap., £2 500. Electricians, battery chargers, etc. Solicitor: H. H. Vowles, 65, Northgate Street, Gloucester.

SERVALL ELECTRIC CO., LTD.—Cap., £1 000. Electrical and general engineers, contractors, etc. Reg. Office: 46, Hamilton Road, Cambuslang.

BRITISH ELECTRICAL GRID CO., LTD.—Cap., £300. Electricians, electrical and general engineers, etc. Reg. Office: 45/6, West Sunniside, Sunderland.

ELECTRICAL MANUFACTURERS FINANCE CO., LTD.—Cap., £10 000. Financiers, bankers, etc. Solicitor: A. R. Monks, Crown House, Aldwych, London, W.C.2.

ACCUMULATOR CO. OF SCOTLAND, LTD.—Cap., £100. Manufacturers and repairers of batteries and magnetos, etc. Reg. Office: 101, West Nile Street, Glasgow, C.1.

EAST DEVON ELECTRICITY CO., LTD.—Cap., £10 000. To carry on business of electricity supply company. Solicitor: Horace Davey, 47, Parliament Street, London, S.W.1.

MODERN ELECTRICAL SUPPLIES (LEEDS), LTD.—Cap., £500. Electricians, electrical engineers and contractors, suppliers of electricity, etc. Reg. Office: 98B, North Street, Leeds.

SUN-RAY ELECTRIC LAMP CO., LTD.—Manufacturers of and dealers in electric lamps, fuses and signs, dealers in electrical and wireless apparatus, etc. Reg. Office: Wash Lane, Clacton-on-Sea.

E. JEFFERY, LTD.—Cap., £1 000. To acquire business of manufacturing electrical engineers, etc., heretofore carried on at 22, Denmark Place, Charing Cross Road, London, W.C. as "Jeffery and Co."

GORDON HUGHES ELECTRICAL CO., LTD.—Cap., £1 000. Electrical contractors, manufacturers of and dealers in electrical accessories, wireless, telegraphy, telephony and television parts, etc. Reg. Office: 163, Moor Street, Birmingham.

BRITISH AND POLISH ENGINEERING CO., LTD.—Cap., £5 000. To acquire and obtain contracts for the construction of electric lighting plants, etc., in Poland or elsewhere in Europe, etc. Reg. Office: Lincoln House, 300, High Holborn, London, W.C.1.

SOUTHERN COUNTIES ENGINEERING CO., LTD.—Cap., £2 000. To acquire business of general engineers at present carried on as the "Southern Counties Engineering Co." and to carry on business of general and electrical engineers, etc. Reg. Office: Trading Estate, Slough, Bucks.

BRECKNELL, WILLIS AND CO., LTD.—Cap., £20 000. To adopt agreement with Thrissell Engineering Co., Ltd., to carry on business of traction engineers, formerly carried on at Jacob Street, Bristol, and that of mechanical and electrical engineers, dealers in electrical apparatus. Reg. Office: 114, Jacob Street, Bristol.

MEECH ELECTRIC DRIVES, LTD.—Cap., £5 250. Electrical and general engineers, contractors for and dealers in electric motors, electric switch gear, control gear, and all appliances and apparatus for generation, supply, use and control of electric power, etc. First director: J. Meech, 95, Mayow Road, Sydenham, London, S.E.26.

METAL AND CHEMICAL PRICES.

TUESDAY, April 2nd.

		Price.	Inc.	Dec.
Copper—				
Best Selected ..	per ton	£105 0 0	—	—
Electro Wirebars	,,	£111 0 0	—	£1 12 6
H.C. Wires, basis	per lb.	1s. 2 11/16d.	—	¼d.
Sheet	,,	1s. 2 13/16d.	—	—
Phosphor Bronze—				
Wire (Telephone) basis	per lb.	1s. 5 11/16d.	—	¼d.
Brass 60/40—				
Rod, basis ..	per lb.	9d.	—	—
Sheet ,, ..	,,	1s. 0⅛d.	—	—
Wire ,, ..	,,	1s. 0⅛d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£3 9 6	—	—
Galvanised Steel Wire, basis 8.S.W.G. ..	,,	£14 15 0	—	—
Lead Pig—				
English	per ton	£27 15 0	—	15s. 0d.
Foreign or Colonial	,,	£26 7 6	—	5s. 0d.
Tin—				
Ingot	per ton	£220 7 6	—	7s. 6d.
Wire, basis ..	per lb.	2s. 10½d.	—	—
Aluminium Ingots	per ton	£95 0 0	—	—
Spelter	,,	£27 10 0	5s. 0d.	—
Mercury	per bottle	£22 5 0	—	—

Sulphur—Flowers, Ton £12 0 0 *Sulphuric Acid*—
,, Roll ,, £10 10 0 (Pyrites, 168°) Ton £6 15 0
Copper Sulphate ,, £25 to £25 10 0 *Sodium Chlorate* per lb. 2½d.
Boric Acid (Crystals),, £30 0 0 *Sodium Bichromate* per lb. 3½d.
Rubber—Para fine, 1s. 0½d.; plantation, 1st latex, 11⅛d.

The metal prices are supplied by British Insulated Cables Ltd.

COMMERCIAL INFORMATION

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debt. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

CHAPMAN, Mr. J., 29, Grovedale Road, Mossley Rill, electrical engineer. £15 15s. 6d. January 22nd.

HACKETT, Alfred Reginald, 185, London Road, Hazel Grove, motor engineer and wireless dealer. £22 19s. 8d. December 12th.

HAMBLING, CLAPP AND CO., LTD., 21, Garrick Street, W.C., wireless factors. £10 12s. 10d. January 1st.

HAYES END ELECTRICAL STORES, London Road, Hayes End, electricians. £22 8s. January 28th.

HOOK, Victor, Electric Light Yard, West Street, Bromley, electrical engineer. £22 11s. 2d. January 18th.

SMITTEN, A. E., 110, Forest Road, Leicester, electrical engineer. £19 19s. 1d. December 19th.

Deeds of Arrangement.

FRY, Horace Dorland, trading as ASHTON ELECTRIC CO. and ASHTON SERVICE CO., 33, Naylor's Row and 5, Spring Bank, Hull, dealer in wireless and electrical apparatus. Dated March 20th, filed March 27th. Trustee, S. G. Oxley, Commercial Chambers, Commercial Road, Hull, I.A. Liabilities unsecured, £1 545; assets, less secured claims, £497.

RUTHERFORD, Albert, Plowmans Yard, Church End, and 20, West Way, Finchley, electrician. Dated March 13th, filed March 20th. Trustee, W. A. J. Osborne, 119, Finsbury Pavement, E.C., accountant. Liabilities unsecured, £689; assets, less secured claims £175.

Bill of Sale.

ROBINSON, George William, 74, Northumberland Road, Old Trafford, electrical engineer. Dated March 18th, filed March 19th. £40.

Mortgages.

[NOTE.—*The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—allowed by the date of the Summary, but such total may have been reduced.*]

ALLITE, LTD., London, E.C., dealers in electrical goods, etc.—Registered March 18th, £2,000 debentures; general charge.

BAXTER AND CAUNTER, LTD., London, W., electricians.—Registered March 19th, debenture and two Land Registry charges collateral thereto, to Bank; charged on 219, Tottenham Court Road, and 8, Alfred Place, also general charge. *£12 440. July 17th, 1928.

London Gazette, etc.

Companies Winding-up Voluntarily.

ELECTROMOTORS, LTD. By special Resolutions, March 11th, confirmed March 26th. F. S. Abbott, chartered accountant, 40, South King Street, Manchester, appointed as liquidator for the purposes of amalgamation. Meeting of the creditors at the offices of Abbott and Son, 40, South King Street, Manchester, on Thursday, April 11th, at 2.30 p.m. All creditors will be paid in full.

SWINDEN AND CO., LTD.—By reason of its liabilities, March 26th. R. M. Pembridge, chartered accountant, Lincoln House, 296, High Holborn, London, W.C., appointed as liquidator. Meeting of creditors at the Institute of Chartered Accountants, Moorgate Place, London, E.C.2 (entrance, Great Swan Alley), on Thursday, April 11th at 3 p.m.

Winding-up Petition.

ZONE WIRELESS CO., LTD. A creditor's petition for winding-up has been presented by Marconi's Wireless Telegraph Co., Ltd., Marconi House, Strand, London, W.C., and is to be heard at the Royal Courts of Justice, Strand, London, on April 15th.

Bankruptcy Information.

SMITH, Boulton (trading as H. WORTON), The Crescent Spalding, electrical engineer. Receiving order, March 23rd. Debtor's petition. First meeting, April 5th, 11.30 a.m., White Hart Hotel, Spalding. Public examination, April 26th, 10.45 a.m., Law Courts, Peterborough.

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PATENT RECORD.

The following information is prepared from the Illustrated Official Journal (Patents) by permission of the Controller of H.M. Stationery Office. Printed copies of full Patent Specifications, when accepted, may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at 1s. each.

Specifications Accepted.

306 172 E. F. Russ. Induction furnaces. (15/11/27.)
306 197 A. Reyrolle and Co., Ltd., B. H. Leeson and R. H. Brierly. Electric fuses. (21/11/27.) (Addition to 276 740.)
306 198 A. Reyrolle and Co., Ltd., J. Mirrey and A. Allan. Electric switches. (21/11/27.)
306 211 E. W. Challans and Westinghouse Brake and Saxby Signal Co., Ltd. Electromechanical devices of the induction type. (29/11/27.)
282 392 R. Sarazin. Electrode holders for arc welding. (18/12/26.)
306 232 T. F. Wall. Electromagnetic testing of steel-wire ropes and other articles of magnetisable material. (20/12/27.)
282 766 British Thomson-Houston Co., Ltd. Electric discharge devices. (23/12/26.)
301 478 Langbein-Pfanhauser-Werke Akt.-Ges. Electrolytic deposition of chromium. (1/12/27.)
306 249 J. A. Crabtree and J. R. Dolphin. Manufacture of moulded articles, such as switch bases, fuse holders and other electrical apparatus. (12/1/28.)
306 253 A. F. Pollock and D. A. Pollock. Inter-valve couplings for thermionic valves. (16/1/28.)
306 268 W. Bryan. Loud-speaker apparatus for wireless telephony. (6/2/28.)
306 278 E. J. Marriott and C. French. Loud-speaking apparatus for wireless or other purposes. (11/2/28.)
306 281 M.O. Valve Co., Ltd., A. L. Reimann and J. W. Ryde. Manufacture of thermionic cathodes for electric discharge devices. (20/2/28.)
306 292 J. L. V. Armstrong (Telefunken Ges. fur Drahtlose Telegraphie). High-frequency telephone systems. (3/3/28.)
286 647 British Thomson-Houston Co., Ltd. Electric meters. (7/3/27.)
296 363 Siemens and Halske A.G. Circuit arrangement for telephone installations with main and branch exchanges and selector working. (30/8/27.)
296 424 Siemens and Halske A.G. Circuit arrangement for double-duty selectors in telephone installations. (1/9/27.)
306 312 E. Thomas and Williams, Ltd., and J. Bowen. Electric accumulators. (2/4/28.).
288 606 International General Electric Co., Inc. Current transformers. (13/11/27.)
306 323 Siemens Bros. and Co., Ltd., and D. P. Long. Telephone systems. (17/4/28.)
296 299 Siemens-Schuckertwerke A.G. Sheet-metal laminated cores for dynamo-electric machines. (27/8/27.)
306 336 Maxlume Lighting and Heating Co., Ltd., and F. W. Thorpe. Electric light fittings. (4/5/28.)
306 337 C. Nunn. Electric switchgear. (4/5/28.)
291 058 British Thomson-Houston Co., Ltd. Induction voltage regulators. (25/5/27.)
306 344 Hermsdorf-Schomburg-Isolatoren Ges. Protective arrangement for springs used in association with electrical apparatus. (1/5/28.)
292 922 Metropolitan-Vickers Electrical Co., Ltd. Electrical circuit-controlling apparatus. (24/6/27.)
294 171 Siemens Schuckertwerke A.G. Liquid seal between chambers or spaces of different pressure. (19/7/27.)
295 710 Dr. W. Rogowski and Dr. E. Flegler. Cathode-ray oscillographs. (18/8/27.)
295 592 Felten and Guilleaume Carlswerk A.G. Avoidance of cross-talk in telephone cables. (11/8/27.)
295 601 Marconi's Wireless Telegraph Co., Ltd. Means for transmitting radiant energy such as light, and apparatus for use therewith. (13/8/27.)
297 004 Marconi's Wireless Telegraph Co., Ltd. Circuit arrangements for use in high-frequency communication systems. (10/9/27.)
301 021 Siemens Schuckertwerke A.G. Electric signalling circuit for use in mines. (23/11/27.)
306 378 C. O. G. Taylor. Trolly-heads for electric traction. (14/9/28.)

Applications for Patents.

February 7th.

4 149 Accumulatoren Fabrik A.G. Accumulator battery. (27/2/28, Germany.)
4 163 Anglo-American Chemical Co., Ltd., and R. M. Burlison. Loud speakers.
4 189 Associated Telephone and Telegraph Co. Telephone systems. (17/3/28, U.S.)
4 066 A. H. Avery. Connection indicator for electrical machines.
4 063 A. V. Gee. Electric switch.
4 126 H. T. Harrison. Thermal storage appliances.
4 127 H. T. Harrison. Electric water heating appliances.
4 128 H. T. Harrison. Electric thermostats.
4 056 C. Harvey and C. Harvey and Co. Electric candles.
4 172 Igranic Electric Co., Ltd., and A. H. Mackley. Counting systems.
4 087 A. D. Jones. Method of amplifying electrical impulses.
4 129 R. Jones. Variable condensers.
4 122 R. G. Kennard. Electric headphones, etc.
4 072 E. C. Maccormac. Electric lighting equipment for vehicles, etc.
4 186 N. V. Philips' Gloeilampenfabrieken. Automatic electric switches. (29/2/28, Holland.)
4 110 F. W. Read. X-ray, etc., apparatus.
4 180 A. H. Seabrook. Conductors for electricity.
4 106 C. H. W. Brookes-Smith and Standard Telephones and Cables, Ltd. Wireless signalling.
4 107 Standard Telephones and Cables, Ltd., and E. P. G. Wright. Telephone systems.
4 055 A. M. Taylor. Electrical power transmission.
4 182 Telefunken Ges fur Drahtlose Telegraphie. Radio direction finding apparatus. (8/2/28, Germany.)
4 170 L. D. J. Tisseyre. Electric furnaces. (8/2/28, France.)

February 8th.

4 266 Associated Electrical Industries, Ltd., and F. E. Bancroft. Electric light fittings, etc.
4 316 Automatic Telephone Manufacturing Co., Ltd., and P. N. Roseby. Magnet cores for loading coils, etc.
4 317 Automatic Telephone Manufacturing Co., Ltd. Imitation fires.
4 249 British Thomson-Houston Co., Ltd. Protection of electric systems. (8/2/28, U.S.)
4 310 A. M. H. R. Brown and S. G. Brown, Ltd. Sound reproducing, etc., instruments.
4 330 F. E. Dadd. Electric lamp holders.
4 242 D. Dunnett. Ignition apparatus.
4 251 Edison Swan Electric Co., Ltd., and L. H. Soundy. High frequency signal receiving systems.
4 264 A. N. Erickson. Measuring electrical potential, etc. (25/2/28, U.S.)
4 244 C. Lorenz A.G. Picture transmission. (8/2/28, Germany.)
4 330 W. McLaren. Electric lamp holders.
4 295 N. V. Ingenieurskantoor voor Scheepsbouw and Svenska Aktiebolaget Tradlos Telegraphi System Telefunken. Apparatus for wireless bearing finding, etc. (19/4/28, Germany.)
4 255 A. F. and D. A. Pollock. Thermonic valves.
4 204 F. H Reeves and Revo Electric Co., Ltd. Electric lamp fittings.
4 332 A. H. Seabrook. Conductors for electricity.
4 282 H. Sonnenfeld. Electric cables. (6/12/28. Austria.)
4 298 L. M. Ericsson Telefonaktiebolaget. Band filters for telephone systems. (27/2/28, Sweden.)
4 435 C. A. Turner. Electric switches. (15/11/27.)
4 264 V. M. Vertucci, Measuring electrical potential, etc. (25/2/28, U.S.)
4 203 P. L. de Voy. Means for joining electrical cables, etc.

February 9th.

4 445 E. A. Bayles and British Insulated Cables Ltd. Coating wires with metal.
4 444 F. L. Brislee and British Insulated Cables, Ltd. Insulation of electric cables.
4 419 A. P. C. Collier and E. F. Stephenson. Electric circuit control devices.
4 369 J. A. Crabtree. Electric insulators.
4 416 E. J. Francois. Electric wire attachments.
4 417 W. Germershausen. Electric discharge tubes. (14/2/28, Germany.)
4 371 J. A. Higgins. Automatic electric switches.
4 411 R. G. Kennard. Magnetic relay amplifiers, etc.
4 356 Landis and Gyr Soc. Anon. Driving system for a.c. meters. (24/3/28 Switzerland.)
4 426 C. Lorenz Akt. Ges. Apparatus for transmission, etc., of ultra short waves. (12/5/28, Germany.)
4 384 F. Merk. Telephone installations. (5/3/28, Germany.)
4 405 B. D. Space. Thermostatic device for controlling electric circuits.
4 364 E. A. Tyrrell. Electrical signal apparatus for motor cars.

COMING EVENTS.

Friday, April 5th.

Institute of Transport (Leeds and District Section).—Annual genera meeting. 7 *p.m.*

Institution of Electrical Engineers (Meter and Instrument Section).—Institution, Savoy Place, Victoria Embankment, London. Paper by Mr. E. W. Hill on "Some Technical Considerations Concerning Power Factor in Relation to Tariffs." 7 *p.m.*

Institution of Electrical Engineers (North-Eastern Centre Students' Section).—Lighting Service Bureau, Dial House, Northumberland Street, Newcastle-on-Tyne. Annual general meeting. 7.15 *p.m.*

Monday, April 8th.

Royal Institution of Great Britain.—21, Albemarle Street, London. General meeting. 5 *p.m.*

Electrical Contractors' Association (Hastings Sub-Branch).—Lewcocks' Restaurant. Ordinary meeting.

Electrical Contractors' Association (Liverpool Branch).—Ordinary meeting. 3 *p.m.*

Institution of Electrical Engineers (Western Centre).—Council Chamber, Guildhall, Plymouth. Lecture by Mr. H. C. Sanders, on "Water Heating." 6 *p.m.*

Institution of Electrical Engineers (North-Eastern Centre).—Armstrong College, Newcastle-on-Tyne. Annual general meeting. Paper by Mr. B. L. Goodlet on "The Testing of Porcelain Insulators." 7 *p.m.*

Tuesday, April 9th.

Electrical Contractors' Association (Leicester Branch).—Corridor Chambers. Ordinary meeting.

Electrical Contractors' Association (Swansea Branch).—Ordinary meeting.

Institution of Civil Engineers.—Great George Street, Westminster. Paper by Mr. H. Hall on "The New Piccadilly Circus Station." 6 *p.m.*

Institution of Electrical Engineers (North-Western Centre).—17, Albert Square, Manchester. Annual general meeting. Papers by The Hon. Sir C. A. Parsons, F.R.S. and Mr. J. Rosen on "Direct Generation of Alternating Current at High Voltages," and Mr. J. A. Kuyser on "Recent Developments in Turbo-Generators." 7 *p.m.*

Institution of Electrical Engineers (North Midland Centre).—Hotel Metropole, King Street, Leeds. Annual general meeting. 7 *p.m.*

Institution of Electrical Engineers (Scottish Centre).—Royal Technical College, Glasgow. Annual general meeting. Paper by Messrs. E. B. Wedmore, W. B. Whitney and C. E. R. Bruce on "An Introduction to Researches on Circuit Breaking." (Electrical Research Association Report.) 7.30 *p.m.*

Electrical Association for Women (Manchester Branch).—Corporation Electricity Showrooms, 28, St. Ann Street. Lecture by Miss G. L. Entwisle on "Elementary Facts about Electricity." 7.30 *p.m.*

Electrical Contractors' Association (Bournemouth Branch).—Ordinary meeting. 7.30 *p.m.*

Wednesday, April 10th.

Rugby Engineering Society.—Benn Buildings. Paper by Mr. H. Jack on "Recent Developments in A.C. Machines."

Electrical Contractors' Association (Eastbourne Sub-Branch).—South Street. Ordinary meeting.

Electrical Contractors' Association (Sheffield Branch).—Ordinary meeting. 5.30 *p.m.*

Institute of Fuel.—Chemical Society, Burlington House, Piccadilly, London. Paper by Major W. Gregson, "Some Notes on Waste Heat Recovery." 6 *p.m.*

Royal Society of Arts.—John Street, Adelphi, London. Lecture by Mr. G. H. Nash on "Some Modern Aspects of Electrical Communication." 8 *p.m.*

Thursday, April 11th.

Electrical Contractors' Association (Birmingham Branch).—Ordinary meeting.

Electrical Contractors' Association (Nottingham Branch).—Ordinary meeting.

Electrical Contractors' Association (East Yorks Branch).—Metropole Hall, Hull. Ordinary meeting.

Institution of Electrical Engineers.—Institution, Savoy Place, Victoria Embankment, London. Paper by Mr. B. L. Goodlet on "The Testing of Porcelain Insulators." 6 *p.m.*

Friday, April 12th.

Royal Society of Arts.—John Street, Adelphi, London. Lecture by Mr. A. T. Cooper on "Recent Electrical Developments in India." 4.30 *p.m.*

Saturday, April 13th.

Association of Mining Electrical Engineers (Western Sub-Branch).—Swansea. Annual dinner.

Institution of Electrical Engineers (South Midland Students' Section).—Afternoon visit to Messrs. General Electric Co., Witton.

LONDON ELECTRICAL ENGINEERS (R.E.).

26th A.A. Battalion R.E. (T.A.).—Arrangements have been made for single-day camps at the School of A.A. Defence, Biggin Hill, on the following dates:—301 Coy., April 20th–21st; 303 Coy., May 4th–5th; 302 Coy., June 8th–9th. The annual camp will be held at Manston (near Margate) from August 18th to September 1st, and it is hoped again to arrange for detachments to live out on the searchlight sites. Lt.-Col. E. V. Gabriel has been appointed Honorary Colonel of the Battalion. The telephone number of Battalion Headquarters at the Duke of York's Headquarters has been changed to Sloane 8866.

27th A.A. Battalion R.E. (T.A.)—In Battalion Orders for April the retirement of Capt. S. W. P. Goodwin is announced on attaining the age limit. A new Trade Testing Board has been appointed, with Major P. F. Foulger as President. The members are: Capt. H. Leigh, Lt. T. H. Solomon, Lt. F. B. Allcock, and 2nd Lt. W. H. Stillwell, with 2nd Lt. H. Wright in attendance. Recruiting has been good, over 40 having joined since last camp, but more recruits are urgently needed. The Officers' Mess annual dance will be held at Headquarters, Rochester Row, London, S.W.1, on April 13th, from 8.45 p.m.

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THE ELECTRICIAN

Established 1861. The Oldest Weekly Illustrated Journal of

Electrical Engineering, Industry, Science and Finance.

Bouverie House, 154, Fleet Street, London, E.C.4. Telegrams: "Benbrotric, Fleet, London."
Telephone: City 0244 (Ten lines).

[Closed on Saturdays in accordance with the "Five-Day Week" plan adopted by Benn Brothers, Ltd., and its associated organisations.]

No. 2654. [No. 15. Vol. CII.] Friday, April 12, 1929. Annual Subscription, 25s. Overseas, 30s.

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Current Topics.

Trade with Russia.

MUCH has been made of the fact that one of the firms represented on the British Industrial Delegation to Soviet Russia has been promised a substantial order, but gratification at this gesture is inevitably discounted by the Soviet demand for the resumption of normal diplomatic relations as a necessary preliminary to the resumption of trade between the two countries. Though there is no question that Russia is a market which, under stable government, might provide an outlet for British electrical production, recent happenings strengthen the view that, in general, British sales policy is more profitably pursued in other directions, and that firms contemplating Russian business should still regard such experiments in a speculative light. It is true that some American electrical firms are getting orders from Russia. Even as we write the news is to hand that two American concerns are sharing a £500 000 order for equipment for the Dnieper hydro-electric station. The contract involves the giving of five years' credit. If business on such terms is considered to be worth having it can be obtained. In this connection a shilling booklet by Dr. E. Luboff, entitled "Can We Trade with Russia?" (London: Anglo-Russian Press) is deserving of study. Here it is shown that the schemes for industrialisation on a grand scale are literally worthless, and that in any case the hypothetical orders for these requirements are subject to enormous loans and "political friendship." In addition to long-term credits for the actual equipment, additional "free monetary" credits are required to enable the Soviets "to build the factories where the equipment could be placed, to erect the necessary houses for the accommodation of the workers to be employed when the factories are completed, to buy raw and semi-raw materials, and to have sufficient money left for working capital to keep the factories going." Put at an almost absurdly optimistic level, the possible orders we might get from Russia would amount in a year to £30 000 000, but to secure this credit business we should have to put up the enormous sum of about £145 000 000. Although Dr. Luboff despairs of any trading extension, along normal lines, or in conformity with the fantastic demands of the Soviets, he is still able to give an affirmative answer to the question of his title and to formulate a plan which he claims would give us a possibility of £20 000 000 worth of trade annually without any financial risk whatever. But even under his plan—which boils down more or less to a system of barter—it is doubtful whether the electrical industry would secure a very large proportion of the total.

How Not to Sell.

A CERTAIN company which is offering to the public by circular "a free trial for two months" of any number of the lamps which it supplies at discount terms of 20%, with further discounts of 5% for 50 and 10% for 100 lamps ordered, is also responsible for the dissemination of an argument which is not to the advantage of the industry or the consumer, and as it is put forward as "expert advice" it may receive undue credence. "Very often," they say, "lamps of unnecessarily high wattage, such as 60 W, are used in positions where a high candle power is not really essential, and if you could manage to halve the wattage of every lamp which you use you would automatically halve your electric light bill." At a time when people are only beginning to realise the advantages of adequate illumination, advice of this kind is to be deprecated. There are few situations in a house which do not need lamps of at least 60 W. If consumers want to economise in lighting there are better ways than decreasing the wattage of lamps. The provision of a number of extra light sources of low intrinsic brilliancy for use when maximum general illumination of a room is not required, and cultivation of the easy habit of switching off lights when they are not actually needed leads to really economical and satisfactory lighting.

The Unwanted Window.

ALTHOUGH tradition bids us put windows in all buildings, many of them are quite unnecessary in offices and the big shops. Daylight, when there is any, is nominally free, but its quality varies from hour to hour and it costs a remarkable amount of money to bring it into the buildings, not only on capital account but also for keeping the windows clean and the frames painted, the provision of curtains, blinds, etc. And when we have gone to all that trouble and expense artificial light must still be used during a portion of most days. In department stores, where artificial illumination is necessary throughout the day, the

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mixture of natural and artificial light near the windows is most unsatisfactory, while in offices, where the outlook from a window is usually only of a row of roofing, its presence is only a useless distraction from work. The design of many of our office buildings is severely limited by the necessity for balanced fenestration, with the result that our offices have windows in unsuitable positions, and their size and shape are arbitrarily determined by this unalterable factor. To those who do not work in the crowded cities these points may seem to constitute a rather exaggerated picture of what may happen in the distant future, but we think that those with experience of city life to-day will agree that the windowless office and store will come in our time. It is certainly a possibility worthy of careful consideration. The rapidly developing art of architectural lighting is surely paving the way for this revolution. Even now the lighting of business premises is assuming large proportions and providing our central stations with individual loads of hundreds, and in some cases thousands of kilowatts, and it may well be that the elimination of unwanted windows will make the lighting load the most desirable of all to many supply undertakings.

Electric Sign Maintenance.

WHILE it is acknowledged that electric advertising signs provide a desirable off-peak load for central stations, it it not so generally recognised that ill-kept signs mean a real loss of revenue to the supply authority. A recent inspection of 378 signs in New York revealed that those signs had no fewer than 4 588 unlighted lamp sockets. Assuming the lamps to be of 10 W each, the electricity suppliers would lose 45·8 kWh per hour, and as the average electric sign burns for about 2 000 hours a year the annual sales of energy lost to the suppliers would be 91 600 kWh—a sufficient reason for the adoption of a sign maintenance plan. The lamp manufacturers should also be interested in sign maintenance, for of course every burned-out lamp represents a potential sale.

A Lighting Fallacy.

THE fallacious idea that longevity is the best and only test of the qualities of an electric lamp is one that persists, though a moment's thought is sufficient to show its futility. We only mention the point again now because a firm of shopkeepers, who had a lorry through their windows, found that while a lighting pendant was smashed the lamp inside it was not. Delighted to see such evidence of strength they wrote to the lamp manufacturers about it, and mentioned that the lamp had been in use for over two years, and was still doing useful work. Of course, it is no rare thing to hear of similar instances, and if it were thought desirable, lamps with still longer lives might be produced. But so long as it is considered that lamps will give the most satisfactory lighting service when designed for a normal life of 1 000 hours, people who burn their lamps for 3 000 or 4 000 hours are indulging in a peculiar form of false economy. Once a lamp is past its period of maximum effective service, not only does its illuminating efficiency decrease, but the consumer uses and pays for just as much energy as he would with a new lamp. Many people, through sheer ignorance, are as proud of the age of their lamps as of the contents of a well-planned wine-cellar. Electrical men coming into contact with such people might, with advantage, demonstrate the futility of judging a lamp on its age alone.

Britain's Contribution to America's Export Trade.

AMERICAN electrical export figures for the year 1928 show that more than 50% of the total was shipped to the Western Hemisphere. The United Kingdom was the leading consumer of portable electric tools, parts for motors, insulating material, insulated copper wire and cables, and electrodes for electric furnaces, holding the doubtful honour of being the most important market in the United States' trade with European countries in the past year. On the domestic appliances side it is interesting to note that out of a total shipment of 60 269 vacuum cleaners to all parts of the world, 29 018, or nearly half the total, were absorbed by this country, while Australia, Canada, South Africa, and New Zealand imported between them 17 948 machines. These figures mean that of the total of 60 269 cleaners sent overseas by American manufacturers, 46 966 were absorbed by the British Empire, leaving only 13 303 for the rest of the world. That this state of affairs is not to our liking goes without saying, and though there may be some reason for the colonial preference for American cleaners, surely there can be none in this country. With the E.D.A. selling campaigns pulling such weight, we feel that something should not only be done, but that it should be done quickly, or else before very long the E.D.A. may become a selling propagandist—for America's domestic appliances, with the financial support of British manufacturers.

A Japanese Problem.

ONE after another, foreign countries are realising the wastefulness of haphazard development of the electricity supply industry, and the latest convert is Japan, where, according to latest advices, a special Government Committee has been appointed to investigate the desirability of unified control. The primary reason for the appointment of the Committee is, however, an unusual one, for it is simply that for some time past there has been a production of energy surplus to the requirements of users. But in a country where, as was recently reported, the consumers go on " strike " as a protest against high prices for electrical energy, such a situation does not seem altogether unnatural.

The Five-Day Week.

THE report that the American General Electric Co. has decided to put all its factories on a five-day week schedule has revived interest among British electrical firms in the possibilities of this desirable reform. As most of our readers are aware, the staffs of THE ELECTRICIAN and associated enterprises have for several years enjoyed the advantages of the five-day week. Experience has amply proved that the longer week-end is definitely beneficial to employers, in the improved health and therefore greater efficiency which it promotes among the workers. Office and factory heating, lighting and cleaning costs for a half-day's work—and usually a short one at that—are unnecessary expenditure when equivalent production can be secured by a little extra concentration during the five full working days. As pioneers of the five-day week in this country we unhesitatingly affirm its desirability from all points of view, and, as we would like to see more people participating in its advantages, we hope that the example of the American G.E.C. will be widely followed by British electrical firms.

" A Golden Jubilee of Electric Light."

DURING recent times it has been firmly established that the credit for the invention of the incandescent electric lamp belongs to the late Sir JOSEPH SWAN. But for the mistaken notions about this fundamental English discovery which have gained currency abroad it would have been almost unnecessary to emphasise this fact, except on the recent centenary of the inventor's birth, and the jubilee of his lamp invention, as most of us have for long years been fully aware of the world's indebtedness to this great British scientist. In the United States, however, preparations are now in hand for a nation-wide celebration, from June to October, of the " golden jubilee of electric light," the announcements of this celebration being linked with the statements that " the fiftieth anniversary of Edison's incandescent lamp should be the occasion for widespread jubilation." This claim may be strictly true if applied solely to Edison's own lamp, but if this is the intention it would be only fair to mention that the jubilee of the invention of the first incandescent electric lamp was celebrated last year.

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ELECTRICAL CIRCUIT THEORY BASED ON THE METHOD OF COMPLEX NUMBERS.

The Expression of Circuit Constants by Means of Complex Quantities—Practical Application to Theory of Alternating Currents.

By G WINDRED.

(*Concluded from page* 411).

WE proceed in the present section to demonstrate the applications of the foregoing methods to the representation of alternating current circuit constants. The property of admittance, and its components, conductance and susceptance, are by this means rendered more readily understandable and applicable to actual problems than is the case when ordinary methods are employed.

It appears to the writer that some apology is due to those readers who are already fully acquainted with the inverse methods, as they are sometimes called, but since the modern tendency seems rather to neglect than to employ these methods, a brief demonstration on the lines of complex representation may be pardoned.

From the preceding remarks it is clear that the vector representing the impedance of any circuit of resistance R and reactance, X is expressible in the various forms:

$$Z=\sqrt{R^2+X^2} \quad \text{(Algebraical)}$$
$$\mathbf{Z}=R+jX \quad \text{(Complex)}$$
$$\mathbf{Z}=me^{j\theta} \quad \text{(Exponential)}$$

in which m is the modulus, and θ the argument, $=\tan^{-1}\frac{X}{R}$ of the vector.

Similarly, the voltage vector is expressed

$$E=\sqrt{E_R^2+E_X^2}$$
$$\mathbf{E}=E_R+jE_X$$
$$\mathbf{E}=me^{j\theta}, \text{ where } \theta=\tan^{-1}\frac{E_X}{E_R}$$

and the current vector

$$I=\sqrt{I_R^2+I_X^2}$$
$$\mathbf{I}=I_R+jI_X$$
$$\mathbf{I}=me^{j\theta}, \text{ where } \theta=\tan^{-1}\frac{I_X}{I_R}$$

If sufficient capacity reactance exists to make the current lead the voltage, the above equations hold good for the usual method of representation in Cartesian co-ordinates, but when the current lags behind the voltage, as in an inductive circuit, it is necessary to substitute a minus sign wherever plus occurs in the above equations; thus obtaining a new set of equations which are conjugate to the foregoing. This, however, is a matter of convention which is not likely to introduce difficulty.

Reciprocal of Impedance.

There are many instances in which advantages may be obtained from the use of the reciprocal of impedance, which quantity Steinmetz calls the Admittance of the circuit. Its components are termed Conductance and Susceptance, the former of which is expressed as the ratio I_R/E, and the latter as the ratio I_X/E, where I_R is the current in phase with E, and I_X is the reactive current in quadrature to E. The equation relating these values is then

$$Y=\sqrt{g^2+b^2}, \text{ or } \mathbf{Y}=g+jb$$

where g is the conductance and b the susceptance. Since $Y=Z^{-1}$, it follows that

$$I=EY=E\sqrt{g^2+b^2},$$
and $$\mathbf{I}=\mathbf{E}\mathbf{Y}=\mathbf{E}(g+jb).$$

Also we have

$$E=\frac{I}{Y}=\frac{I}{\sqrt{g^2+b^2}},$$
$$\mathbf{E}=\frac{\mathbf{I}}{\mathbf{Y}}=\frac{\mathbf{I}}{g+jb};$$
$$Y=\frac{I}{E}=\sqrt{g^2+b^2},$$
$$\mathbf{Y}=\frac{\mathbf{I}}{\mathbf{E}}=g+jb.$$

Whether the equation of impedance or of admittance is used in a calculation depends upon the form of the circuit and the attendant circumstances. In the cases of a number of circuits in parallel the total admittance of the complete circuit is evidently the sum of the admittances of the component circuits, whereas the total impedance is the reciprocal of the sum of the reciprocals of the impedances of the component circuits. The former operation is manifestly the more practicable of the two in the majority of cases.

Conversely, in the case of a number of series circuits the total admittance is the reciprocal of the sum of the reciprocals of the admittances of the component circuits, whereas the total impedance is the sum of the impedances of the component circuits.

Related Circuit Constants.

Thus, in dealing with parallel circuits it is better to employ the impedance equation. Finally, it is instructive to note the relation between the various circuit constants which have now been established.

Since we have seen that $Y=Z^{-1}$, it follows that $YZ=1$ and therefore $(g^2+b^2)(r^2+x^2)=1$. From these relations the admittance may be calculated from the impedance, and the conductance and susceptance from the resistance and reactance. In this connection it should be noted that when $x=0$, $r+jx=r$, and $g=\frac{1}{r}$. This relation therefore applies only to a non-inductive circuit or a direct current circuit.

The deduction of the usual formulæ expressing the conductance and susceptance in terms of the resistance and reactance, and the resistance and reactance in terms of the conductance and susceptance tends to preclude the possibility of confusion in appreciating the significance of these terms, and seems therefore to be warranted in the present instance.

Since the admittance is the reciprocal of the impedance $r+jx$, we must write $\mathbf{Y}=g-jb=(r+jx)^{-1}$ which gives, on multiplication by $r-jx$,

$$g-jb=\frac{r-jx}{(r-jx)(r+jx)}=\frac{r-jx}{r^2+x^2}$$

whence

$$g-jb=\frac{r}{r^2+x^2}-j\frac{x}{r^2+x^2}, \text{ or } \frac{r}{Z^2}-j\frac{x}{Z^2},$$

from which we obtain

$$g=\frac{r}{Z^2}=\frac{r}{r^2+x^2}, \quad b=\frac{x}{Z^2}=\frac{x}{r^2+x^2},$$
$$r=\frac{g}{y^2}=\frac{g}{g^2+b^2}, \quad x=\frac{b}{y^2}=\frac{b}{g^2+b^2}.$$

These are the forms in which the various circuit constants are expressed in the majority of electrical text-books. It is probably unnecessary to remark upon the advantages which result from the applications of such methods of calculation, which have in many cases greatly simplified the solution of such complicated circuit arrangements as are frequently encountered in modern practice. In spite of the evident analytical value of the theory the space devoted to its elucidation in the standard text-books is very small.

For the successful practical application of the theory in a general way to the theory of alternating currents it must necessarily be extensible to alternating wave theory. Such applications of the theory result in certain practical advantages which we proceed to demonstrate.

From Fourier's theorem in harmonic analysis we know that the alternating current waves encountered in practice are expressible in the form

$$A=A_1\cos(\theta-\alpha_1)+A_3\cos(\theta-\alpha_3)+\ldots A_{2n-1}\cos(\theta-\alpha_{2n-1}).$$

Each term of the right-hand member of this equation represents a pure alternating wave of the form $A=A_x\cos(\theta-\alpha_x)$ and may therefore be represented by the alternative vectorial expression

$$\mathbf{A}=a_1+ja_2=a(\cos\theta+j\sin\theta)$$

The expression for the complete wave may therefore be resolved into a series of complex expressions of different modulus and argument, each of the component expressions being amenable to the general theory of complex quantities, and the whole wave consequently expressible in the complex

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form. In the usual notation we may write for the alternating current wave

$$i = I_1 \sin(\omega t - \alpha_1) + I_3 \sin(3\omega t - \alpha_3) + \ldots$$
$$= I_1 (\cos\theta_1 - j \sin\theta_1) + I_3 (\cos\theta_3 + j \sin\theta_3) + \ldots$$
$$= (i_1 - j i_{11}) + (i_3 - j i_{33}) + (i_5 - i_{55}) + \ldots$$

which expression may be put in the form

$$\mathbf{I} = \Sigma_1^{2n-1} (i_n - j i_{nn}).$$

The suffixes of the terms in these expressions serve to indicate the different frequencies of the component waves or vectors.

The extension of the foregoing principles follows naturally from these equations, which also exhibit the advantages which are obtainable by the adoption of complex methods in alternating wave theory.

Other Applications.

Considerations of space prevent us from pursuing the applications of the theory to their logical conclusion. It must suffice to remark that electrical theory, although offering many suitable problems, is by no means the only science of applied mathematics offering scope for the application of complex methods. The fundamental equation connecting spatial and temporal measurements in the theory of relativity makes use of the imaginary operator, which is also used in the Lorentz transformations connected with the theory, and in relativistic mechanics. There are also many of the more advanced branches of ordinary mechanics which make use of this conception. In practically every branch of advanced analysis where the higher mathematical theorems are employed we find ample scope for the application of complex methods of representation, which in some cases considerably shorten and simplify the mathematical operations, and in other cases render the problems amenable to analysis. Two very important branches of applied mathematics may be cited as instances of these conditions. In the theory of conjugate functions, leading to problems in two dimensions and ultimately to the theory of Riemannian potentials, the operations are based upon the conception of complex quantities. This also applies to the theory of wave propagation in its application to the electromagnetic theory of light.

In conclusion, we venture to express the hope that before long the methods of analysis forming the subject of the present slight treatment may reach a condition of more extended application, thereby extending to modern theory the unpremeditated but none the less real advantages resulting from the researches of the early mathematicians.

BOOK REVIEWS.

"Heaviside's Electrical Circuit Theory." By LOUIS COHEN. (London: McGraw-Hill Publishing Co.) Pp. ix+169, with 27 figures. 12s. 6d. net.

Since his death a few years ago, the scientific world has slowly awakened to a true appreciation of Heaviside's contributions to electrical theory, but unfortunately his own works have remained inaccessible to the majority of electrical engineers, owing partly to their apparent discontinuity and vagueness, and partly to the unusual nature of the mathematical processes employed.

The book under review represents a very praiseworthy attempt to remedy this state of affairs by putting before the electrical engineer a simple explanation of the principles of Heaviside's operational calculus as applied to circuit theory.

Stated briefly, Heaviside developed a new method of solving the differential equations which arose in connection with telephone line and cable problems, and by means of his celebrated Expansion Theorem, he obtained directly the complete solution for voltage or current distribution in the circuit for both the steady and transient states. In the present work, the application of the Expansion Theorem is shown to the solution of such problems as filter circuits, transmission lines, and artificial telephone lines, as well as to the problems orginally studied by Heaviside.

After a short introduction by Prof. Pupin, Chapter I develops, in a clear systematic way, the theory of the operational calculus, and illustrates its use by simple problems involving circuits with concentrated resistance, inductance and capacity.

The Expansion Theorem, the nucleus of Heaviside's theory, is derived in a comparatively simple manner in Chapter II, and it is shown to be applicable to all kinds of circuits, including those with distributed electrical constants. Examples are considered for both d.c. and a.c. voltage disturbances applied to simple circuits containing concentrated inductance and capacity, to divided circuits, and to coupled inductive and oscillatory circuits.

In Chapter III is considered in some detail the solution of problems of electric filter circuits, these comprising recurrent sections of constant capacity and inductance in various combinations. Low pass filter circuits with inductive series elements, and high pass filter circuits with capacity series elements are dealt with, and also magnetically coupled filter circuits. The resonance effects of multiperiodic circuit systems are discussed.

Chapter IV on "Ocean Cables," deals principally with circuits of distributed capacity and resistance, this being one of the main subjects of Heaviside's original investigations. The chief result required is generally the current at the receiving end due to a given disturbance at the sending end. The effect of terminal impedances, and the resulting incomplete reflections, on the characteristic of the cable is considered.

In Chapter V on "Transmission Lines," the more general problem of circuits with distributed inductance and leakance, as well as resistance and capacity, are considered. Mention is here made of the "distortionless" line. Cases taken include a finite line open and grounded at the ends, and also with terminal impedances.

Chapter VI is devoted to a study of artificial lines which are of practical importance in connection with their use for balancing telephone lines or ocean telegraphs for duplexing or other purposes, and also in connection with the study of phenomena on long transmission lines.

The final chapter gives a brief historical survey of the manner in which Heaviside was led to develop his expansion formula. This is useful in that it emphasises the much greater simplicity of Cohen's treatment from the point of view of the practical engineer.

Some notes on Bessel functions and a collection of mathematical formulæ used in the book are given in an appendix.

The whole book is well produced, the mathematical parts in particular being clearly set out and easy to follow.

R. T. C.

Die Asynchronen Drehstrommaschinen mit und ohne Stromwender. By FRANZ SALLINGER. (Berlin: Julius Springer.) Pp. 197+vi. RM. 8; bound, RM. 9·20.

The author of this excellent little book is the Professor at the Esslingen Engineering School, and the work is for the express purpose of widening the scope of lectures to his students. The hope is expressed in the preface, however, that the book will make a wider appeal to practical engineers as well as students. A good groundwork in the technology of alternating currents is presupposed. The subject is tackled in a pleasingly logical way, sections on windings, induced e.m.f., the rotating field, leakage, etc., receiving clear and concise treatment, after which, in Part II, the induction motor is considered. No attempt is here made to get very closely to the fundamental verities, the rotating field and the transformer induced e.m.f. equations being used in the well-known manner to find the rotor current, electrical and mechanical rotor powers, and the torque. A consideration of the Heyland diagram is amplified by an investigation of no-load and short-circuit conditions, after which a section on the induction generator concludes the simpler theory of the machine. A good deal of space is devoted to the "exact" circle diagram with its torque-power, power-factor slip and efficiency lines. It appears to be the fashion in German books to obtain as much information from, and to put as many lines in, the circle diagram as possible, without much regard as to the suitability of such lines for the purpose intended. This applies more especially to the slip and efficiency lines. Speed regulation receives considerable attention, many systems such as the Krämer being described, together with variable-speed sets utilising rotary converters, frequency changers, etc. Part III deals with the a.c. commutator machines. The influence of Arnold's "Wechselstromtechnik" is here considerable. This is no fault, for the author does not pretend to a presentation of anything new, but draws freely on the best authorities. The treatment of the commutator machines is largely descriptive. A number of variable speed sets utilising commutator machines as auxiliaries to main induction motors are described to close the book. The field covered by this work is already very well exploited by both British and American writers, but those who are familiar enough with the language and who are interested in a fresh and concise presentation of a subject will find this book of interest. The typography is of the standard that Springer has made famous.

S. PARKER SMITH.

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UNTREATED FABRICS FOR ELECTRICAL PURPOSES.

Special Needs of the Electrical Industry and the Characteristics of Some Materials Available—Increasing Use of Fine Silks and Asbestos Tapes.

By A. R. DUNTON, A.M.I.E.E., and A. W. MUIR, D.S.O., M.C., B.Sc.

WHILE fabrics and tapes are of considerable importance in insulating processes the amount of these materials required for such work is so small compared with the quantities required for other purposes that up to the present time few, if any, mills have specialised in the manufacture of materials suitable primarily for electrical purposes. Indeed, during the cotton boom period it was practically impossible to arouse any interest in this application among the producers of woven goods. More recently there has appeared a greater willingness to try to meet the special needs of the electrical industry, and it is well that these needs should be reviewed, and that the characteristics of the materials which are available, and those which are desirable, should be appreciated.

Some progress has been made, in that most of the large electrical users have detailed their requirements by the issue of purchasing specifications and have installed special apparatus for testing the materials. In most cases, however, the actual selection involves a careful and costly examination of large numbers of samples submitted, apparently in the hope of some one or other having approximately the characteristics required. In this respect, as well as in the development of new materials, much benefit should result from the greater co-operation which now seems possible between the makers and the electrical users.

Fabrics are used in the electrical industry either in their natural state or impregnated with resins, gums or other materials. As indicated by the title, this article deals mainly with fabrics for use in their untreated state, treated materials being mentioned only for purposes of correlation and comparison.

Electrical Strength of Fabrics.

So far as untreated materials are concerned, the electrical strength of fabrics is not such as to render them of any real value as insulators. Their porous nature results in the breakdown values being, at their best, practically the equivalent of those of the same distances in air. Ordinarily the electrical strength of fabrics is rather less, owing to the presence of moisture in the material. Further, even though insulating properties of practical value may be obtained under perfectly dry conditions, this state of affairs cannot be permanently maintained owing to the great affinity for moisture characterising the whole range of fabric materials at present available.

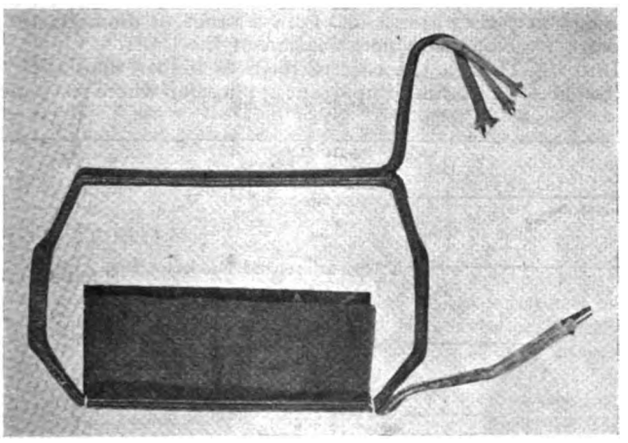

Fig. 1.—Partly insulated coil showing use of cambric-mica cell material and binding tape on slot portion and cotton sleeving on leads.

Good electrical strength can be obtained with fabrics only when all the interstices of the material are completely filled with varnishes or gums of good insulating properties. In such cases the fabric may be considered to act as a carrier or mechanical reinforcement rather than as an actual insulator. The impregnation of fabrics for electrical purposes may be carried out either before their application, or afterwards. In the latter case it may be noted that a stronger and closer binding is obtained. Untreated materials wrap more tightly than those which have been previously impregnated. The tightness of wrap is further increased by the shrinkage which takes place in the impregnation process, and the mechanical strength is improved by the sealing together of the layers.

The selection of untreated fabrics is thus influenced to a much greater extent by considerations of mechanical strength than by that of electrical strength. A further consideration is also of great importance, however, namely that of space. Manufacturers of fabrics have, up to the present, failed completely to realise the importance of this consideration with regard to electrical applications, probably because it does not apply to anything like the same extent in connection with the materials they supply for other uses.

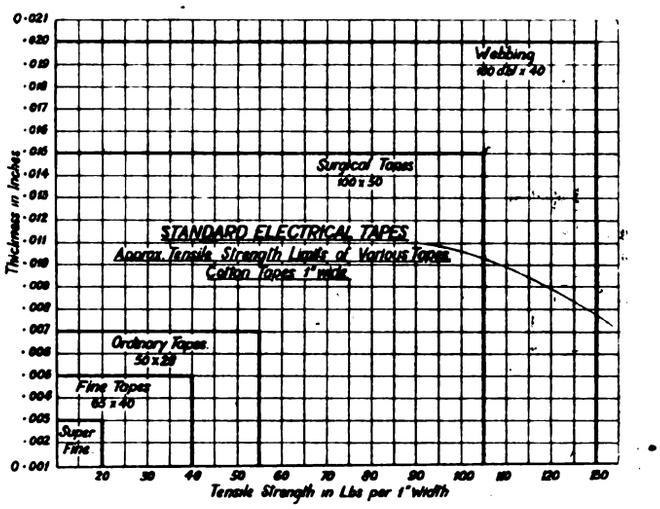

Fig. 2.—Tensile strength limits of suggested standard electrical tapes.

In electrical apparatus increasing efficiency has demanded the use of finer and finer materials, and for this reason an extended use has been made of fine silks, in spite of their cost being higher than that of cotton goods. A great deal of silk is now commonly used in the insulation of slot portions of coils for motors and generators, in which application the space factor has probably its greatest importance.

The Ideal Fabric.

From the designer's point of view the ideal fabric would have minimum thickness, absolute uniformity, sufficient mechanical strength to ensure tight and clinging application, and good ageing properties, even at high temperatures. In the absence of the ideal, the various considerations have led to the use of available materials somewhat as follows:—Silk—where space requirements predominate; superfine cotton—where space is important but price consideration predominates; cambric—where good mechanical properties are of more importance than electrical features; linen—where resistance to abrasion is required; canvas—almost entirely for mechanical properties under normal temperature conditions; asbestos—to ensure maintained mechanical properties at high temperatures.

SILK.—Fine silk tapes are used for binding purposes for such work as finishing off instrument coils, leads, etc. An even finer grade of silk or chiffon is used in the manufacture of composite tapes, ribbons and sheets, in which thin selected mica splittings are bonded to form flexible wraps, the silk being used as mechanical reinforcement. High grade silk is also used in varnish treated form, produced by selected material being run thrugh a suitable varnish and dried in heated towers. The characteristics of the different varieties of silk used for these purposes are approximately as follows:—

	Thickness (inch).	Warp × Weft (Threads per inch)	Tensile strength (Lb. per inch width.)
Silk tapes ..	0·0035—0·004	100 × 80	16
Baking silk ..	0·0015—0·002	130 × 110	12–15
Varnish silk ..	0·0025—0·003	90 × 90	12

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SUPERFINE COTTON.—Many attempts have been made to produce superfine cotton fabrics to compete with the Jap silks used for baking mica sheets, and cotton materials have actually been made with a thickness of 2 mils, but their mechanical strengths are slightly inferior to those of silks.

The finest actual commercial lengths that have been made in this country were obtained from fine Egyptian cotton,

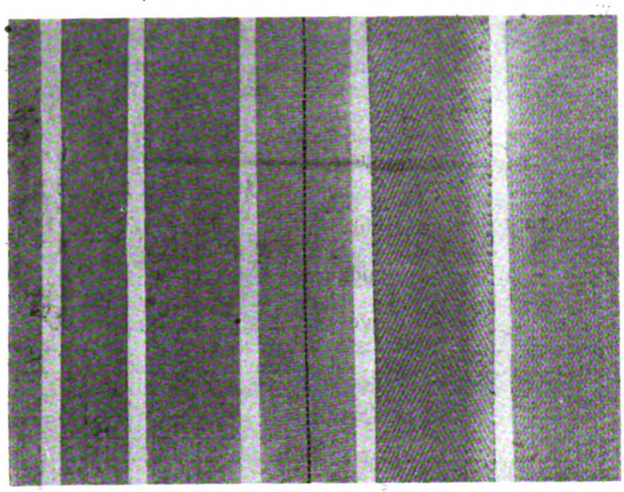

Fig. 3.—Tapes used for electrical purposes, showing (left to right) silk, superfine cotton, fine cotton, ordinary cotton, and surgical cotton tapes and webbing.

and were produced in 1925 by the joint co-operation of Messrs. William Heaton and Sons, the Metropolitan-Vickers Research Department, and the British Cotton Research Association. This resulted in the production of a fabric with the following characteristics :

Thickness (inch).	Warp × Weft (Threads per inch).	Tensile Strength (lbs. per inch width).
0·0022	116 × 110	10·5—11·2

There was at that time every likelihood of this material actually replacing Jap silk, but activities in this direction were brought to a standstill, following a big reduction in the price of silk, and, since the reduced price of silk has held, no further developments in this direction have been made. The results of the work may well be of practical value, however, should the economic position change at some future date.

The chief application of superfine cotton is chiefly as a tape where neatness and space are important factors and where a thickness of 3 mils is permissible. The characteristics of the material as commonly used are shown below.

	Thickness (inch).	Width (inch).	Warp × Weft (Threads per inch).	Tensile Strength (lbs. per inch width).
Superfine ..	0·003	$\frac{3}{8}$	92 × 60	34·2
Cotton Tapes	0·003	$\frac{3}{4}$	88 × 60	40·5

CAMBRIC.—This is a thin, straight-woven cotton cloth. For electrical uses the colour is not important, and the material is therefore ordinarily used in its unbleached state. Its principal use is as a reinforcement for mica cells for the slot portions of coils. Fig. 1 shows a coil in process of insulation, one half having the mica cambric cell material in position ready for wrapping, and the other half showing the cell completed, and bound in position by a layer of superfine cotton tape.

A suitable material is generally rather open in weave, with characteristics approximately as follows :—

	Thickness (inch).	Warp × Weft (Threads per inch).	Tensile Strength (lbs. per inch width).
Cambric ..	0·003—0·004	85 × 60	16 (warp direction). 9 (weft direction).

Suggested Standards.

SILK AND COTTON TAPES.—Owing to the non-existence of any standard terminology, various tapes have been called by different names, and it is somewhat difficult to obtain required tapes without choosing from a variety of samples, but there appears to be a growing tendency to recognise the types shown in the following table for the uses indicated.

Suggested Name.	Thickness.	Trade Names.	Chief Uses.
Silk Tapes	0·002	Silk Ribbons	Fine taping of instrument coils.
Superfine Cotton	0·003	Egyptian Cotton	Small coils, solenoids, leads, etc.
Fine Cotton	0·005	"Linen-finished" Egyptian, etc.	Medium sized armature and field coils.
Ordinary Cotton	0·007	"American" Standard	End windings of large coils.
Surgical	0·015	Herring-bone, etc.	Tight taping of field coils, etc., to improve rigidity.

The approximate tensile strengths are indicated in Fig. 2, together with the usual limiting thickness, whilst the appearance of the tapes can be judged from Fig. 3, which shows the more pronounced features of the webbings, the straight line weave of the superfine, fine and ordinary tapes, and the "herringbone" or star pattern of the "surgical" tapes.

A recommended special feature of electrical tapes is the existence of a coloured thread running down the centre of the tape, as shown in one of the specimens in Fig. 3. Such a line facilitates accurate taping operation where tapes have to be applied with overlaps of $\frac{3}{8}$ or $\frac{5}{8}$ of the tape width.

COTTON SLEEVING.—Extensive use is made of cotton sleeving material for additional insulation on the leads of coils, as, for instance, on the close-packed conductors between the slot portion and the armature of d.c. machines. The sleeving materials are available in a range of diameters and in various colours for identification of the leads.

LINEN.—Though the cost of linen is higher than that of cotton materials it finds important application where resistance

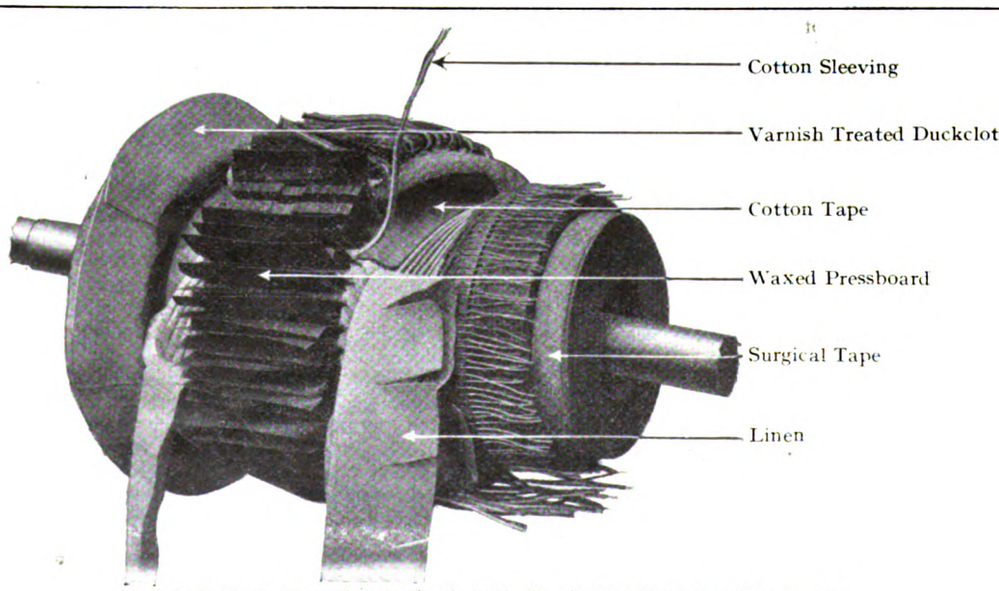

Fig. 4.—Partly wound armature showing the application of various fabrics in machine insulation.

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to abrasion is required, as, for instance, for reinforcing the insulation between cross turns of armature coils. The material used for such work is a strong unbleached straight-woven cloth with characteristics approximately as follows :—

	Thickness (inch).	Warp × Weft (Threads per inch).	Tensile Strength (lbs. per inch width).
Linen..	0·001—0·015	60 × 44	100 (in any direction).

Fig. 4, which shows a partly-wound armature, illustrates the use of linen as mentioned above, and also the application of other fabrics in machine insulation.

CANVAS AND DUCKCLOTH.—These heavy cloths are used for the protection of the end windings of machines. One of the essential features of the materials is good mechanical strength even after prolonged service at high temperatures. To check this property it is often a practice to subject samples to a temperature as high as 180 deg. C. for several hours, after which it should still be capable of being bent flat on itself without cracking.

Canvas materials should be woven from Egyptian cotton, and in general conform to the following details :—

	Thickness (inch).	Warp × Weft. (Threads per inch).	Tensile Strength (lbs. per inch width). Warp.	Weft.
Canvas or Duckcloth	0·020	44 × 40	100	50
	0·035	24 × 24	130	120

Where this class of material is required for the production of synthetic resin canvas boards, a material with a more open texture is generally employed, as this allows better adhesion between laminæ through the interlocking of the interstices under the pressure to which it is subjected. In this case the range of thickness varies between 15 mils and 25 mils.

ASBESTOS FABRICS AND TAPES.—With the refinements which have been introduced during the last few years in the art of weaving asbestos, a growing demand for this material is evident. Originally its chief use was in the manufacture of synthetic resin asbestos boards, but it is quite common now to find it fulfilling a much more important function, chiefly in the form of the superfine asbestos tapes for insulating heavy duty field coils and the individual conductors of coils for large turbo-alternators.

The advance in the use of this material is due to improved uniformity and reduced thickness, combined with reduced cotton content and good mechanical strength. A superfine asbestos tape of 0·007 in. thickness is now being sought for, but in the meantime excellent results are being obtained with a 10 mil tape which gives a tensile strength of approximately 20 lbs. per in. width.

The authors' acknowledgments are due to the Metropolitan-Vickers Electrical Co. for the use of information and photographs.

ELECTRICAL INSULATING PAPERS FOR THE MANUFACTURE OF POWER CABLES.*

Impregnated Paper the only Practical Dielectric for High Voltages—Physical and Electrical Characteristics of Paper—Need for Research on Properties of Fibres.

By T. N. RILEY, D.S.C., M.Sc., M.I.E.E., and T. R. SCOTT, D.F.C., B.Sc., A.M.I.E.E.

IF an engineer were asked to choose a cable dielectric, without regard to existing knowledge on the subject, it is not probable that he would place paper first in his choice of materials for investigation. It is hygroscopic and has to be covered by an impermeable outer sheath; it has to be put on in layers in order to attain flexibility, and its electrical characteristics are not the same along and across the layers; the gas spaces between the fibres must be replaced by oil or similar material which is less liable to break down.

Up to the present, however, no solid flexible material of equally good dielectric qualities and equally low cost has been evolved; and impregnated paper, therefore, remains the only practical dielectric for high-voltage cable work. This is partly owing to the large amount of experimental work which has been carried out, in conjunction, by paper makers and cable makers, in order to overcome the natural disadvantages of the material and improve its quality as electrical requirements have been made more severe.

All the earlier authors based the main distinction between papers on the fibre stock from which they were made. More recently it has been realised that the very considerable differences in the physical structures of papers made from the same fibre stock have an important bearing on their suitability for insulating purposes. Before attempting to estimate the relative importance of these two points of view it is desirable to consider what is actually required of the paper.

It is proposed to discuss mainly the physical and electrical characteristics of paper. Although little or no reference is made to the chemical characteristics (i.e., freedom from acidity and alkalinity, low ash content, freedom from resinous and nitrogenous material, etc.), the authors do not wish it to be inferred that these qualities are of no importance for cables. They have not been referred to because such requirements for cable paper do not differ essentially from those for paper for other insulating purposes, and these requirements, and the methods of test for them, have already been adequately dealt with in previous publications.

Since the paper must be applied in layers to secure flexibility, it must have sufficient mechanical strength, both along and across the machine direction of the sheet, to permit of the core being wrapped without undue breakage of paper, and to permit of the cable being bent in service without cracking the paper tapes. As it is possible to obtain the necessary mechanical strength with a number of different types of paper, this characteristic cannot be made the primary controlling factor in deciding on the type of structure to be used.

The paper fibres always contain moisture colloidally linked with the cellulose as part of the structure. In the air-conditioned state they also contain a large percentage of free moisture. The "combined" moisture cannot be removed without physical damage to the paper. Manufacture of the paper must be so carried out that the "combined" moisture is kept to a minimum, and the electrical conductivity can be reduced to the lowest possible value by the removal of the whole of the free moisture.

The structure must also be such as to facilitate the removal and replacement by oil of all the gas content, both in the pores of the fibres and between them.

It is impracticable to discuss electric strength as a function of the paper alone; but obviously the structure must be such as to result in the highest possible electric strength in combination with the impregnating compound in the finished cable. It has already been stated that the conductivity of the dielectric is reduced by the removal of the free moisture; but the conductivity of the fibre itself should also be as low as possible, in order to minimise dielectric losses in service.

The paper must also have good ageing qualities, so that there will be no deterioration of the electrical or physical characteristics with time.

Some of these requirements are conflicting, and improvements in one direction can be obtained only at the expense of losses in others. It is, therefore, necessary for the cable maker to determine which compromise he will adopt in order to obtain the best results from the finished cable in service.

High electric strength is obviously a requirement in which little concession can be made, and it is, therefore, proposed to discuss first the features which secure this.

High breakdown voltage may be dependent on the impregnating compound, on the paper, or on the two in conjunction. Its exact value will also depend on the temperature of the sample and on the rate of duration of application of the voltage. The mechanism of failure may also vary with variation of these conditions, but this is still imperfectly understood.

Dry paper alone makes a very satisfactory dielectric for low voltage work and is in universal use for telephone cables, for example. At high pressures, breakdowns occur in the air spaces between the fibres, leading to charring and ultimate failure. One point of view, therefore, is that in power cables the compound is added to prevent breakdown of the air spaces in the paper, which is the main dielectric.

The greatest gain in electric strength is to be obtained by reducing the surface leakage, first by removing every trace of surface moisture, and, second, by increasing the strength of the leakage path. In order to effect improvements in this

* Extracts from a paper read before the Institution of Electrical Engineers.

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respect, some means of comparing different papers quantitatively must be devised. For the usual cable-paper structures, any increase of strength of the interfibrous channels will also increase their resistance to the flow of air.

The type of structure which appears to give the highest breakdown strength is also that which the lowest power factor is most easily obtained and which gives the highest thermal conductivity.

Forthcoming Improvements.

There is little doubt that the main development of cable-paper types to be expected in the immediate future is that of obtaining increased capillarity and rate of oil absorption without loss of other desired characteristics; and the values exhibited from time to time by paper samples suggest that great improvements along these lines are possible, once the desired control has been obtained.

In general, it may be said that calendering or hydration, which tend to close up the surface of the paper, also tend to increase the time required for penetration, although judicious calendering may not exert a great influence. Calendering appears to affect both surfaces of the paper, though not to the same extent.

There is distinct evidence that, although in all conditions in which paper is in practical use as an insulator it is nominally in a dry state, its electrical conductivity and electrostatic capacity are still modified by the presence of moisture; and that the variation of moisture content leading to irregular electrical tests is intimately connected with the structure of the paper.

During manufacture, paper comes in contact with many times its own weight of water, and the purity of the water in respect of dissolved salts must affect the purity of the paper. The adsorptive properties of the colloidal cellulose for electrolytic salts must, therefore, be taken into account, and there is little doubt that conductivity values are considerably affected. The amount of such impurities is indicated by the ash content.

Mechanical strength is a secondary consideration in selecting a type of structure, since in most cases it is comparatively simple to obtain sufficiently high values to meet the various stresses encountered in manufacture, laying, and service. Similarly, ageing is a characteristic which should be considered only after the initial requirements have been obtained. It does not appear to be reasonable to build up a structure capable of retaining its qualities for many years if the structure itself is unsuitable and likely to induce breakdown at an early stage in the life of the cable.

Paper is applied to the cable in an air-dry condition, and the strength values necessary can, therefore, be determined empirically by comparison of performance on the machine with standard air-dry tests. The stresses encountered in lapping, laying-up, and reeling a cable are a mixture of tensile tearing and bursting stresses. Fortunately they can, on the whole, be judged fairly accurately by the tensile strength in the longitudinal (or machine) direction and by the strength in the cross direction. It is generally found that where high values of longitudinal tensile strength are obtained at the expense of the strength in the cross direction—i.e., by lining up the fibres in the machine direction, the value of tearing strength in the longitudinal direction is greatly reduced. A sufficiently high tensile strength in the cross direction (say, not less than 50 per cent. of the value in the longitudinal direction) must therefore be specified in addition.

During drying and impregnation the cable is not subjected to mechanical stresses, and the characteristics of the paper subsequent to the latter process are next of interest. In general, a loss in strength is to be expected, although there are a few exceptions. It is sometimes of interest to trace whether this loss of strength is due to the drying process or to the impregnation process, and the standard E.R.A. ageing test provides a simple means. There is, in general, a slight increase of bursting strength during drying.

The ageing quality is not solely dependent on the original fibre, but is affected, for example, by the amount of heating, and therefore the amount of hydration of the cellulose by the chemical impurity remaining as a result of imperfect washing or impure washing water, and also by the conditions under which the paper is to be used. It is, therefore, unsafe to draw conclusions except from the particular paper in question tested under the actual conditions in which it is to be used.

In one respect there is room for decided immediate improvement of supplies—namely, with regard to uniformity. While admitting the difficulty of controlling paper making processes to a fine degree, it would seem that some improvement should be possible.

The former practice of specifying Manila paper for power cables is not justifiable at the present day. Satisfactory behaviour depends more on the chemical cleanliness of the materials and processes, and on the physical formation of the paper, than on the fibre base. Freedom from acidity or alkalinity, low ash content, and freedom from sizing and loading materials, are essential if the electrical qualities desired are to be obtained, and, in discussing the physical results of the manufacturing process, it has been assumed that all possible precautions to meet chemical requirements have already been taken.

If the various physical attributes of the paper be considered together, it is evident that for impregnated papers a strong case can be made out, on the basis of standard tests, for the type which exhibits low bulk combined with high oil absorbency. The low bulk should be obtained by packing of fibres, with judicious use, to a strictly limited extent, of hydration and calendering. Heavy surface calendering is undesirable. A paper made up of chemical wood-pulp appears to give all-round satisfactory characteristics, but, apart from the question of adaptability to structural requirements, there appears to be no reason why other types of fibres should not be employed. It is not suggested that the optimum compromise has been reached—in fact there are indications that further development is possible, and the outlook for cable-insulating papers of the future appears to be distinctly promising.

In order that further progress may be made, there appears to be a need for more fundamental research on the properties of the individual fibre. In the textile industry much valuable information has been gained on the physical structure and characteristics of textile fibres. Very little has been done from this standpoint as regards the fibres used for paper making. It is a field suited to the independent investigator or research association, rather than to the factory research-laboratory, and it is suggested that such work would greatly accelerate the development of better materials.

There is also need on the paper makers' part for the development of methods of treatment in which the electrolytic impurities absorbed by paper during the manufacturing process can be reduced, and by which the required dense structure can be attained without undue calendering and with greater uniformity.

TESTING OF HYDRAULIC TURBINES.

THE new British Standard Specification for the Testing of Hydraulic Turbines is the latest addition to the list of British Standard Specifications for Prime Movers, which series includes specifications for steam turbines, reciprocating steam engines, and various types of internal-combustion engines.

The latest specification differs from the previous members of the series, however, in the fact that it relates entirely to the testing of the machine, and does not deal with the performance except insofar as the conduct of the test is concerned.

The following points are dealt with in the specification:—Conditions of head, speed and output for acceptance test; condition of turbine during test; speed variation; power output of turbine; measurement of net or effective head of reaction turbine, Pelton wheel or impulse turbine; errors in measurement; efficiency; measurement of rate of flow. An appendix deals with the information to be given with the inquiry or order.

It is of interest to record that this specification is based on, and is, to all intents and purposes, identical with the International Rules for the Testing of Hydraulic Turbines, published by the International Electrotechnical Commission. Copies of the Specification (No. 353–1929) may be obtained from the British Engineering Standards Association, Publications Department, 28, Victoria Street, London, S.W.1, price 2s. 2d. post free.

A BIG CONDENSER.

What is claimed to be the largest steam condenser in the world is now being assembled at the East River generating station of the New York Edison Co. Nearly 700 tons of steam an hour will be condensed by this unit, and there will be 90 000 sq. ft. of cooling surface. Water for condensing will be supplied by two 54 in. centrifugal pumps, with a capacity of 160 000 gallons of water per minute.

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THE PREVENTION OF IONISATION IN IMPREGNATED PAPER DIELECTRICS.*

Research on Reasons for Failure—Absolute Potential the Deciding Factor—Protective Effect of Guard Strips—A Suggested Test.

By S. G. BROWN, F.R.S., M.I.E.E., and P. A. SPORING, M.Sc., A.I.C.

IT is known that the performance of paper-dielectric condensers which in this country are generally used on 600 V a.c. circuits, has not been entirely satisfactory. The experience of the manufacturers of such condensers has been that a number of failures occur after a period of service varying from one to two years, and that in each case the symptoms have been very similar. The failures have taken place notwithstanding most severe tests before installation; and there appears to be no relation between any test which can be applied before installation and the length of life in service. These results are very similar to those obtained on high-tension cables which have failed in the same way.

In recent years much research has been carried out to discover the reason for the frequent failure of impregnated paper dielectrics which have been subjected to alternating potentials for considerable periods.

In the cable industry particularly, the effect of the presence of air bubbles upon the dielectric properties of high-tension cables has been investigated at length, and, while it cannot be said that opinion is unanimous as to what part ionisation plays in dielectric breakdown, there is a large amount of evidence which ascribes a preponderating influence to this effect, as is shown by the various methods which have been developed for reducing the amount of ionisation or of evading its consequences by replacement of air by a more inert gas.

It has been found that if the power factor of, for example, a high-tension cable is measured at increasing values of voltage, the measured losses increase rapidly when a certain voltage is exceeded. This potential has been referred to as the "critical" or "ionisation" voltage, and it has been tacitly assumed that as long as the cable is working below this voltage, ionisation of the enclosed air cannot take place. This assumption is not quite correct. If the dielectric contains but little occluded air, then, since the proportion of air to the remainder of the dielectric is very low, the losses in the air must rise to a very great value before they can be detected by the measuring instruments, which automatically read an average power factor over the whole of the dielectric. The true ionisation voltage may be exceded many times before any increase in the power factor can, with certainty, be detected.

False Security.

A straight-line power factor voltage curve does not mean that ionisation is not taking place, and it may in fact give an altogether false sense of security. To reduce the quantity of air in the dielectric to an amount so small that the increased losses due to ionisation cannot be read on the measuring instruments is of doubtful utility, since the tendency of the dielectric in service will be to increase the proportion of ionisation loss; and it appears that to obtain an accurate idea of the behaviour of a dielectric in which air is present, it is preferable to study that dielectric with as large an amount of entrapped air as possible (in order that the effect of the ionisation of the air may not be masked by the large amount of other dielectric present) and then to see whether it is possible to discover some method of completely preventing ionisation.

The first point to be considered is the effect of ionisation of entrapped air upon the electrical properties of the dielectric. It is considered probable that breakdown is largely due to secondary chemical reactions set up by the ionisation, ozone and nitrous oxides being produced and leading finally to the destruction of the dielectric.

As a measure of the chemical state of the dielectric a knowledge of the insulation resistance is invaluable, as this enables one to study the effect of prolonged ionisation by placing a condenser on an alternating potential greater than that required to start ionisation, and measuring the insulation resistance and power factor at intervals.

It appears that if the dielectric contains air it is not possible to prevent ionisation by increasing the dielectric thickness except to a prohibitive extent. In other words, the absolute potential, rather than the potential gradient, is the deciding factor. It is quite possible to have two condensers with identical potential gradients, one in a most unsatisfactory condition and one working quite well.

It is true that any particular potential difference across a definite distance can be expressed as an average potential gradient, but no real advantage is gained. It is quite impossible to tell from the potential gradient alone whether the dielectric will eventually fail; but it is suggested that, from a knowledge of the absolute potential, this is possible.

The principle on which design is to be based is that ionisation of entrapped air is impossible unless the voltage applied to the electrodes exceeds the minimum sparking potential, which in air at atmospheric pressure is about 300 V.

The correct method, then, of building a dielectric to work at a given voltage is not to increase the thickness so that ionisation is prevented by this means, since economic considerations render this practically impossible; but rather to arrange that the dielectric consists of such a number of series sections that the voltage across any one section shall not exceed that required for ionisation.

The Limiting Thickness.

The limiting thickness which may be used for one section will be determined by the puncturing voltage of the thin layers used. The permissible potential gradient will increase indefinitely as the thickness of the dielectric decreases the voltage remaining constant at 300 V. Thus the final thickness used will be a compromise.

A remarkable confirmation of the protective effect produced by inserting the guard strip was obtained during tests of condensers. After working on 600 V and 50 frequency for some days, a number of condensers were found to have broken down, and on examination it was found that the guard strip did not cover the electrodes exactly, but left a narrow strip of unguarded condenser along one edge. It was this edge that had broken down. The remainder, which was covered by the guard, was quite sound.

The extension of this principle to cable manufacture is evident. If the dielectric be divided up into a large number of sections of equal capacity by layers of metal foil, or preferably by paper coated with a semi-conducting film, then by adjusting the number of sections the voltage applied to each can be kept below ionisation potential.

Consider the case of a cable with an air dielectric which is to work at 50 kV (R.M.S.). For simplicity it will be assumed that the centre conductor is of such a diameter that the problem can be considered to be that of two planes. The necessary thickness of air-gap to withstand this voltage will be 1 in., corresponding to a potential gradient of 50 V per mil (20 kV per cm).

If the dielectric be subdivided on a basis of 250 V per unit thickness, the thickness necessary to withstand 250 V at atmospheric pressure is approximately 0·2 mil. Thus to withstand 50 kV it is necessary to have 200 such sections in series, giving a total dielectric thickness of (200 by 0·2) = 40 mils, and an effective potential gradient of 1 250 V per mil (500 kV per cm).

The presence of solid dielectric will not materially affect these calculations. The tendency will be to exaggerate the defects in the plain unguarded cable, since the potential gradient will be greater across the air bubbles, owing to the low dielectric constant of air compared with that of the solid dielectric.

The methods of testing generally in use are not such as to give an indication of the behaviour of the dielectric under working conditions. The instantaneous breakdown voltage is of value in so far as it discloses actual mechanical defects in construction. On experimental lengths, power-factor/voltage curves, taken with the dielectric impregnated but not evacuated, give a reliable indication of the performance under working conditions.

Obviously, however, this test cannot be applied to any finished product. The test suggested for such a case is that a sample length of cable or condenser should be taken and placed in a vacuum, and its power-factor/voltage curve taken under these conditions.

* Extracts from a paper read before a meeting of the Institution of Electrical Engineers.

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THE SOLUTION OF PLAIN & AMALGAMATED ZINCS IN ELECTRIC BATTERIES.*

By J. NEWTON FRIEND, D.Sc., Ph.D., F.I.C.

An Investigation into the Possibility of Using High-Grade Instead of Amalgamated Commercial Zinc—No Change Recommended.

ABOUT a year ago a British firm inquired of the author (1) whether plain high-grade 99·9% zinc might be used to replace amalgamated ordinary commerical 98 to 99% zinc in electric batteries, and thus enable the expensive and somewhat dirty process of amalgamation to be dispensed with; or (2) failing this, if it would be more efficient to employ amalgamated pure zinc in such batteries. An investigation was therefore undertaken, and as the results may be of interest to others it has been decided to make them public.

TABLE I.

Series.	Corroding Medium.	Grade of Zinc.	Specimen No.	Rods or Cylinders.	Period of Exposure, Months.	Loss in Weight. Grm.	Mean Loss.	Remarks.
I.	10 per cent. H_2SO_4 in tank	OZA	27	Cylinders	3	7·58	5·56	All in good condition
			28			6·59		
			31			2·52		
		PZA	29			58·88	59·88	All eaten through
			30			54·67		
			32			66·08		
II.	Saturated ammonium chloride solution in tank	OZ	18	Cylinders	9	85·85	..	Pitted
		PZ	20			41·05	..	,,
		OZA	17			7·44	..	Fairly smooth
		PZA	19			11·50	..	,, ,,
III.	Saturated ammonium chloride solution in tank	OZ	10	Rods	9	5·83	5·84	Pitted
			16			5·85		
		PZ	12			4·02	4·24	,,
			15			4·45		
		OZA	9			2·52	2·62	Evenly attacked
			14			2·72		
		PZA	11			2·35	2·30	,, ,,
			13			2·25		
IV.	Saturated ammonium chloride solution in Leclanché cells used intermittently	OZ	2	Rods	9	7·13	9·61	Pitted
			6			12·09		Very deeply pitted
		PZ	2			9·05	8·77	Eaten away and roughened
			8			8·48		
		OZA	1			3·23	3·08	Fairly evenly attacked
			5			2·92		
		PZA	3			2·75	2·81	Fairly evenly attacked
			7			2·86		
V.	Saturated ammonium chloride solution in telephone cells used frequently	PZ	42	Rods	9	3·90	4·29	Roughened
			43			4·68		
		OZA	46			3·19	3·27	,,
			47			3·35		
		PZA	40			3·07	3·21	,,
			41			3·34		
		PZ	44			5·01	..	,,
		OZA	45			1·87	..	Least pitted in set

The zinc was provided by the London Zinc Mills, Ltd., and was in two forms:

(1) Sheet zinc, 0·35 cm. thick, bent round into a hollow cylinder 11·5 c.m long and 4·5 cm. in diam. It was fitted with a tongue, to which was riveted a thin copper strip for electrical connection, and this latter was coated with black varnish. Weight, approximately 350 grm.

(2) Cylindrical zinc rods, 15·3 cm. long and 0·96 cm. in diam. These were joined at the top to copper wire in the usual manner for Leclanché cells. Weight, approximately 85 grm.

Each of these forms was prepared in four varieties—namely, plain ordinary 98 to 99% zinc, "OZ"; ordinary zinc amalgamated, "OZA"; high-grade 99·9% pure zinc, "PZ"; and pure zinc amalgamated, "PZA."

The ordinary zinc had the following composition: Lead, 1·12; iron, 0·05; arsenic, 0·006 (approx.); zinc, 98·82%.

Dilute Sulphuric Acid Tests.

SERIES I.—In this series amalgamated cylinders alone were used, for the action of dilute acids upon various plain zincs had already been made the subject of extensive inquiry by numerous other workers. Preliminary tests showed that although the plain pure zinc was much more resistant to sulphuric acid attack than the ordinary metal, it was nevertheless attacked too vigorously to be of use in an electric cell. Thus, in 1 hr. a plain pure zinc cylinder lost 5·26 grm. in 10% sulphuric acid solution, whilst in the same period a cylinder of ordinary zinc lost 29·5 grm.

The results of exposing cylinders of the amalgamated metals to the action of dilute sulphuric acid for three months are given in the table. The cylinders stood upright on a glass plate in a large glass trough containing several litres of 10% sulphuric acid, and were immersed to a depth of 7·5 cm. The amalgamated pure zincs lost ten times as much in weight as the amalgamated ordinary zincs, and were eroded through in numerous places.

Ammonium Chloride Tests.

Although the effects of impurities on the corrosion of plain zincs by ammonium chloride solution have been investigated, notably by Drucker, published data concerning amalgamated zincs is very scanty. The following results, therefore, possess a special interest.

SERIES II. TESTS WITH CYLINDERS.—Four zinc cylinders were exposed in a large glass tank to the action of saturated ammonium chloride solution for nine months. They stood on a glass plate and were immersed to a depth of 11·8 cm. The results (see Table 1) show the superiority of the pure zinc over the ordinary metal in the plain condition, but the amalgamated pure zinc proved slightly less resistant than the amalgamated ordinary metal.

SERIES III. TESTS WITH RODS.—Eight rods were suspended from glass rods in a saturated solution of ammonium chloride for nine months. They were immersed to a depth of 11·8 cm. The plain pure zinc again proved superior to the ordinary, and the amalgamated pure zinc was also slightly superior to the amalgamated ordinary metal (see Table I.).

SERIES IV. LECLANCHÉ CELL TESTS.—Eight cells were fitted up in series and connected to a bell, which was used intermittently for nine months. The results (see Table I.) confirm those of the previous series.

SERIES V. TELEPHONE CELL TESTS.—Eight rods were placed in Leclanché cells in the college telephone batteries which were in constant use. After nine months the rods were removed, with the results shown in Table I. The amalgamated metals have behaved alike, and their superiority over the plain pure zinc is evident.

Comparing Series II. and III. it is seen that the plain zinc cylinders in Series II. lost very much more in weight in proportion to the amalgamated cylinders than the corresponding rods in Series III. Thus, in Series II. the cylinder ratio OZ : OZA is nearly 12 : 1, whereas in Series III. the rod ratio OZ : OZA is only 2·2 : 1. Similarly the cylinder ratio PZ : PZA is 3·6 : 1, whilst the corresponding rod ratio is 1·8 : 1. Possibly this is connected with the work done on the metal sheets when shaping them into cylindrical form. One would expect amalgamation of the surfaces to assist recovery to a fairly uniform potential.

The single OZA cylinder in Series II. lost less in weight than the PZA cylinder, although in general the OZA rods lost slightly more in weight than the PZA rods. This may, of course, be an accident. In any case one cannot safely generalise from a single test. The differences between the various zincs in Series V. are somewhat less than in the other series. This was to be expected, since in Series V. some of the zinc was used in service.

The Conclusions.

It is recognised that only two varieties of zinc have been used in these tests, and that the tests themselves have been limited in character; but the metals were typical commercial brands, and it is thought that the following conclusions are justified:—

(1) The use of plain high-grade 99·9% zinc in electric batteries cannot be recommended in place of amalgamated zinc.

(2) In dilute sulphuric acid the amalgamated pure zinc may be even less resistant to attack than the amalgamated ordinary metal.

(3) In ammonium chloride solutions there is little to choose between amalgamated pure and amalgamated ordinary zincs. No change from the usual practice of using amalgamated ordinary zinc is, therefore, recommended.

* From a paper read at a meeting of the Institute of Metals, in London.

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AUSTRALIAN LETTER.

Unified Control of Generation for New South Wales.

By WILLIAM DAVEY (Managing Editor, "Australasian Electrical Times.")

MELBOURNE, *February* 25th.

ONE of the most important events of the month, electrically, is the move by the Government of New South Wales to establish a State Electricity Commission. New South Wales has a white population of 2 437 277, of whom 1 101 190 are living in Sydney. There are now over 250 electricity supply authorities, mainly municipal.

In the City of Sydney there are two authorities, the municipality, and the Electric Light and Power Supply Corporation, Ltd., the former having over 140 000 and the latter 21 000 consumers. Part of the energy distributed by the municipality is generated at the power stations of the Railway Commissioners, but the Civic Commissioners have just placed in commission the first 25 000 kW unit of their Bunnerong power station which will have an ultimate capacity of 300 000 kW, and this will gradually do away with the purchase of energy from the Railway Commissioners, who are electrifying their suburban railways, and will be requiring the full output of their generating stations.

The State Government has already done good work, its steam station at Port Kembla supplying a half-dozen country towns in bulk, and its hydro-electric station at Barren Jack a similar number. The Port Kembla power house has a capacity of 5 100 kW, the principal units being three 1 500 kW Brush-Ljungström turbo sets; and at Barren Jack there are two "Francis" type water turbines direct coupled to alternators, each having an output of 5 000 kW at 6 600 V, three-phase, 50 cycles.

New South Wales is standardising on 415/240 V for distribution, whereas Victoria uses 400/230V, the system in both cases being three-phase, 50 cycles.

The new Commission will have charge of all power supply matters, and will determine the most economical numbers and types of large stations to replace the present mass of small ones.

A movement which may not be unconnected with this is the formation in Sydney of a Radio and Electrical Development Association, in connection with the Electrical Employers' Association of New South Wales. The two movements in conjunction will doubtless expedite electrical progress, and enlarge the market for appliances of all kinds.

* * *

Australian electrical people have now had time to think and talk a good deal about the recent visit to this country of Sir Hugo Hirst, whose frankness in discussing with individuals and associations the problems of the electrical business in Australia was very acceptable to the Australian temperament. If more of your big men would come out and see this young country for themselves, they would form, in many cases, an opinion of its people and its opportunities, quite different from that which they now hold. The very blunders of Australia are evidence of a driving force which will not be gainsaid, and there is no doubt of the great electrical future of this Commonwealth.

You read much in England about our droughts and our bush fires, but most Australians have never seen either. You hear about our labour troubles, but the vast majority of Australian men and women are workers who have earned the admiration of Sir Hugo Hirst, and many other British industrial leaders by their capability, energy, and initiative.

* * *

The British General Electric Co., Ltd., has been entrusted with the supply of equipment for transmission of pictures between Melbourne and Sydney, which is to be placed in commission in about six weeks' time. The charge is to be 20s. per picture. The equipment will be of the "Siemens-Karolus" type, for which the General Electric Co., of England, has the British Empire rights.

Among other notable British business closed here during the month is a tender of John Thompson, Wolverhampton, for 8 boilers and accessories for the State Electricity Commission of Victoria, amounting to £233 000; that of the Australian General Electric Co., Ltd., for an 18 750 kW B.T.H. turbo-alternator, with condensers and auxiliaries, for the Brisbane City Council, at £67 427, and one of Messrs. Babcock and Wilcox, Ltd., for three boilers for the same authority, at £74 266.

CORRESPONDENCE.

The Editor welcomes the free expression in these columns of genuine opinion on matters of public interest, although he disclaims responsibility alike for the opinions themselves and the manner of their expression.

The Electric Sign Load.

[TO THE EDITOR.]

SIR,—Recent descriptions and illustrations in your paper of exterior shop lighting in the form of marquise lights and electric signs suggest that central stations have here an important load for development. In the striking sign used by Selfridge's during their birthday week is seen an example of remarkable developments offering in this field. Although I have not had access to the details, I estimate that roughly about 30 000 lamps were used for this gigantic sign, and if we assume that the individual voltage throughout was 30, we have a total load of some 900 kW, an item not to be sneezed at by most city supply undertakings.—I am, etc.,

"ELECSIVE."

London, N.W.1.
April 9th.

Electric Propulsion for River Boats.

[TO THE EDITOR.]

SIR,—It is with much pleasure that I note the encouraging words in your reference to the growing dangers of petrol engines in small river boats, the filthy smoke and smell, the awful noise which they make, and the very dangerous wash which they throw off, at the foolish speeds at which they are, so far, allowed to proceed.

During the last thirty years, I have had to make experiments with many petrol-driven boats, and also the electric battery boat, and can assure you that your words are perfectly true, and there is to-day no reason, whatsoever, why the public cannot enjoy the real pleasure of electric propulsion, at a reasonable commercial figure.

In the old days, and I am now speaking of my original experiments on the Thames back in 1890, we had not nearly the facilities which we have to-day, to demonstrate the almost ideal pleasures of electrically-propelled boats, and the commercial advantages of same for many industrial propulsion schemes. Very little was known by anyone, concerning the very complicated factors of the screw propeller, and most of the early electric boats had the very inefficient high revolution small area screw propellers fitted, and claims were actually made that this allowed the use of a lighter, and cheaper electric motor for the purposes. To-day we have much more efficient propellers, which are run at such low revolution speed, that very little cavitation takes place, and there is a consequent reduction in watt-energy used per ton-mile at any given boat speed.

Again, to-day, we have the benefit of the great advance which has taken place during the last 30 years in the design and construction, and of big improvements in the design and construction of storage batteries. In the old days we all used "series wound" motors for propeller driving, in spite of the fact that the torque characteristic of any sort of marine propulsion is almost ideal for "shunt" or separately excited propelling driving motors. We tolerated the loss of energy, due to series racing and slowing, when at uneven immersion of the propellers, and this again during my experiments I have found represents quite a big loss of watt-energy.

Then, how many supply stations actually made a real attempt to encourage the use of low voltage energy suitable for this pleasure craft business? In my opinion, if it was not for the few people who put down their own charging stations (and thus at the same time limited the radius of travel by the electrically propelled boat), there would have been even fewer electric boats than actually existed.

Again, there is the great question of steering control. Considerable loss in watt-energy takes place by the continued use of the rudder, owing to the crowded condition of the river, and it was this question which brought about my experiments with the "Paragon" steering and reversing propeller, described in Mr. H. M. Hobart's book on Electrical Propulsion of Ships (Harpers). By means of this new thrust making machine, we secure quite a lot of extra propulsive efficiency per unit of electrical energy used, not only because the actual propulsive power is used for steering, but, also because of the constant depth at which the blades are immersed.

The price of petrol is going up still higher in the future, and there is not the least doubt that builders and users of river-

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craft are looking round for something not only better and safer, but, also cheaper than can be expected from the thermally inefficient petrol engine. By that statement, I mean, not only is the average thermal efficiency very low, owing to constantly throttling, etc., owing to traffic conditions, but in many cases the brake thermal efficiency is not more than 15 to 20%, and by the time the mechanical energy gets past the propeller losses (again owing to their very high revolution speed) only about 5 or 6% of the petrol fuel heat used actually pushes the boat.

Yes, Sir, I think that we can now expect something to happen. The pleasure loving public want real river pleasure cheaply, and above all with safety, but they will not get it while they adhere to early Victorian ideas and methods.

I quite agree with "Aquatic" in your issue of March 29th that people should demand electric propulsion. Then the great potentialities of this twentieth-century descendent from "Jacobi's" famous Russian experiment on the river Neva in 1838 will be realised. I am, etc.,

WILLIAM P. DURTNALL.

Westminster, London, S.W.1.
March 30th.

"Electrical Firms and the B.I.F."

[TO THE EDITOR.]

SIR,—I was glad to see that "Doubtful" last week revived the question of the suitability of the present date of the British Industries Fair, a point which has been discussed in your columns at various times during the past two or three years. It has, I think, been shown in these discussions, that a change in the date of the Fair is a reasonable and necessary alteration if the Fair is to justify its claim to appeal to and attract the attendance of buyers from overseas. Why, then, is it so difficult to secure adequate consideration of such proposals by the ultra-conservative members of the Fair Management Committee?

I know that some of those who are resisting the idea of a postponement until May or June base their arguments on the possibility of attracting buyers who have made long journeys to see the Leipzig and Vienna Spring Fairs. But if we want to secure the attendance of these buyers we must hold our Fair after and not before the Continental exhibitions, so that if our Fair were arranged to start immediately after the second of these—the Vienna Fair—it would fall in the third or fourth week in March. Personally I do not consider this to be an ideal time, but it would at least be an improvement on the present arrangement.

Again, those who consider that the early months of the year are generally acceptable to those participating in the Continental Fairs, are labouring under a misapprehension, for I note that in the official report on the business done at this year's Vienna Fair refers to requests that were made for holding that exhibition at a later date. The change was resisted, but mainly on the grounds that there must be no interval between Leipzig and Vienna, and that some of the visitors would have made arrangements based on the usual date.

It is obviously impossible to change the date of an exhibition a month or two before it is due to open, but it is only about that time that exhibitors seem to discover the need, and fair management committees to realise that an alteration is desired.

If the Birmingham Fair Committee is so sure that it is right in sticking to February why does it not ascertain the views of the electrical industry now, and not when it is too late?—I am, etc.,

H. C. M.

Newcastle.
April 8th.

ADDITIONAL GENERATORS FOR GATINEAU RIVER.

The Gatineau Power Co., controlled by Canadian Hydro-Electric Corporation, Ltd., a subsidiary of International Paper and Power Co., has started additional generators in its Farmers and Chelsea hydro-electric plants on the Gatineau River, six miles north of Ottawa. The two new generators, with a combined capacity of 58 000 H.P., raise the total installed capacity of the Farmers and Chelsea plants to 232 000 H.P. The total capacity of the plants of the Gatineau Power Co. is now 562 600 H.P. installed and in process of installation, slightly greater than the developed power on the American side of Niagara Falls. In 1928 the Gatineau Power Co. produced 1 286 000 000 kWh.

THE NATIONAL REGISTER.

Eighteen Further Applications Accepted by Executive Committee.

DESPITE the fact that the number of electrical installation contractors who are qualified for enrolment on the National Register of Electrical Installation Contractors is steadily diminishing, the Executive Committee at its last meeting, held at the Institution of Electrical Engineers on April 5th, had no fewer than 32 applications for consideration.

Of these, 18 were accepted, 4 withdrawn, and 10 declined. Names and addresses of successful applicants are set out below:—

Ashworth, Walter, 145, Chorley New Road, Horwich, Lancs; Barnes, F. A. and Son, Sussex House, New Road, Shoreham, Sussex; Bessant, A. J., Ltd., 32, Grove Road, Eastbourne; Carrack, J. W. and Son, 17, Vicarage Place, Kirkstall, Leeds; Davis, H. and Son, 30, Westbourne Road, Walsall; Dove, W. E. and Co., Ltd., Bondgate, Darlington; Durrant, Laurence H., 330, High Street, Harborne, Birmingham; Eyre, R. E., and Sons, 447, Yardley Road, South Yardley, Birmingham; Hall's Longitudinal Lighting Co., Ltd., 5, Victoria Street, Westminster, London, S.W.1; Harris, F. W. and Co., 9, Primrose Hill Street, Coventry; Henwood, J. H. and Co., 5, Church Row, Aldgate, London, E.1; Lincoln and Egerton, 40, Fuller's Hill, Great Yarmouth; Lye, Charles, 11, Northernhay Place, Exeter, Devon; McRobb, Andrew, 27/29, Adelphi, Aberdeen; Moffett, Charles R., 130, Victoria Road, South Shields; Rock Electrical Engineering Co., 36, Barker Street, Oldham; Rugby Electrical Engineering Co., Regent Place, Rugby; Whitton, Fred and Son, 19, De Lacy Mount, Kirkstall, Leeds.

The annual ordinary general meeting of the Registration Board will be held at the Institution of Electrical Engineers on April 15th at 2.30 p.m. The following is the agenda:—

(1) To receive and consider the reports of the Executive Committee and auditors of the balance sheet to December 31st, 1928.

(2) To receive nominations for members of the Registration Board, and confirm.

(3) To elect a chairman and vice-chairman for the current year of the Register.

(4) To receive a recommendation from the Executive Committee that certain examples of defective installation work shall be the subject of a Regulation or Standing Order of the National Register, and, if approved, to confirm same.

(5) To elect members of the Executive Committee in place of those retiring—viz., Messrs. Hunter, Dykes and Cash, all of whom are eligible and offer themselves for re-election.

(6) The election of auditors.

(7) Any other necessary business.

IN LIGHTER VEIN.

WHILE the members of the staff at the offices of W. T. Henley's Telegraph Works Co. were enjoying the Easter vacation, a London pigeon, presumably deciding that someone must work, though cable makers make holiday, gained access to the fifth floor *and laid an egg in a correspondence tray*. The bird had flown before the advent of the cleaners, but it left the egg behind it. Knowing bird!

* * *

The following definition of electricity is put forward by the "New York Utility Bulletin":—

Electricity is something that starts the Lord knows where and ends in the same place. It is $\frac{3}{4}$ of a second faster on its feet than its nearest competitor, backyard gossip, and when turned loose in Europe, will get to the United States five hours before it starts. Nobody knows exactly what it is, because it has never stood still long enough.

Electricity is sometimes known as science gone crazy with the heat, and if you can understand its manœuvres you can do anything with it except open a can of peanut butter at a picnic.

Electricity was locked up in ignorance for centuries until Ben Franklin let it out with a pass key, and since then it has been pulling off more new stunts than a pet monkey.

With it you can start a conversation or stop one permanently, cook dinner, curl your hair, press your trousers, blow up a battleship, run an automobile, or signal Mars, etc.

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NEWS IN BRIEF.

Preston Electrical Exhibition—Chertsey Institution Lighting—Hire-Purchase at Swansea—Electric Pumping Plant at Northampton.

A NEW lighting system is being installed at the greyhound racing track at Slough.

Preston electricity department has been "overwhelmed" with inquiries as the result of its recent exhibition.

Steps are being taken at Charlbury, Oxon, to ascertain the number of residents who would avail themselves of an electricity supply.

Imports of electrical goods into the Irish Free State during February, last amounted to £30 886, as compared with £53 848 for the same month last year.

Aldershot T.C. is advertising for suitable premises for use as showrooms in connection with the electricity undertaking.

Glasgow Watch Committee has decided to re-wire and improve the electric lighting at the various police halls in the city.

Chertsey Board of Guardians has decided to use electricity at the Institution in place of gas, the supply to be given by the Woking Electric Supply Co.

Glasgow Finance Committee has appointed a committee to report upon the alterations and improvements of the electric wiring which will be necessary at the various burgh halls in order to obtain sanction to their use for cinema purposes.

At a meeting of the West Wales (Swansea) Sub-Centre of the Institution of Electrical Engineers, April 5th, Mr. J. W. Burr (Swansea) spoke on "The economic relation between electrical energy produced at a super power station and electrical energy produced by small power plants." He believed it would be impossible for the small and medium-sized stations to generate as cheaply as a super power station. At present, electricity was being generated for less than a pound of coal per kWh.

Following the fire at Pontardulais which gutted the distributing station of the Gorseinon Electric Supply Co., a new station was erected and the service restored within 48 hours.

The annual meeting of the North Midland Centre of the I.E.E. will be held at the Hotel Metropole, Leeds, on April 16th. Dinner will be served at 6 p.m., and a smoking concert will follow the meeting.

Members of the South Midlands Students' Section of the I.E.E. will visit the G.E.C. Witton works to-morrow (Saturday). This year's joint meeting with the Rugby Engineering Society will be held on April 23rd.

The annual meeting of the Iron and Steel Institute will be held at the Institution of Civil Engineers on May 2nd and 3rd, commencing each day at 10 a.m. The annual dinner will be held on May 2nd at the Connaught Rooms, London.

The next meeting of the Physical Society will be held at the Imperial College of Science, London, on April 19th, when the Guthrie medal will be presented to Dr. C. E. F. Guillaume. The lecture to follow will be delivered by Prof. W. R. Bridgman.

At a sales conference held by the North Midland area of the E.D.A. on April 4th, at Leeds, Mr. D. Millner read a paper entitled "Organising for Better Selling in Electrical Showrooms." Mr. F. N. Rendell-Baker presided, supported by Lieut.-Col. W. A. Vignoles.

A strike of 5 000 Chinese and Indian labourers, who have been engaged on the construction of the large dam in connection with the Perak River hydro-electric works at Chenderoh, commenced on April 1st. It is understood that the stoppage is due to a proposed reduction of 10% in wages.

Shipton-under-Wychwood will shortly enjoy street lighting by electricity.

It is reported that the Pope has ordered additional plant for the power station at the Vatican.

Members of the Institution of Mechanical Engineers will visit the new generating station at Oldham in June.

The annual general meeting of the North Western Students' Section of the I.E.E. will be held on April 16th. Following the meeting Mr. F. Roberts will read a paper entitled "Errors in Current and Voltage Measurements at Radio Frequencies."

Swansea Electricity Committee has adopted in principle the idea of supplying electrical apparatus on the hire and hire-purchase system, and instructed the engineer to prepare details.

Northampton Water Committee has received a report from the Water Engineer on the question of the electrification of the pumping plant at the Billing Road pumping station, at an estimated cost of £1 750. The saving on the present system is estimated at £300 per annum. The Committee recommends that, subject to satisfactory arrangements being made with the Northampton Electric Light and Power Co., as to power supply, the Engineer be authorised to purchase the necessary plant.

The Minister of Labour gives notice that he will designate to the Electricity Commissioners, the employees' organisations having members in the employment of authorised undertakers in the North-West Midlands Electricity District, in order that the organisations so designated may choose a representative of persons employed in connection with the supply of electricity in the District to be a member of the Joint Authority. Any employees' organisation desirous of being considered for designation should apply to the Minister by April 22nd, on a form to be obtained from the Secretary, Ministry of Labour, Montagu House, Whitehall, London, S.W.1.

At meetings of electrical engineers held simultaneously in Sydney and Melbourne, communication was made by means of the carrier-wave telephone system. Speakers in Melbourne and Sydney were heard with equal clearness at both meetings.

At the annual conference of the National Federation of Sub-Postmasters on Monday, it was resolved to ask for increased payment for telephone cabinets on sub-postmasters' premises. Delegates criticised automatic telephones, alleging that they lent themselves to fraud.

The public exhibition of works sent in for this year's open competition of Industrial Designs will be held under the auspices of the Royal Society of Arts, at the Imperial Institute, London, from August 3rd to September 1st. Entries must be in by May 27th, and the judging will take place in July.

In a paper read at a recent meeting of the Manchester Branch of the Institute of Public Administration, Mr. H. Townshend, the British representative on the International Telephone Consultative Committee, said international telephone communication—between Great Britain and France—was commenced in 1891. The personal call system, which guaranteed connection with the required person, was only in use in America and Scandinavia. Between the spring and autumn of last year calls between this country and France increased from 1 000 to 1 500 per day.

LOOKING BACKWARD.

FIFTY years ago, as reported in THE ELECTRICIAN *of April 12th, 1879:—*

Mr. Latimer Clark was considering the application of a thermo-electric battery for the production of light.

Under the command of Major A. C. Hamilton a troop of the Mounted Royal Engineers sailed for Natal. On arrival at the seat of war they were to form the Land Transport and Telegraph Corps.

An agreement for the extension of the lighting by electricity of the Victoria Embankment provided for the placing of 20 lamps between Waterloo and Blackfriars bridges. Thus, the electric light, with 40 lamps from Westminster, was "applied over a distance of 2 145 yards from one centre, worked by Ransome's series of 20 H.P. engines and two Gramme batteries."

* * *

TWENTY-FIVE years ago, it was recorded in THE ELECTRICIAN *dated April 15th, 1904, that:—*

Birmingham Corporation decided to build a new power station at Summer Lane.

Mr. G. C. Lloyd was appointed secretary of the Institution of Electrical Engineers, and Mr. P. F. Rowell, chief assistant to the late Mr. McMillan, became assistant secretary.

Representatives of municipalities owning and working telephones were considering what action should be taken with regard to the proposal of the Government to take over the National Telephone Co.

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MANUFACTURERS' EQUIPMENT.

New Starting Gear for Squirrel Cage Motors—Electric Furnaces for Strip Metals and Wire—A New Portable Paint Sprayer—Heating of Workshops and Factories.

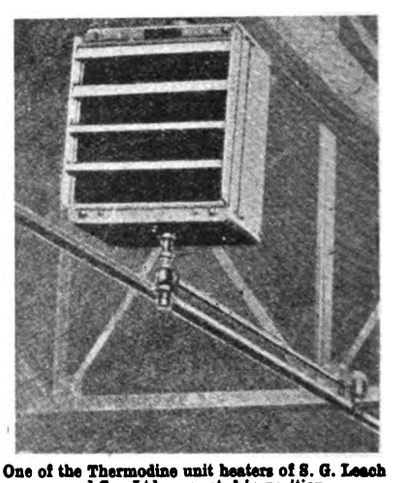
THE ENGLISH ELECTRIC CO., LTD., Queen's House, Kingsway, London, W.C.2, has introduced a series of oil-immersed starters for squirrel-cage motors up to 650 V. These units are listed as Class OS, are ironclad in construction and are totally enclosed. Special features of the units are that the two throw switches with neutral "off" position can be operated by one handle; complete free handle freedom for releases to operate in any position required; drum and contactor type switching according to size is provided, which accessibility to contacts and all other parts has received adequate attention. The starters are made in four types, A being for direct-on starting of 2- or 3-phase motors on 3-wire circuits; B for star-delta starting; C for series-parallel starting of 2-phase machines on 3- or 4-wire circuits; and D for direct-on starting of 2-phase motors on 4-wire circuits. The starters can be fitted with a low-voltage release and one, two or three overload releases, while a trip coil for remote stopping can be provided if desired. In the latter case not more than two overload trips can be fitted. The low-voltage release consists of a contactor-type laminated magnetic circuit controlled by a phosphor-bronze spring, a damping winding being provided to ensure quiet working. The overload releases are mounted at the front of the starter and are supplied with time-lags. The overload setting can be adjusted over a wide range, the adjustment being effected from outside the starter. In the smallest size of starter the contacts are of the drum type with renewalable drum contacts and fingers. No flexible connection is used, and the drum is mounted eccentrically to assist return to the "off" position. In the larger sizes large "butt" type contacts are provided and so disposed as to give a horizontal break under a good head of oil. Fixed and moving contacts are interchangeable and either can be removed by taking out one screw. The operating mechanism consists of a system of levers acting on a modified toggle principle, which gives complete "free-handle" action. The contacts are held in the "run" position by a compound latch, which gives a delicate and reliable tripping arrangement. Where required, an ammeter can be fitted to the top cover. Connection is made by knife contacts and reinforced U clips so that easy removal of the starter cover is in no way interfered with. All starters are tested at 2 000 V a.c.

The "Cadillac" blow torch, by the Metropolitan-Vickers Electrical Co., Ltd.

An electric tubular furnace for the continuous heat treating of strip metal and wire has been designed and placed on the market by H. O. SWOBODA, INC., Pittsburgh, Pa. The furnace consists of a sheet steel-encased body about 20 in. high, 20 in. wide and 60 in. long, supported by four angle iron uprights. The chamber within the furnace consists of the usual refractory material used for furnaces of this type, the resistor and a tubing within the refractories forming the chamber proper. The nickel chromium resistor is arranged in four units of the "hairpin" type connected in series and extending over the length of the furnace. The tubing is made of an alloy which, it is claimed, will not scale at the operating temperature of the furnace; it is large enough to accommodate steel strips or wire up to one inch wide. The refractories forming the chamber are surrounded by fire bricks which withstand temperatures up to 2 500° F. and they are enveloped by heat insulating bricks which reduce the temperature of the outer casing to less than 175° F. The energy for the resistor is supplied by a single phase auto-transformer of the dry type, the primary winding of which can be furnished for any standard voltage. The control apparatus consists of a recording control pyrometer with the necessary switches and relays. The pyrometer records two temperatures, one being the temperature of the resistor, the other the temperature of the strip metal passing through. The automatic control is connected to the thermo-couple recording the temperature of the resistor. The strip metal can be passed through the furnace at speeds as high as 1 500 ft. per hour if not thicker than 0·006 in. Heavier strips have to be fed at correspondingly lower speeds. The energy consumption per pound of metal heat treated is stated to be slightly less than 0·1 kWh.

We have received from B.E.N. PATENTS, LTD., of 92, Tottenham Court Road, London, W.1, details of a new portable paint spraying equipment. It is claimed that this new gun utilises a new principle of atomisation, and requires a much smaller volume of air without sacrificing in any way the quality or efficiency of the work performed. It is also stated that the plant enables a comparatively small compressor to do the work formerly requiring a larger machine. Atomisation is effected on the discharge of 3½ cu. ft. of air per minute. The method of vapourising with the B.E.N. gun gives a smooth finish, obviating to a great extent any rubbing and cutting down. The unit is automatically controlled, and ensures a constant pressure of air in the tank at all times. Another feature is that the air receiver is insurable, being constructed of heavy steel, rivetted and tested to double working pressure. The motor used is a ¾ H.P.

A system of heating of interest to all trades, whether for the factory, office or home, is presented in the "Thermodine Unit Heater" marketed by S. G. LEACH AND CO., LTD., of 26/30, Artillery Lane, London, E C.1. By its use, it is claimed that an industrial plant can be heated as effectively as it is illuminated, it is possible to direct the heat down, just as light rays are directed where needed, while undesirable "cold spots" in a building can be eliminated. Some idea of the capacity of one of these units may be gathered from the fact that it is claimed that a radiating surface of approximately 3·5 sq. ft., and weighing 125 lb., replaces 600 sq. ft. of cast-iron radiation weighing over 2 tons. An inspection of the unit reveals that it consists essentially of three parts, the condenser, the manifold and frame, and fan. The condenser is constructed of seamless copper tube, held in position by horizontal fins so spaced as to baffle the air passing through. Soldered joints are eliminated, and in this way any possibility of softening under hot water or steam temperatures is prevented. The manifold consists of an upper cast tank and an integral welded steel structure of bottom and side members. Allowance is made for expansion and contraction in the method of attaching the condenser to the upper tank, and by allowing the lower end to move freely. On a steam system the unit only requires low pressure, the maximum necessary being 10 lb. The figures given on the next page, obtained by the makers as a result of tests made on Model 701 give some indication of the heat transfer.



One of the Thermodine unit heaters of S. G. Leach and Co., Ltd., mounted in position.

Model 701, with a steam pressure of 5 lb., gives a heat equivalent of steam condensed of 160 000 B.T.U. per hour with an air temperature of 60° F. entering the unit, and 183 000 B.T.U. at an air temperature of 45°. The units are installed overhead and throw the heat downwards. Due to their light weight it is possible to suspend these heaters from the steam main, with only the supply connection as a support. After

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mains and returns have been run, the installation consists merely of making up two unions, one in the supply to and the other in the return from the heater, and making the necessary electrical connections. Thermodine unit heaters are manufactured in various sizes, the No. 700 series is designed

RESULTS OF TESTS WITH THERMODINE MODEL 701.

Steam pressure—5 lb.
Steam temperature—227° F.

Temp. Entering Average °F.	Total heat Delivered B.T.U. per hr.	Air delivery Aver. feet per min.	Final air Temp. °F.	Condensate lb. per hr.
30	203 000	1 883	125·8	210·5
40	191 100	1 906	128·7	198
50	178 800	1 928	132·0	185
Heat loss in still air	5 940	—	—	6·2

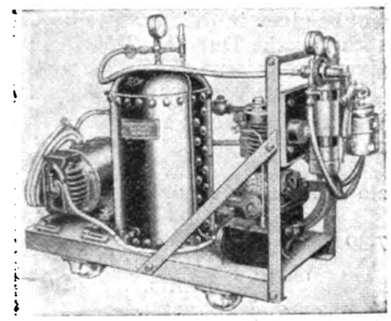
to replace from 600 to 700 sq. ft. of cast iron radiation. They are equipped with one-sixth horse-power motors. When equipped with the three-speed special motor any desired degree of quietness can be obtained. No. 500 series will replace about 500 sq. ft. of cast-iron radiation and are equipped with one-tenth horse-power motors, thus meeting the demand for a comparatively quiet unit. No. 300 series, is designed for heating smaller spaces, and will replace from 250 to 275 sq. ft. of cast-iron radiation. One-twentieth horse-power motors are fitted. No. 200 series will replace from 175 to 200 sq. ft. of cast-iron radiation. Equipped with one-thirtieth horse-power motors. No. 100 series will heat rooms that require from 90 to 100 sq. ft. of cast-iron radiation, and these are equipped with one-twentieth horse-power motors.

The METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester, has introduced a "Cadillac" blow torch designed to meet the demand for an instantly available forge for quick repair jobs and light routine work. The Research Department of the company in a report on these torches says "the results were decidedly good and the blow torch can be recommended as efficient. The control of the air is excellent and superior to the ordinary type of blow pipe. Wattage consumption is extremely economical (150 W) and the insulation resistance is satisfactory after a test of 10 days in ordinary workshop atmosphere." If used continually the gas consumption is only 70 cu. ft. per hour, or ½ therm. Laboratory tests gave the flame temperature at 2 900° F. or 1 600° C. The following table gives a comparison :—

METAL.	MELTING POINT.	ANNEALING TEMP.
Aluminium	1 214° F.	990° F. to 1 040° F.
Brass	1 650° F. (Approx.)	1 450° F.
Copper	1 982° F.	1 450° F.
Glass	2 007° F.	
Cast Iron	1 960° F.	
Wrought Iron	2 768° F.	
Nickel	2 646° F.	
Gun Metal	1 825° F.	
Steel Castings		1 500 F. to 1 700° F.

In considering these figures it must not be taken for granted that any metal or substance with a melting point below 1 600° C. can be readily operated upon with a blow torch. Much depends on the size of the job in hand. The machine is simple, the essential point being that the motor should always be turned on first and turned off last. In other words, the motor must at all times be running when the gas is on, in order to carry the latter out of the machine. If this instruction is reversed, gas will accumulate in the fan chamber and backfire will result. The gas tube is connected to a gas main, not necessarily under pressure as the blower will create its own volume of displacement. The motor is connected to any convenient point, and to commence operations the motor should be started with the air intake valve on the fan chamber fully open. It should then be partly closed and the gas turned on whilst holding a lighted match in front of the torch burner. Immediately the gas ignites it will cause a fairly loud report, and the air intake should then be fully opened to get the requisite blue flame. Intensity is regulated by the air valve.

The GODFREY ENGINEERING CO., LTD., 18, Essex Street, Strand, London, W.C.2, has sent us particulars of the "Godfrey" oxygen jet cutting machine. This is fitted with two compound traversing slides, i.e., main slide and cross slide, with automatic screw feeds, which can be manipulated manually exactly as on a milling or slotting machine, enabling much work to be done without the use of any template. It will cut square or oblong holes from 1½ in. by 1½ in. up to 3 ft. by 3 ft. without a template, and by means of trip actions on each traverse which automatically stop the cut at the required distance, the cut can be exactly duplicated without resetting. The circular motion on the cross slide enables circular holes or blanks to be cut in plates from 1½ inches to 36 inches in diameter in graduations of one thirty-second of an inch. This circular attachment can be brought into correct position by means of the screw feed on the traversing slides. A removable graduated bar scaled in thirty-seconds of an inch controls the path of the torch, so that it can be set to the size of hole required without the necessity of making any measurement. A rotating table can be provided if required which also serves as an adjustable work table that can be moved to any position relative to the machine, so that discs or holes up to 15 feet diameter or more can be cut. A bed plate is provided to carry the rotating table and keep it in exact alignment with the cutting machine. The table will rotate under a load up to 8 tons. A mandrel fits into the centre of the table, whereby collars, cams, etc., can be quickly made. This mandrel is equipped to carry a template at the top, enabling irregular shapes to be cut. A division plate is arranged below the table which enables the operator to cut large square, hexagon, or octagon nuts and other pieces without a template. For simple irregular shapes templates can be made out of ply-wood. For complicated shapes each machine is equipped with a specially designed automatic attachment, together with a special machine for cutting compound ply-wood templates. Both traversing slides and the rotary attachment on cross slide can be worked simultaneously. The machine is fitted with a speed regulator to give required variable speeds for different thicknesses of metal.



The dual air unit and paint spraying equipment of B.E.N. Patents, Ltd.

The results of a series of tests of soldered aluminum joints, reported by Mr. A. Kapteyn, president of the ALUMINUM SOLDER CORPORATION OF AMERICA, indicate that lap joints are in many cases as strong as the metal itself. The ultimate strength of duralumin to duralumin butt joints was 30 000 lb. per sq. in.; that of aluminum to aluminum butt joints was 12 000 lb. per sq. in. when the joint broke, but in several cases failure did not occur at this point. Nearly all the aluminum to aluminum lap joints were stronger than the metal itself. In the case of soldered joints subjected to salt spray for two weeks, said to be the equivalent of two years' exposure, there was apparently no reduction in the strength of the joints. The soldering material was "Soldalume," and the tests were conducted by the testing laboratory of Columbia University, New York.

DONOVAN AND CO., 47, Cornwall Street, Birmingham, have introduced a new isolating link which consists of a cast iron case arranged to connect to 1¼ in. conduit at one end, and to conduit or to a starter or switch at the other end. Inside the case are fitted 2 d.p. or 3 t.p. porcelain-clad bases arranged to take cable up to 19/.064, fitted with hand-shield porcelain clad removable links. The contacts are self aligning, and, it is claimed, the contact is such that the capacity could be increased five or six times were the size of the cable not limited by the dimensions of the terminals. The electrical resistance of these links approximates to 6 in. of 19/·052 cable, and the watt dissipation per link at 60 A is under ½ W. When work is to be done on the control gear, the current is first switched off and the shielded links are removed; the whole of the control gear, including all its mechanism, is then isolated from the live supply, and can be cleaned and adjusted without danger. One size only is manufactured up to 60 A, so that contractors and engineers may standardise the No. 1 size for all ordinary duty. It is understood that higher currents than 60 A require a larger size.

H. CLARKE AND CO. (M/C) LTD., "Atlas" Works, Old Trafford, Manchester, advise us that they are prepared to send to manufacturers for testing purposes, samples of any of their products These include micanite in flexible, moulding and commutator qualities; tubes, round, square or oval, in pure mica, mica paper, paper and bakelite; micafolium, mica cloth, mica paper, fibre, leatheroid, presspahn, Indian and Egyptian cotton tapes, "Atlas" varnished cloth, tape, silk and paper, cotton sleeving, black adhesive and rubber tapes; "Atlas" superfine and tubular sleeving in natural colours or dyed.

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THE E.C.A. CONFERENCE.

Preliminary Details of the Forthcoming Visit to Bournemouth.

AS already announced in THE ELECTRICIAN, the fourth annual conference of the Electrical Contractors' Association will be held at Bournemouth, on Wednesday, Thursday and Friday, June 26th, 27th, and 28th. The business meetings will be held in the Town Hall, while the social events will be given in the new Pavilion which was opened on March 19th, by the Duke of Gloucester and of which details were given in our issue of March 22nd.

The provisional arrangements are :—

WEDNESDAY, JUNE 26TH.

10.0 a.m.	Joint meeting of the Councils of the E.C.A., N.E.C.T.A., and N.F.E.A. at the Town Hall.
2.0 to 10 p.m.	Arrival of delegates and registration at the new Pavilion.
7.30 p.m.	Reception by the President at the Pavilion. Dancing in the ball room and light refreshments.

THURSDAY, JUNE 27TH.

9.30 a.m.	Annual General Meeting at the Town Hall. (Open to members only.)
11.30 a.m.	Opening of Conference at the Town Hall. Address of Welcome by the Mayor of Bournemouth (Ald. C. H. Cartwright), and reply by the President. Presidential address by Mr. W. H. Walton.
12.30 p.m.	Luncheon.
2.0 p.m.	Delegates assemble at the Central Station, Bournemouth.
2.15 p.m.	Departure by special train for Southampton.
3.20 p.m.	Arrive Southampton Docks and proceed on board R.M.S. "Aquitania" for tour of inspection.
5.0 p.m.	Tea at the South Western Hotel.
5.45 p.m.	Departure of special train from Terminus Station, Southampton.
6.35 p.m.	Arrival at Bournemouth.
8.15 p.m.	Smoking concert at the new Pavilion.

FRIDAY, JUNE 28TH.

9.30 a.m.	Conference re-assembles at the Town Hall, for paper and discussion.
1.0 p.m.	Luncheon.
2.30 p.m.	Conference re-assembles at the town Hall for second paper and discussion.
4.0 p.m.	Tea Interval.
4.30 p.m.	Installation of new President and short address.
5.0 p.m.	Official photograph.
9.0 p.m.	Ball and supper at the new Pavilion by invitation of the Mayor of Bournemouth.

Arrangements can be made for golf, bowls, tennis, drives, etc., for those members who are desirous of remaining in Bournemouth over the week-end.

LIGHTING SERVICE LECTURES.

Special Lectures to the Trade on Technical Characteristics of Glareless Lamps.

A LIST of lectures which will shortly be delivered by Mr. W. J. Jones and Mr. H. E. Hughes, of the E.L.M.A. Lighting Services Bureau, in all the principal centres in the country, has been prepared. These lectures have been arranged for members of the electrical trade exclusively, and have as their object the popularisation of glareless lamps, by a complete explanation of their technical characteristics and sales potentialities.

The dates of the lectures, towns, etc., are as follows :— April 12th, London (15, Savoy Street, W.C., 6 p.m.); April 15th, Glasgow (Royal Philosophical Society Hall, 207, Bath Street, 7.45 p.m.); Manchester (Bureau, 4, Fountain Street, 7 p.m.); April 16th, Edinburgh (Royal Scottish Society of Arts Hall, 117, George Street, 8 p.m.); Liverpool (CommonHall, 3, Hackins Hey, 6.30 p.m.); April 17th, Newcastle (Bureau, Dial House, Northumberland Street, 6 p.m.); Birmingham (Windsor Room, Grand Hotel, 7.30 p.m.); April 18th, Cardiff (S.W. Institute of Engineers, 3.30 p.m.); Leeds (Philosophical Hall, Park Row, 7 p.m.); April 19th, Sheffield (Montgomery Hall, Surrey Street, 7 p.m.); Bristol (Lesser Hall Merchant 'Venturers' Technical School, 7.30 p.m.).

PERSONAL.

AT a general meeting of the Royal Institution on Monday, Sir William Larke, Sir John Snell and Mr. H. E. Wimperis were elected members.

Estate of the gross value of £145 638, with net personalty £134 900, was left by the late Mr. John Marshall Gorham, a director of Drake and Gorham.

The Slough and Datchet Electric Supply Co. presented an oak clock to Miss Dorothy E. Knight and Mr. Charles Gillham on the occasion of their marriage at Upton last week.

Mr. G. A. Vowles, central station superintendent, Stoke-on-Trent, has been appointed personal technical assistant to Mr. J. N. Waite, electrical engineer, Hull, at a salary of £624 per annum.

The Direct Spanish Telegraph Co., Ltd., announces that Admiral H. W. Grant, has been elected a member of the board of the company and that Mr. J. C. Denison-Pender has been appointed chairman.

Mr. S. E. Fedden, general manager and engineer of Sheffield electricity department, has been appointed district engineer for the Mid-East England Electricity Scheme under the Central Electricity Board. He will take up his new duties on May 1st. See page 455.

Stockport T.C. has adopted the recommendation of the Electricity Committee for the appointment of Mr. Robert Lee as borough electrical engineer. He was for many years assistant electrical engineer at Stockport, and went to St. Helens as electrical engineer about twelve months ago.

Mr. H. F. G. Woods, borough electrical engineer and manager, has resigned his position with Torquay Corporation, and after some nine years' experience of the municipal system, has decided to revert to company work, having accepted the position of general manager to the Exe Valley and East Devon Electricity Supply Companies.

Mr. Robert Blackmore, district engineer for the North-West England and North Wales Electricity Scheme, has now vacated the office of chief electrical engineer to the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board, which has adopted a resolution expressing appreciation of Mr. Blackmore's services during the last 25 years.

Mr. A. E. Hailwood, who came into public notice last year by his opposition to the Government, has announced his intention of putting forward candidates in Northern Ireland at the forthcoming general election. He will shortly open his campaign in Belfast, in which safeguarding for the linen industry will play a prominent part. It is understood that he or his nominees will contest North and East Belfast and possibly one or two of the county constituencies.

Dublin City Commissioners last week passed a resolution that on the occasion of the transfer of the Dublin electricity undertaking to the Electricity Supply Board, the Commissioners desired to record their high appreciation of the skilled knowledge, sound judgment and business capacity which Mr. Lawrence J. Kettle, the engineer and manager, had exercised during his twenty-three years' service. The Commissioners also paid tribute to the zeal and loyalty of the staff.

Obituary.

MR. ROBERT HENRY BENSON, on Sunday, aged 79 years. He was chairman of the Anglo-American Telegraph Co. and was on the board of the St. James' and Pall Mall Electric Light Co., and a director of the London Electric Supply Corporation.

MR. VALERE A. FYNN, on March 20th, aged 58 years, at St. Louis, Mo. He contributed largely to the development of the single-phase motor and to other inventions relating to motors, among which is the Fynn-Weichal motor. He obtained his early engineering experience with Brown, Boveri and Co., in Switzerland and with Easton, Anderson and Golden in London, and subsequently he established offices in London as a consulting engineer. His single-phase motors were manufactured by the Elektricitäts-Gesellschaft Alioth of Switzerland, France, Germany, Italy and Spain, and the General Electric Co. of England In 1909 he transferred his interests to the United States, and from that year until 1921 he was retained by the Wagner Electric Manufacturing Co. as consulting engineer. Since 1921 he was engaged in independent consulting engineering work with offices in St. Louis. Mr. Fynn was a fellow of the American Institute of Electrical Engineers and a member of the Institution of Electrical Engineers.

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TRADE PUBLICATIONS.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby, has published list L.469 dealing with the reduced prices of Mazda "pearl" lamps.

The MULLARD WIRELESS SERVICE CO., LTD., Denmark Street, London, W., has published leaflet V.T.33 dealing with type S.W. 3B transmitting valve for short wave work.

The MARCONIPHONE CO., LTD., has published a special coloured poster relating to the deferred payment purchase of the Model 37 receiver. Photographic showcards concerning Models 23a, 35, and 44 have also been issued.

The DRAYTON REGULATOR AND INSTRUMENT CO., LTD., of West Drayton, Middlesex, has issued a new leaflet relative to thermo-contactors types R.C., I.C, H.C., and T.C. Another booklet, dealing with pressure and temperature operated electric switches, has also been issued.

The "Benjamin Reflector" No. 7, Vol. 2, published by BENJAMIN ELECTRIC, LTD., Brantwood Works, Tottenham, N.17, is devoted to the improvement of factory lighting. The issue is arranged to indicate "the ideal," "the complaint," "the diagnosis," "the prescription," "the cure" and "the attainment." The publication is illustrated accordingly.

L. G. HAWKINS AND CO., LTD., have issued a number of pages for inclusion in their general catalogue. These include descriptions of the electric washer and wringer, No. E. 1 250; "Blazor" electric fires; "Peter the Seer," which prevents windows being affected by atmospheric changes; and the "All Over" electric hair clipper. A leaflet dealing with "Vio Ray" artificial sunlight apparatus has also been published.

Direct current hand operated and automatic control switches are dealt with in catalogues Nos. 12 and 13, by BROOKHIRST SWITCHGEAR, LTD., Northgate Works, Chester. These issues are illustrated throughout, and all technical as well as other details are embodied in well worded descriptions. Catalogue No. 12 covers the complete range of d.c. hand operated gear, while No. 13 also covers the automatic range. These two catalogues together supersede and cancel catalogue No. 5 and the d.c. portion of No. 10; the a.c. portion of the latter still stands. The junior drum type panels shown in catalogue No. 10 have been absorbed in the main drum range (catalogue No. 12) and the junior solenoid type in the main solenoid range (catalogue No. 13), the gears being modified so that the specification agrees. Catalogue No. 13 includes a new range of junior solenoid panels (originally designed for printing machinery); also a complete range of contactor type panels. The gears in both new catalogues embody drip-proof hoods and other detail improvements.

I.E.E. GOLF COMPETITION.

THE second annual golf tournament of the Scottish Centre of the I.E.E. in aid of the Benevolent Fund and for the trophy presented by Messrs. W. L. Winning and Andrew Hutchison, will be held this summer on the various courses within the Scottish Centre. The competition will be open to members of all classes, and should specially appeal to the benevolent instincts of every member and student of the Centre. The Committee would like every member of the Institution to subscribe to this competition, whether he be a player or non-player, in view of the particular object for which the competition is being promoted. The competition in the first place will be divided into districts, and the following have consented to undertake the duties of local secretaries:—

GLASGOW: Mr. Harold W. Bewsher, 147, St. Vincent Street, Glasgow, C.2; EDINBURGH: Mr. J. Johnstone Foggo, 37, St. Patrick Square, Edinburgh; DUNDEE: Mr. P. Philip, Dundee Electricity Department, Dudhope Crescent Road; ABERDEEN: Mr. J. Alex. Bell, Aberdeen Electricity Department, Millburn Street.

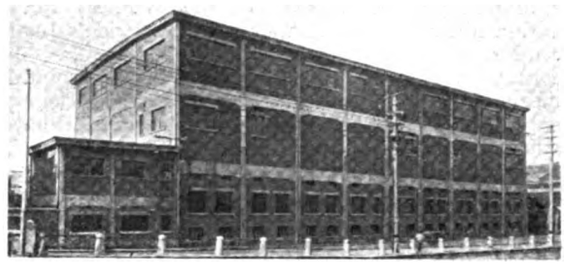
A SUCCESSFUL APPEAL.

The appeal of Babcock and Wilcox, Ltd., against a fine of £1 000 and an order for payment of £10 000 to the Sydney Electricity Department, imposed by the Sydney magistrates, has been allowed by a majority judgment of the New South Wales Court of Appeal. The company had been found "guilty" of charges of corruption in paying £10 000 to Mr. S. Y. Maling, former manager of the Electricity Department, in connection with tenders for power plant. The Court of Appeal held that there was no evidence to show that the company had authorised the payments alleged.

The Crown Law Department has decided to appeal against the decision.

BUSINESS ITEMS.

MR. CECIL HODGES announces that he has no connection with any company bearing his name except the HODGES SWITCHGEAR CO., LTD., of Wool Exchange, London, E.C.2, and HODGES & DIXON, LTD., which has been absorbed by the former.



THE super sub-station of Shanghai Electricity Department in Fearon Road, the lighting scheme for which is carried out on the Henley wiring system. Among other recent installations in Shanghai for which this method has been used are the Brunner Mond Building, the Bank of China—which used to be the German Club—and Kelmscott Gardens.

It is reported that FERRANTI, LTD., Hollingwood, Lancs., will establish a branch at Mount Denis, a suburb of Toronto. A modern plant, 110 by 400 ft. will be erected and the principal lines of manufacture will be radio equipment, meters and transformers.

The NOX ELECTRIC LAMP CO., LTD., Clarence Road Works, Hunslet, Leeds, points out that the company's works are being extended. For the year ended March 31st the output was just a fraction under double that of 1928. Preparations are being made with regard to plant and extensions, to double last year's output.

Arrangements are being made under which R.I. products will henceforth be distributed and invoiced by RADIO INSTRUMENTS, LTD., direct from 12, Hyde Street, London, W.C.1, on the same system as that in force prior to the appointment in June, 1927, of R.I. and Varley, Ltd., as distributing agents, the arrangements with that company having terminated.

The RELAY AUTOMATIC TELEPHONE CO., of Relay House, Streatham Hill, London, S.W.2, is making for the Manchester station of the B.B.C. a new power board for controlling the plant for charging the large accumulators which supply current to the main transmitting valves and for regulating the charging equipment for the high tension and grid bias batteries. This power board will control three charging motor generators and will provide the necessary switching for changing over the batteries from charge to discharge. The supply mains are of 400 V, while the large batteries are 6, 8 and 50 V. The small batteries used for grid bias purposes are 24, 150 and 300 V units. There is also a distributing fuse panel for small subsidiary circuits fitted to the board, a photograph of the back of which is given on page 458.

Owing to the fact that there appears to be a wrong impression in regard to the retention of the Dolphin standards on the Victoria Embankment, London, the GENERAL ELECTRIC CO., LTD., announces that in the new scheme of illumination the original standards along the parapets are definitely to remain, and will still function as they have done since the Embankment was opened in 1870. There is also some misconception concerning the new system of twin overhead suspended lighting along the roadway, which is to be done by means of two 1 500 W lamps, housed in "Wembley" lanterns suspended 30 ft. over the roadway. In all, there are to be 50 spans, spaced at intervals of 140 ft., each span carrying two lamps. The existing standards alongside the kerb-edge of the Embankment are being removed with a view to their ornamental bases being re-spaced and augmented to accommodate the new steel suspension poles, which will be mounted in such of the existing bases as are at present fixed along the Embankment, and which, bearing the small dolphin design and the old coat of arms, will be retained to accommodate the new poles. As, however, there will not be enough of these old bases, new ones are being supplied of similar design, but embodying the new L.C.C. coat of arms in place of that of the old type. See page 455.

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WIRELESS NOTES.

Wireless Telephony and Shipping—American Radio Exports during 1928.

IT is reported that the use of wireless apparatus in Siam is temporarily prohibited.

The German Government is arranging for the installation of loud speakers in the Reichstag.

The annual general meeting of the Wireless Retailers' Association was held on Wednesday, at St. Bride's Institute, London, E.C.4.

According to the Wireless Branch of the Commonwealth Postmaster-General's Department there were at the end of September last approximately 300 000 licensed listeners in Australia.

The first automatic wireless beacon in Canada was inaugurated on Seal Island, Nova Scotia, last week. This is the first of a chain of seventeen beacons stretching from the Gulf of St. Lawrence to the Great Lakes.

At a meeting of representatives of Hamburg shipping companies on Monday, it was stated that technical difficulties in the way of wireless telephonic communication with ships at sea had been removed, but there were still obstacles in the way of fitting passenger vessels with the necessary telephone apparatus on account of expense. Experiments are now being made with fishing vessels, and it is asserted that, as the use of the telephone does not require any special skill, this would render unnecessary the carrying of a wireless operator.

Shipments of radio apparatus from the United States during 1928 amounted to $12 061 410, an increase of $2 878 987 over 1927. Canada was the largest consumer of these shipments, having taken approximately 40%. Argentina and Australia were next in importance; these countries purchased radio apparatus valued at $1 613 693 and $1 189 450 respectively. Argentina's principal imports were receiving sets and components, but Australia took chiefly receiving sets and accessories, although components valued at $239 992 were shipped to that country during the year. The market in the United Kingdom was limited to a small amount of components and accessories. Uruguay took $148 385 worth of receiving sets during 1928.

A "Gecophone" adjustable reed cone movement for portable sets and small power loud speakers, has now been introduced by the General Electric Co., Ltd. In general design the movement consists of an electro-magnet mounted beneath the free end of a reed armature. A thumb-screw at the back of the magnet-and-armature supporting frame controls a helical-spring armature adjustment. The reed, which has a length of just over 2½ inches, is fixed to the upper side of the armature and is not susceptible to "chatter." As this movement is of the single pole type, it is important that the h.t. supply be connected to it in the correct way. On the side of the supporting frame are the two loud speaker terminals, and one of these is clearly marked with a positive sign in order to ensure that the unit be correctly connected.

ARTIFICIAL LIGHT TESTS.

New Apparatus for Examining Dyed Materials in Artificial Light.

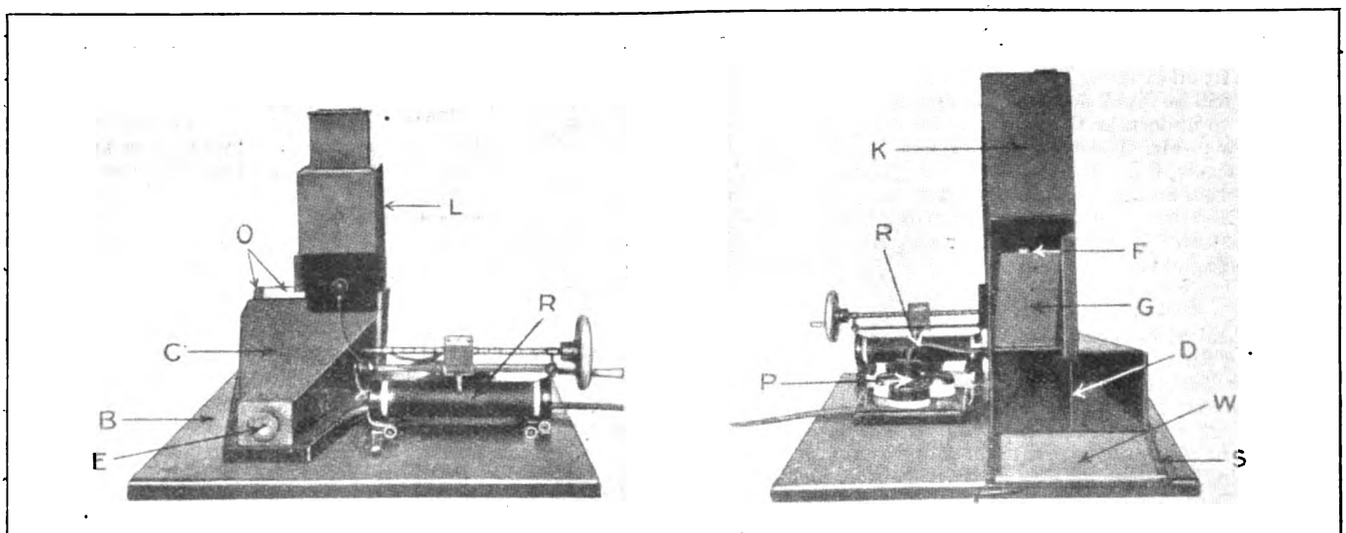
AN application for a patent for an apparatus for the examination of dyed materials in artificial light has been made by Imperial Chemical Industries, Ltd. The difficulty of making an accurate comparison between the effects of daylight and artificial light on dyed materials has led the British Dyestuffs Corporation to design a special equipment for the purpose, and a description of the plant has just been published. The apparatus consists of a casing C (see Figs. 1 and 2), divided in two compartments by means of a longitudinal division D. At the narrow end of the casing is an eyepiece opening E, the opposite end being closed by means of the shutter S holding a wooden slide W. Above one compartment is a lamp casing L holding an electric filament lamp F, the light from which is scattered by a ground-glass slide G. The lamp is ventilated with screened ventilation holes. One compartment is illuminated by daylight which enters through the side and top at O, while the other compartment is illuminated by the light of the lamp. A door K in front of the lamp casing allows the ground glass or lamp to be removed and other lamps inserted. The casing is fixed to the base board B, where a switch or plug P, together with a variable resistance R, are connected with the lamp. Duplicate patterns of the material to be examined are fixed one on each side of the slide W, and the shutter S closed. The apparatus is placed adjacent to a window so that the opening O is well illuminated with daylight. The lamp is then switched on, and the patterns viewed through the eyepiece E, when the two patterns of the material are seen simultaneously illuminated by daylight and artificial light respectively. The intensity of the artificial illumination is then adjusted by means of the resistance R until it is equal to that of the daylight, when the change in tone, if any, can be readily seen. Various types of filament lamps can be used to give light of varying quality.

This apparatus can also be used for testing "daylight" bulbs or "daylight" filters. For this purpose dyed patterns should be selected which show marked differences when examined in daylight and artificial light.

THE SOCIAL SIDE.

The tenth annual G.E.C. London sports gathering will be held at Wembley on June 8th.

The London Telephonists' Society produced at King George's Hall, Tottenham Court Road, London, W., on April 4th, a play entitled "Telephone Tangles, or Love in a Mist," the subject matter for which showed a very considerable appreciation of the shortcomings of the telephone service. Loud applause and laughter, from a hall crowded with telephone operators, greeted a scene showing the entrance to a telephone exchange, with a number of complaining subscribers waiting to step into a lift that was out of order.



THE new apparatus which has been developed by Imperial Chemical Industries, Ltd., for the examination of dyed materials in artificial light. Fig. 1, referred to above is shown on the left, with Fig. 2 on the right.

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BUSINESS OPENINGS.

Latest Particulars of Electrical Engineering and Wiring Installation Contracts for which Tenders are being Invited at Home and Abroad.

WE give below the latest particulars of contracts for which tenders are invited. The closing date is given, when available.

FIRST CHURCH OF CHRIST SCIENTIST, BLACKPOOL.—Electric wiring, fittings, etc., in new building. Further particulars from Mr. H. Best, 20, Clifton Street, Blackpool.

STOKE-ON-TRENT CORPORATION, April 12th.—Supply and erection of 22/24 H.P. heavy oil engine at Stallington Hall, near Stoke-on-Trent (contract 2 915). Specification, etc., from the City Electrical Engineer, St. George's Chambers, Kingsway, Stoke-on-Trent; deposit £2.

PRESTWICH URBAN DISTRICT COUNCIL, April 13th.—Supply of electric lamps, etc. Form of tender from the Surveyor, Town Hall, Prestwich, Lancs.

BATLEY CORPORATION, April 15th.—Supply of l.t. cable. Forms of tender from the Borough Electrical Engineer, Electricity Works, Batley.

BRIDPORT CORPORATION, April 15th.—Complete installation of three-phase cables, h. and l.t. underground and overhead sub-stations, street lighting and services. Specification, etc., from the Town Clerk; deposit £2 2s.

CANTERBURY GUARDIANS, April 15th.—Completion of electric light installation at the Institution. Particulars from the clerk, Mr. H. Rose, 80, Castle Street, Canterbury.

IRVINE CORPORATION, April 15th.—Electric lighting work in 24 dwelling-houses to be erected at Clark Drive, off Thornhouse Avenue, Irvine. Specifications from the Town Clerk; deposit £1 1s.

SUDBURY CORPORATION, April 15th.—Supply of electric fittings, etc., for one year. Forms of tender from the Borough Surveyor, Town Hall, Sudbury, Suffolk.

CENTRAL ELECTRICITY BOARD, April 15th.—Supply and erection of 33 000 V overhead transmission lines, in connection with the North-West England and North Wales Electricity Scheme. Specification (No. N.W.E.-S.L.2) from Mr. R. H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

EAST LOTHIAN EDUCATION AUTHORITY, April 15th.—Electrical and heating installations in new school at Tranent. Schedules, etc., from Messrs. R. and A. K. Smith, 4, Forres Street, Edinburgh.

YSTRAD MYNACH AND DISTRICT WELFARE ASSOCIATION, April 15th.—Electric lighting installation in connection with erection of a pavilion on the Association's grounds. Specifications can be seen on the site.

BIRKENHEAD CORPORATION, April 16th.—Twelve months' supply of stores to the electricity generating station, including house service and mains boxes, insulating tapes, electrical engineering sundries, etc. Specification, etc., from Mr. F. E. Spencer, borough electrical engineer, Craven Street, Birkenhead.

MANCHESTER CORPORATION, April 16th.—Supply of electric welding apparatus, for tramrails. Specifications, etc., from the General Manager, Corporation Tramways, 55, Piccadilly, Manchester.

DUMFRIES CORPORATION, April 17th.—Supply and erection of one water cooling tower, for the Electricity Department. Specification, etc., from Mr. W. S. Johnston, engineer and manager, Electricity Works, Leafield Road, Dumfries; deposit, £1 1s.

LEEDS GUARDIANS, April 17th.—Supply and erection of steam driven generating sets, boiler feed pumps, etc.; and supply and erection of switchboard and mains, at the Institution, Rothwell, near Leeds. Specifications, etc., from Mr. E. Griffiths, 44d, The Temple, Dale Street, Liverpool, until April 9th.

Public Institution Lighting.

METROPOLITAN ASYLUMS BOARD, April 17th.—Electric light installation at the Hostel, Little Gray's Inn Lane, London, E.C.1. Specification, etc., from the Board's office, Victoria Embankment, E.C.4; deposit, £1 1s.

SMETHWICK CORPORATION, April 17th.—Electric light installation at slipper baths, Mallin Street, Smethwick. Specification, etc., from the Borough Engineer, Council House, Smethwick; deposit £1 1s.

WEST RIDING EDUCATION COMMITTEE, April 17th.—Electric light installation at Edlinton New Middle and Elementary Schools and caretaker's house. Specifications, etc., can be obtained from the Education Officer, County Hall, Wakefield.

BIRMINGHAM GUARDIANS, April 18th.—Installation of call lighting system, at Dudley Road Hospital, Birmingham. Conditions, etc., may be seen at the Union Offices, Edmund Street, Birmingham.

RENFREWSHIRE EDUCATION AUTHORITY, April 19th.—Electrical work in connection with alterations and additions to North Public School, Paisley. Schedules, &c., from Mr. J. H. Pullar, 16, Glasgow Road, Paisley; deposit £1.

CENTRAL ELECTRICITY BOARD, April 22nd.—Supply and erection of 33 000 V and lower voltage transformers. Specification (No. N.W.E.-ST.2) and form of tender from Mr. R. H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

Scottish School Lighting.

EDINBURGH EDUCATION AUTHORITY, April 22nd.—Electric lighting work, in connection with erection of Saughton Mains School. Specifications, etc., from Mr. J. A. Carfrae, 3, Queen Street, Edinburgh.

DUNDEE CORPORATION, April 24th.—One year's supply of stores to transport department, including armature and field coils, carbon brushes, etc. Specifications from Mr. D. P. Morrison, Transport Office, Dundee.

COMMISSIONERS OF HIS MAJESTY'S WORKS, ETC.—April 22nd.—Supply of incandescent lamps. Forms of tender, etc., from the Controller of Supplies, King Charles Street, Westminster, S.W.1.

DUNDEE HARBOUR TRUSTEES, April 27th.—Supply and erection of two 3-ton electric travelling jibs, portal cranes at King George V. Wharf, Dundee Harbour. Specifications, etc., from the General Manager and Engineer, Harbour Chambers, Dundee.

CENTRAL ELECTRICITY BOARD, April 29th.—Supply and erection of electricity meters, in connection with the Central Scotland Electricity Scheme. Specification (No. C.S.-S.S.14) and form of tender from Mr. R. H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

SOUTHAMPTON CORPORATION, April 30th.—(1) Steel framed building, platform for fans, overhead bunkers, etc.; (2) two water tube boilers with superheaters, economisers, stokers, fans, soot blowers, etc.; (3) steam, feed water and other piping, etc.; and (4) water softener, at Electricity Works, Western Esplanade, Southampton. Specification, etc., from Mr. W. G. Turner, borough electrical engineer; deposit, £2 2s.

STAFFORDSHIRE EDUCATION COMMITTEE, April 30th.—Electric light installation in the Girls' High School, Stafford. Specification, etc., from Messrs. Moffett, Rosher and Mann, Union Chambers, Temple Row, Birmingham; deposit, £3 3s.

STAFFORDSHIRE EDUCATION COMMITTEE, April 30th.—Electric light and power installation in new High School for Girls, Wellington Road, Bilston. Specification, etc., from Messrs. Moffett, Rosher and Mann, Union Chambers, Temple Row, Birmingham; deposit £5 5s.

WALTHAMSTOW EDUCATION COMMITTEE, May 3rd.—Electrical installation in Billet Road School, Walthamstow. Specification, etc., from Mr. G. R. Spurr, Electricity Works, Exeter Road, Walthamstow, London, E.17; deposit £1.

CENTRAL ELECTRICITY BOARD, May 4th.—Supply and erection of 33 000 V and lower voltage cables, under the South-East England electricity scheme. Specification (No. S.E.E.-G.C.1) and form of tender from Mr. Richard H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

ISLINGTON (LONDON) BOROUGH COUNCIL, May 6th.—Supply and installation of two lead batteries for Edison refuse collecting vehicles, having carrying capacity of 3½ to 4 tons. Further particulars from the Cleansing Superintendent, Liverpool Road, N.1.

WEST MIDLANDS JOINT ELECTRICITY AUTHORITY, May 10th.—(a) Main 33 000 V switchgear, each circuit breaker having rupturing capacity of not less than 1 500 000 kVA; (b) auxiliary 33 000 V switchgear, each circuit breaker having rupturing capacity of not less than 500 000 kVA, with group feeder reactors, for Ironbridge power station. Specification (No. 4) and form of tender from Mr. E. F. Hetherington, chief

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engineer and manager, Phœnix Buildings, Dudley Road, Wolverhampton; deposit, £2 2s.

WEST MIDLANDS JOINT ELECTRICITY AUTHORITY, May 10th.—(1) One 50 000 kW turbo-alternator, with step-up transformers, etc.; (2) condensing plant, boiler-feed pumps, evaporators, etc.; (3) circulating water pumps, etc., for Ironbridge power station. Specifications (No. 2) and form of tender from Mr. E. F. Hetherington, chief engineer and manager, Phœnix Buildings, Dudley Road, Wolverhampton; deposit, £2 2s.

Overseas.

UNLESS otherwise stated, particulars of overseas contracts are to be had from the Department of Overseas Trade (Room 52), 35, Old Queen Street, Westminster, London, S.W.1. *Note.—An asterisk denotes that local representation is, in practice, essential.*

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, April 15th.—Conductor cords (No. P. and T., 151/1 319). (Reference B.X. 5 098.)

INDIAN STORES DEPARTMENT, April 16th (extension of time).—Supply of 30 kW steam engine driven generator set (order No. N. 9 538). (Reference B.X. 5 167.)

INDIAN STORES DEPARTMENT, April 16th.—Supply and erection of one 5-ton overhead electric three-motor gantry crane (order No. N. 9 536). (Reference A.X. 7 652.)

INDIAN STORES DEPARTMENT, April 16th.—Supply and erection of one 5-ton electric telpher (mono rail), with track (order No. N. 9 537). (Reference A.X. 7 653.)

NEW ZEALAND POST AND TELEGRAPH DEPARTMENT, April 17th.—Supply of copper earthplates (specification 133). Reference A.X. 7 556.)

UMTALI MUNICIPALITY, April 18th.—Supply of line sundries switchgear and transformers, in connection with extensions of electricity undertaking. (Reference B.X. 5 142.)

UMTALI MUNICIPALITY, April 18th.—Supply of 1 000 kW turbo-alternators, spray cooling plant, switchgear and crane (contract B). (Reference B.X. 5 145.)

IRISH FREE STATE ELECTRICITY SUPPLY BOARD, April 29th.—Supply and laying of 40 000 V cables in the county and city of Dublin. Specification, etc., from Mr. P. J. Dempsey, 60-62, Upper Mount Street, Dublin; deposit £5.

VICTORIAN ELECTRICITY COMMISSION, April 29th.—Supply of two or three steam turbo generator sets, with condensers, etc., for Yallourn power station extension (specification 29/7). (Reference B.X. 5 062.)

VICTORIAN ELECTRICITY COMMISSION, April 29th.—Supply of two swing hammer mills with electric motors, for brown coal (specification 29/9). (Reference A.X. 7 434.)

CAPETOWN MUNICIPALITY, May 1st.—Supply of 30 ft. steel poles, cross arms, insulators, fly fuses, etc. (specification 459/1929). (Reference A.X. 7 697.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, May 7th.—Supply of two electric motor driven centrifugal pumps. (Reference A.X. 7 738.)

STATE ELECTRICITY WORKS, MONTEVIDEO, May 6th.—Supply of electric cables and accessories. (Reference B.X. 5 178.)

EGYPTIAN MINISTRY OF PUBLIC WORKS, May 15th.—Supply and erection at Government Printing Office, Cairo, of 120 kW d.c. Diesel electric generating set, with foundations, artesian well, electrically-driven water cooling pump, etc. Forms of tender, etc. (10s. 6d.), from Chief Inspecting Engineer, 41, Tothill Street, London, S.W.1.

MELBOURNE AND METROPOLITAN TRAMWAYS BOARD, May 15th.—Supply of 500 kW sub-station rectifier unit, arranged for automatic control, with necessary switchgear (contract 677). (Reference B.X. 5 206.)

MELBOURNE AND METROPOLITAN TRAMWAYS BOARD, May 15th.—Supply of sub-station units for automatic control, comprising two rotary converters of 1 000 kW and one of 500 kW (contract No. 678). (Reference B.X. 5 210.)

NEW SOUTH WALES PUBLIC WORKS DEPARTMENT, May 13th.—Supply and erection of synchronous condenser (contract 257, 28). (Reference B.X. 5 205.)

VICTORIAN RAILWAY COMMISSION, May 15th.—Supply of one geared three-phase electric winding engine (contract No. C.M. 778). (Reference A.X. 760.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, May 16th.—Supply and installation of electric signalling apparatus at Johannesburg. (Reference B.X. 5 165.)

BLOEMFONTEIN MUNICIPALITY, May 18th.—Supply and erection of (*a*) turbine and generator, condensing plant and auxiliaries and switchgear and cables; (*b*) cooling spray pond equipment, or cooling tower (contract No. 1). (Reference B.X. 5 192.)

PLOVDIFF (BULGARIA) PROVINCIAL COUNCIL, May 20th.—Supply of two Francis turbines, two 5 000 kVA generators, two 5 000 kVA, two 1 000 kVA and two 150 kVA transformers, for Votscha-Kricim power station.

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, May 28th.—Supply of telephone jacks and number plates (schedule C. 417). (Reference B.X. 5 202.)

TANGANYIKA GOVERNMENT, June 1st.—Concession for utilisation of Pangani River Falls for the development of electric power. Copies of the draft concession may be obtained from the Crown Agents for the Colonies, 4, Millbank, London, S.W.1.

STATE ELECTRICITY WORKS, MONTEVIDEO, July 8th.—Construction and equipment of 50 000 kW power station.

NEW ZEALAND PUBLIC WORKS DEPARTMENT, July 16th.—Supply of 250 galvanised steel transmission line towers to carry copper conductors, or 190 towers to carry steel-cored aluminium conductors. (Reference A.X. 7735.)

Tenders Accepted.

ADMIRALTY.—Edison Swan Electric Co., Ltd., accumulators.

PERTH CORPORATION.—M'Cowan and Guild, electric lighting work, in connection with erection of 96 houses at Hillyland, Darnhall and Riggs Road.

EASTBOURNE CORPORATION.—General Electric Co., Ltd., supply of switchgear, £3 504; Ferguson, Pailin, Ltd., supply of four single cubicles, £172.

ST. PANCRAS (LONDON) BOROUGH COUNCIL.—Electric Construction Co., Ltd., erection of kiosk type sub-station at Ossulston Street, £388. (Recommended.)

SWEDISH TELEGRAPH BOARD.—Marconi's Wireless Telegraph Co., Ltd., equipment for new 60 kW broadcasting station, near Stockholm, Kr.400 000 (approximate).

IRISH FREE STATE LOCAL GOVERNMENT DEPARTMENT.—General Electric Co., Ltd., six months' supply of Osram metal filament, gasfilled and vacuum lamps, and Robertson carbon lamps.

WORTHING CORPORATION.—British Thomson-Houston Co., Ltd., converting plant, £5 710, and switchgear, £3 112; Callenders' Cable and Construction Co., Ltd., cable, £9 367, and overhead extension, £1 050.

BRADFORD CORPORATION.—English Electric Co., Ltd. Supply of six double-deck railless electric trolley vehicles, and certain spare parts, £12 768 14s., and one single-deck, railless electric trolley vehicle which has been used by the company for demonstration purposes, £990.

SHEFFIELD CORPORATION.—A. Reyrolle and Co., Ltd., supply of sub-station switchgear, £5 933 8s. 9d.; Metropolitan-Vickers Electrical Co., Ltd., thirty 300 kVA and six 450 kVA three-phase transformers, £6 384; British Electric Transformer Co., Ltd., six 250 kVA single-phase transformers and four 1 000 kVA Scott connected sets, £2 868.

BATTERSEA (LONDON) BOROUGH COUNCIL.—General Electric Co., Ltd., supply of a 750 kW motor converter and automatic switchgear for Lavender Hill sub-station, £5 720; Callender's Cable and Construction Co., Ltd., supply of cables; Chamberlain and Hookham, Ltd., and Ferranti, Ltd., supply of meters, and Dussek Bitumen Co., Ltd., supply of bitumen, for 12 months. (All recommended.)

SHEFFIELD CORPORATION.—Stirling Boiler Co., Ltd., three 120 000 lb. boilers and accessories, £140 206; English Electric Co., Ltd., 25 000 kW turbo-alternator, and condensing plant, £94 413; Brightside Foundry and Engineering Co., Ltd., pipework and valves, £25 492; General Electric Co., Ltd., e.h.t. switchgear, £55 067; British Electric Transformer Co., Ltd., transformers, £5 008; Davenport Engineering Co., Ltd., cooling towers and tanks, £19 194; Mitchell Conveyor Co., Ltd., coal handling plant, £23 292; Isles, Ltd., cranes, £5 421; Mitchell Conveyor Co., Ltd., buildings and civil engineering works, £172 893.

MID-EAST ENGLAND ELECTRICITY SCHEME.

An order for the first generating unit for the new Blackburn Meadows station, which will operate under the Mid-East England electricity scheme, has just been placed with the ENGLISH ELECTRIC CO., who will manufacture the 35 000 H.P. multi-cylinder steam turbine at their Rugby works and the electric generator at Preston. The order is valued at nearly £100 000. The unit will have an output of 25 000 kW, will run at 3 000 r.p.m., and will be supplied complete with condensing plant. An "English Electric" shunting locomotive is also being supplied for the haulage of coal, ashes, etc.

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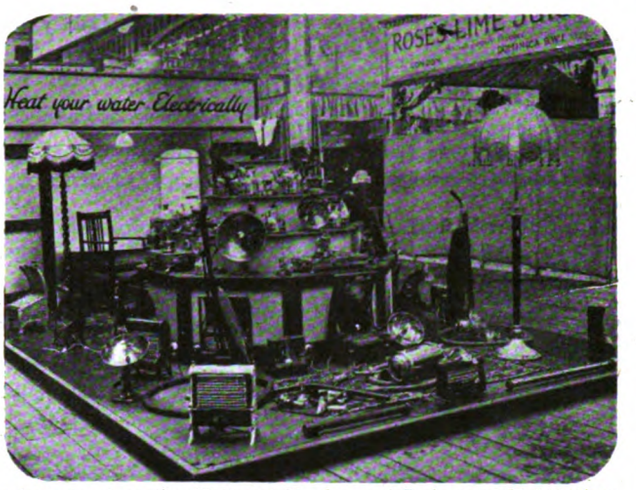
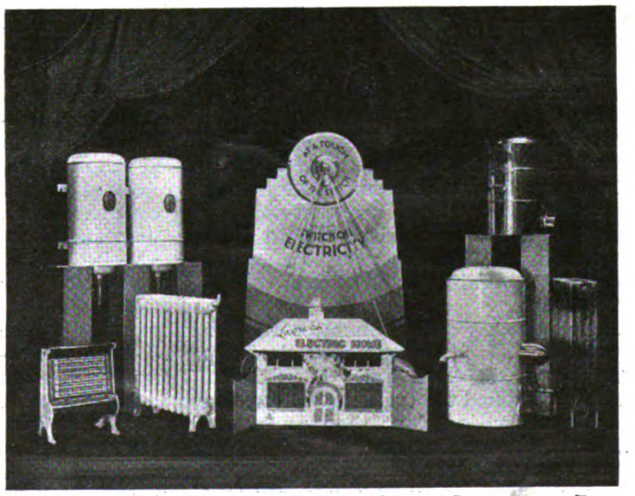
ELECTRICAL NEWS OF THE WEEK IN PICTURES.



The Birmingham Electric Supply Department has a comprehensive stand at the National Trades and Industrial Exhibition which is being held at Bingley Hall, Birmingham, until May 11th. The display includes a large selection of heating, cooking and domestic labour-saving appliances, and special features are being made of water heaters, electric cookers as supplied on hire, and numerous new patterns of electric fires, vacuum cleaners, kettles, toasters, irons and fans. The cooker stand is shown above on the left, with the fires and appliances display on the right. The exhibit is, incidentally, of special interest in view of the April Selling Campaign of the E.D.A., the window displays for which are shown below.

Work on the new lighting system for the Embankment, London, has already commenced, and above may be seen one of the old standard bases being removed in readiness for the new units. The original bases will be used to support the new poles and, wherever necessary, additional bases of the original design are to be made. When completed this will be one of the best lighted streets in London. See page 451.

Mr. S. E. Fedden, who has been appointed district engineer for Mid-East England, under the Central Electricity Board, will take up his new duties on May 1st. See page 450.



The alternative window displays which have been designed by the E.D.A. in connection with the April Selling Campaign. Part of the cube outfit used in previous months is again incorporated, and the story told by the displays advocates electricity as the ideal method of providing local heating during the chilly evenings of the spring and early summer months. The displays are of sizes which can be accommodated in practically every type of window, and their simple design permits of their being arranged without the special skill of a window dresser, while their colour and lighting schemes are sure to attract public attention. In addition to the usual stereos, etc., for local advertising, the Association has also prepared a special poster.

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ELECTRICITY SUPPLY.

Rural Electricity Supply—Mains Extensions at Manchester—Croydon and 230 V Supplies—Proposals at Belfast—Supply Inaugurated at Rainford—New Turbo-Alternator Started at Bury St. Edmunds.

MANCHESTER Electricity Committee seeks sanction to borrow £100 000 in respect of service mains.

Tunbridge Wells T.C. has applied for a loan of £13 302 for mains, sub-station, sub-station pillars, etc.

Epsom U.D.C. is to negotiate with the London and Home Counties Joint Electricity Authority for a supply of electricity in bulk.

East Grinstead U.D.C. has adopted a scheme for supplying electricity to portions of the parishes of Lingfield, Tandridge, and Godstone.

Croydon Electricity Committee recommends the extension of the existing e.h.t. cable from Gibson's Hill Pillar to Ryecroft Road, at an estimated cost of £355.

Powers have been obtained by Chester Corporation to erect overhead lines to transmit at 6 600 V and 400 V, respectively, between Tarporley and Farndon.

It has been decided by Formby U.D.C. to seek borrowing powers for £6 500 with which to finance development work during the three years ending December 31st, 1931.

Having obtained permission to borrow £10 986 for mains, services, and plant, Lytham St. Annes T.C. proposes to extend its supply to Freckleton, Warton, and other districts.

Barnstaple R.D.C. has decided to consent to the Ilfracombe Electricity Co.'s application for a Special Order enabling it to supply Mortehoe, Berrynarbor and Combemartin.

Dublin electricity undertaking passed under the control of the Electricity Supply Board on April 4th. There was a charge balance to credit on the revenue account. See page 450.

Marsham U.D.C. has decided to dispose of its electricity undertaking to the Cleveland and Durham County Electric Power Co. from which a favourable offer has been received.

Belfast Electricity Committee proposes to spend about £77 000 on electrical extensions, and recommends that application be made to the Commissioners for a loan of that amount.

Hambledon R.D.C. is opposed to the proposal of the Aldershot Gas Water and District Lighting Co. to erect overhead cables across certain commons between Farnborough and Hindhead.

The public electricity supply at Rainford was inaugurated last week. The ceremony took place at the Village Hall, the exterior of which was electrically illuminated. The supply is given by St. Helens Corporation.

Barking Electricity Committee has approved a draft deed of transfer from Barking Council to the County of London Electric Supply Co., Ltd., of the right to supply electricity within an area of land adjoining the Barking Power station of the company.

Carlisle Electricity Committee has decided to apply for powers to extend the Corporation's supply area to embrace additional towns and villages, including Wetheral, Brampton and Longtown. The Electricity Commissioners have informed a deputation that they will agree to the proposal.

Inhabitants of Newport (Fife) complain of the failure of the Fife Tramways, Light and Power Co. to supply electricity in the burgh by December, 1928, in accordance with its Provisional Order. The T.C. has instructed the Town Clerk to communicate with the Secretary for Scotland on the matter.

Eastbourne Town Planning Committee has protested against the erection of overhead wires, in connection with the South East England electricity scheme, in country districts where it is considered that the rural scenery will be spoiled. The Electricity Committee is to obtain a site in Arundel Road for a sub-station.

A new 1 000 kW turbo-generator was officially started by the Mayor (Mr. S. J. M. Sampson) at the Bury St. Edmunds electricity works on April 5th. The British Thomson-Houston Co., Ltd., supplied the turbo-generator, Worthington-Simpson, Ltd., the condensing plant, the Premier Cooler and Engineering Co., Ltd., the cooling tower, and Herbert Morris, Ltd., a 10-ton overhead crane.

At a recent meeting of Tarleton ratepayers, convened by the West Lancashire R.D.C., it was decided to adopt an electric lighting scheme for the district, 161 residents having agreed to take a supply. It is proposed to take a bulk supply and to have underground mains, and the charges are to be 8d. per kWh for lighting, and 2½d. for power. It is also proposed to instal 100 lamps for street lighting.

Beckenham U.D.C. has applied for loans as follows:—Mains and services, £25 000; sub-stations, £5 000; sub-station switchgear, £2 000; and e.h.t. cable, £1 837. An agreement has been reached with the West Kent Electric Co. for a partial supply of electricity in bulk. It is proposed to have electricity offices and showrooms erected.

Chester City Council has decided to apply £1 500 out of the revenue of the electricity department to relief of rates. Mr. C. Crosland Taylor, chairman of the Electricity Committee, has reminded the Council that there is only one more year in which the department can subscribe money towards the rates, because the reserve fund is not what it should be.

Stoke-on-Trent Electricity Committee has obtained sanction to borrow £18 000 for works required in connection with the supply of electricity to Leek.—The Committee seeks sanction for loans of £900 in connection with supply to Stone Road, Trentham; £1 200 in connection with supply to Trent and New Wharf Potteries, Burslem; £2 000 in respect of supply to Fegg Hayes and £1 200 in respect of supply to Lytton Street and High Street West, Fenton.

Sheffield Electricity Committee has authorised mains extensions at a cost of £11 265. The Committee has obtained sites for sub-stations at Norton Lees Road and Rushley Road, Dore. In view of the new rating assessments, the Electricity Committee recommends that in the case of domestic supplies the amended assessments shall be the basis for calculation for the fixed charge per annum under the inclusive domestic rate, and that the fixed charge per annum shall be one-twelfth of the net assessment for rateable value, divided into four quarterly payments.

Croydon Corporation is recommended to purchase a 1 000 kVA Scott-connected oil-cooled transformer and an oil switch, at an estimated cost of £730. It is proposed to continue the work of standardisation of pressure in the borough to 230 V by conversion in various districts at an estimated cost of £5 000. The Electricity Committee proposes the erection and changeover of street lamps at an estimated cost of £310; and mains extensions at £648.

A scheme for demonstrating the practicability of electricity supply in rural areas, embracing the experiences of the Chester undertaking and the S.W.S. Power Co., has been prepared for operation in part of the area served by Bedford Corporation. It is intended to lay mains in the area concerned and to then invite the inhabitants to avail themselves of the service offered. The scheme, supported by the Electricity Commissioners, the Ministry of Transport, the Ministry of Agriculture, and several electricity undertakings, including those named above, will probably be subsidised by the Treasury until it becomes self supporting.

Mr. A. D. Erskine held a Ministry of Transport inquiry last week into the application of the Bedfordshire, Cambridgeshire and Huntingdonshire Electricity Co. to continue an overhead line from the works of the East Anglian Cement Co. at Shepreth to Harston. The Cement Co. refused consent unless they were compensated, and urged that the present cable was intended for the supply of electricity for power only to themselves. The company did not object to the cable being extended for lighting purposes, but objected to the extension in order to supply power to the Great Portland Cement Works and the Barrington Cement Works. Mr. S. S. Scott, for the electricity company, said they were under statutory obligation to supply the other cement companies, and they were not prepared to consider the question of compensation.

Sir W. F. Marwood, on behalf of the Ministry of Transport, held an inquiry on Monday into the application of Luton Corporation for a compulsory wayleave for an overhead electric cable from a point on the Icknield Way to the new estate of the Zoological Society at Whipsnade. Dr. P. Chalmers Mitchell, secretary of the Society, said the supply was an urgent necessity. A water reservoir had to be accepted on completion without test and pumping machinery paid for, although useless at present, because there was no power to operate the pumping plant and fill the reservoir. He could not recommend the society to spend money on putting a cable underground on other people's property. The proposal to erect an overhead line was opposed by members of the local committee of the National Trust and some local farmers.

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COMPANY NEWS.

Electrical Descriptions Mainly Quiet—Telegraph Stocks Improve—Supply Shares Unsteady—Wireless Telegraph Holdings Advance, while Traction Stocks also Show Improvement.

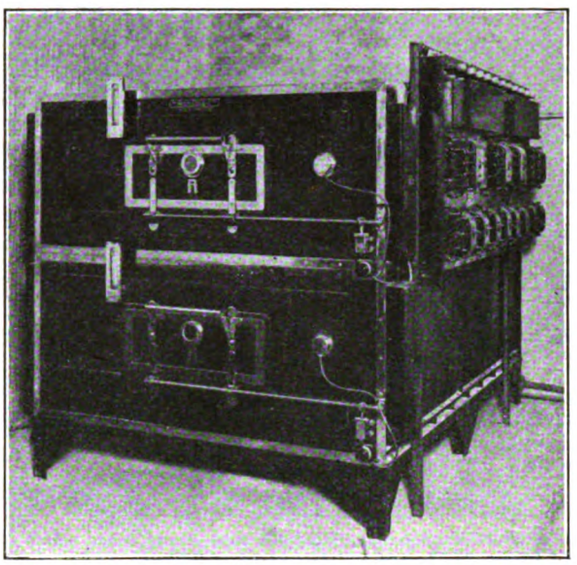
THE electrical share market has continued quiet, some little demand for manufacturing shares leaving price quotations unchanged except for General Electric ordinary, which have further recovered to £3. The only feature elsewhere was the buying of Eastern Telegraph ordinary stock, which at 282½ is 15 points up on the week. Other telegraph stocks show a small improvement, and Marconi's Wireless shares are half-a-crown higher at 86s. 3d. County of London supply shares have eased a shilling, and Metropolitan Railway ordinary stock is slightly better.

Last Annl. Divd.	Description.	This Week.	Last Week.	1926 to 1928. Highest	Lowest.
%	**Electricity Supply.**				
(*d*)	Brompton & Kensington Ord. ..	27/-	27/-	35/6	23/9
4	Central Elec. Sup. 4% Deb. ..	94	94	95½	88½
(*a*)	Charing Cross Elec. Ord. (£1) ..	26/-	26/-	51/-	24/3
4½	,, ,, ,, 4½% C.P. (£1)	17/6	17/6	18/3	16/6
(*b*)	Chelsea Elec. Sup. Ord.	27/-	27/-	45/3	24/-
10	City of Lond. Elec. L'ting Ord. ..	31/10½*	31/10½	52/10½	26/-
6	,, ,, ,, ,, ,, 6% C.P.	23/-*	23/-	24/3	21/6
7½	County Lon. Elec. Sup. Ord. ..	52/6	53/6	68/6	25/9
6	,, ,, ,, ,, 6% C.P. ..	23/-	23/-	24/-	21/3
(*e*)	Kensington & K'bridge Ord. (£1)	26/6*	26/6	27/6	23/9
1/9½	Lon. Elec. Sup. Ord. (£1)	27/-*	27/-	37/6	23/-
1/9½	Metro. Elec. Sup. Ord.	41/3	41/3	53/-	24/9
4½	,, ,, ,, 4½% C.P. ..	17/6	17/6	18/3	16/3
7½	N'castle & Dis. Elec. Ltg. Ord. ..	28/1½	28/1½	31/9	17/6
1/2½	N'castle-upon-Tyne Elec.Sup.Ord.	25/-	25/-	30/3	19/3
6	N. Metro. Elec. 6% C.P.	23/-	23/-	23/9	20/10
6	Notting Hill 6% C.P. (£10) ..	10½	10½	11½	9½
(*c*)	St. James & P.M. Ord. (£1) ..	27/6	27/6	28/6	23/6
1/4½	Shrops.Worcs.&Staffs. Power B.Ord.	37/6	37/6	37/6	21/4
1/9½	W'minster Elec. Sup.Ord. (£1) ..	26/-	26/-	52/9	24/-
4½	,, ,, ,, 4½% C.P. (£1)	17/6	17/6	17/10½	16/7½
8	Yorks. Elec. Power Ord.	34/-	34/-	38/9	24/6
6	,, ,, ,, 6% C.P. ..	24/-	24/-	26/9	20/7
	Railways and Tramways.				
8	Brit. Elec. Trac. Pfd.Ord. Stk ..	128	128	152	117
6	,, ,, ,, 6% Pf. Stk.	128½	128½	133	103½
4	Cent. Lon. Ry. Ord. Stk. (asstd.)	72	72	72	54
4	,, ,, ,, 4% Deb.	80	80	83	77½
4	City & S. Lon. 4% Perp. Deb. ..	79½	79½	81	76½
5	Lon. Elec. Rly. Cons. Ord. Stk. ..	73½	73½	75½	42½
4	,, ,, ,, ,, 4% Pf. Stk.	73	73	77	68
4	,, ,, ,, ,, 4% Deb. ..	80	80	83	76½
5	Lon. & Sub. Trac. A. Deb. ..	97½	97½	97½	74
4	Lon. Un. Trams, 1st Deb. ..	61	61	63	39
4½	Met. Elec. Trams, 4½% Deb. ..	72	72	73½	62
5	,, ,, ,, 5% Deb. ..	67½*	67½	70½	65½
3½	Met. Rly. Cons. Ord. Stk. ..	61	60½	81	54½
3½	,, ,, ,, 3½% Pf. Stk. ..	63	63	67	60½
3½	,, ,, ,, 3½% Deb. ..	70	70	73½	67½
5	Met. Dis. Rly. Ord. Stk.	76½	76½	77½	52½
4½	,, ,, ,, 4½% 1st Pref. ..	80½	80½	84	74½
6	,, ,, ,, 6% Perp. Deb. ..	116½	116½	118½	110
4	S. Met. Elec. Trams, 4% Deb. ..	70	70	70	64½
7	Uudergrouud Electric Rlys. Ord.	23/6 *	24/-	28/2	11/-
—	Yorks. (W.R.) Trams, Ord. ..	5/-	5/-	16/-	3/-
4½	,, ,, ,, 1st. Deb. ..	59	59	78	60
	Electrical Manufacturing.				
7	Brit. Elec. Transformer 7% C.P...	15/-	15/-	19/10	4/6
15	Brit. Insulated Cables Ord. ..	92/6	92/6	86/3	56/-
6	,, ,, ,, 6% C.P. ..	22/6	22/6	23/10	21/-
7	British Thomson-Houston Pref. ..	23/9	23/9	24/9	19/7
7	,, ,, ,, 7% Deb.	104½	104½	109½	102½
10	Brush Electrical Ord.	27/6	27/6	30/9	24/-
15	Callender's Cable Ord.	87/6	87/6	91/3	66/-
6½	,, ,, 6½% C.P. ..	25/-	25/-	25/9	22/-
7½	,, ,, 7½% B. Pref. ..	27/6	27/6	28/3	25/-
8	Crompton-Parkinson 8% Cum. Pf.	25/-	25/-	27/-	14/-
6	,, ,, 6% Cum. 2nd Pf.	18/-	18/-	19/6	9/7
7½	Edison Swan Elec. 1st Pref. ..	25/7½	25/7½	13/-	7/4½
5	,, ,, ,, 1st Deb. Stk.	86½	86½	92	81½
7½	Elec. Construction Ord.	20/-	20/-	32/6	23/6
7	,, ,, 7% C.P.	22/6	22/6	22/9	21/-
—	English Elec. Ord.	7/6	7/6	15/9	5/-
—	,, ,, 6% C.P. ..	9/4½	9/4½	18/9	7/-
7	Ericsson Telephones 7% Pref. ..	20/-	20/-	22/7½	17/6
35	Ever Ready (Gt. Britain) Ord. ..	22/6	22/6	92/3	18/1
6	Ferranti 6% Pref.	18/-	18/-	19/4½	16/9
7	,, 7% 2nd Pref.	21/3	21/3	19/3	13/9
10	General Elec. Ord.	60/-	58/9	46/6	26/6
‡25	W. T. Henley's Ord.	120/-	120/-	120/-	69/3
12½	Johnson & Phillips Ord.	36/3	36/3	67/11	34/-
7½	Lon. Elec. Wire. & Smith's Pref ..	23/9	23/9	25/-	22/3
7½	Siemens Bros. & Co. Ord. ..	27/6	27/6	36/6	24/9
10	Telegraph Const. Ord. (£12) ..	25½	25½	30½	20
	Telegraph.				
3½	Anglo-Am. Tele. Ord. Stk. ..	61½	61½	63½	56½
10	Eastern Ord. Stk.	282½	267½	273	135
3½	,, 3½% Pref. Stk. ..	68½	68½	70½	59
4	,, 4% Deb.	79½	79½	81½	74
10	Eastern Extension Ord. (£10) ..	28½	26½	27½	14
22	Gt. Northern Telegraph (£10) ..	32½	32	43½	26
10	Indo-European (£25)	55½	55½	48½	30
20	Marconi's Wireless T. Ord. ..	86/3	83/9	84/4	12/-
15	,, Int. Mar.	62½*	62/6	90/-	16/6
10	Western Tel. Ord. (£1)	28½*	26½	27⅝	12½

(*a*) 19 7/11d. per share. (*b*) 1s. 9·3d. per share. (*c*) 1s. 6·949d. per share.
(*d*) 1s. 8·706d. per share. (*e*) 1s. 7·181d. per share. ‡ Including 1s. bonus.
*Ex dividend.

AMERICAN TELEPHONE AND TELEGRAPH CO. —Prpsd. incr. authorised cap. stk. fm. $1 500 000 000 to $2 000 000 000.

SOCIETA ADRIATICA ELETTRICITA, VENICE.—Board proposes incr. cap. to 100 000 000 lire, to be offered to shhldrs. at par.



A "Magnet" baking oven installed in the Public Hospital, Wellington, N.Z., by the General Electric Co., Ltd.

HEAD, WRIGHTSON AND CO., LTD.—Div. on pref. shs. at rate of 6% p.a. for half-year ended March 31, 1929 is announced.

ALTON BATTERY CO., LTD.—Fin. div. 5%, less tax, on ord. shs., makg. 8% for year, and div. 8%, less tax, on dfd. shs. for year are declared.

BARCELONA TRACTION, LIGHT AND POWER CO., LTD.—Qrtrly. div. of 1¾% on non-cum. participatg. pref. shs. is payable.

VICTORIA FALLS AND TRANSVAAL POWER CO., LTD.—Net earngs. for qrtr. ended Dec. 31, 1928, before provisn. for British and South African taxatn., £297 987.

NORTH WALES POWER CO., LTD.—A petitn. for confirmatn. of reduction of cap. from £1 000 000 to £808 058 10s. will be heard at the Royal Courts of Justice, London, on April 15.

PARKER, WINDER AND ACHURCH, LTD.—Net pft. for 1928, £4 011, agst. £10 580. Div. on ord. shs. at rate of 10% p.a., makg. 7½%, less tax, for year. agst. 10% on smaller cap. Fwd. £8 563, agst. £10 468.

LANCASHIRE ELECTRIC LIGHT AND POWER CO.—A meeting to consider and, if thought fit, to approve a proposal to increase cap. to £3 171 415 by creatn. of 600 000 further £1 ord. shs. will be held to-day, April 12.

LONDON ELECTRIC WIRE CO. AND SMITHS, LTD.—Accts. for 1928 show net blce. £80 276, agst. £75 614. To gen. res. £30 000, agst. £20 000. Fin. div. on ord. shs. 6¼%, makg. 7½% less tax. Fwd. £22 759, agst. £20 789.

RIVER PLATE ELECTRICITY CO., LTD.—Rev. for 1928, after deductn. of income tax, administratn. exes. and exes. of new issue, £53 400, agst. £51 759. Div. 11%, less tax, on ord. stk.; to gen. res., £6 794, agst. £10 833; fwd. £7 403, agst. £7 596.

LYMINGTON ELECTRIC LIGHT AND POWER CO., LTD.—After providg. for deb. int., pref. div. and income tax and addg. amt. brt. fwd., £472, net rev. blce. was £2 568, out of which intm. div. of 3% on ord. shs. has been paid. Fin. div. on ord. shs. 5%, tax free; to gen. res., £500. Fwd., £228.

BOGOTA TELEPHONE CO., LTD.—In view of reconstructn. programme at present in hand, board has decided to defer consideratn. of paymt. of a div. until accts. of current year's

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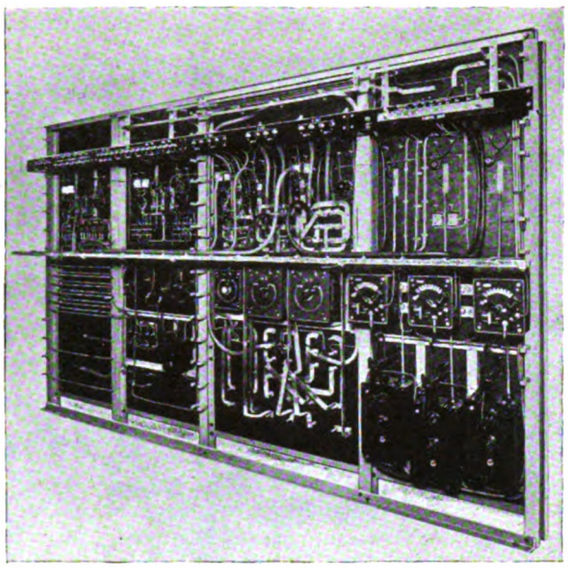
workg. are available; 10% was paid for year ended June 30, 1928.

HONGKONG TRAMWAY CO., LTD.—Pft. for 1928, $970 940, agst. $982 838, plus $252 849 brt. in. Fin. div., 80 cents, makg. $1·40 p. sh. for year (same as previous year). Written off good will, etc. of tramway undertakg., $68 000 (same). Fwd. $245 789.

INTERNATIONAL HYDRO-ELECTRIC SYSTEM.—The whole of the loan cap., amtg. to $30 000 000, of the International Hydro-Electric System, which was recently formed to acquire control of the New England Power Association and the Canadian Hydro-Electric Corporation, was issued recently in New York.



A BACK of panel view of a new power board which is being built by the Relay Automatic Telephone Co., Ltd., for the Manchester broadcasting station. The board is for controlling plants used for charging the large batteries which supply the transmitting valves, and for the charging of h.t. grid bias batteries. A brief description of the board is given on page 451.

KESWICK ELECTRIC LIGHT CO., LTD.—Rev. for 1928, £6 208, increase £426; workg. exes., £2 583, agst. £2 478. Blce. of rev. acct. £3 625, plus £322 brt. in. Deb. and loan int. and bank charges, £1 321; to depreciatn. £750; to res. fund, £1 000. Divs.: 6% p.a. on 6% pref. shs. and 10% p.a. on ord. shs.

ALTRINCHAM ELECTRIC SUPPLY, LTD.—Pft. for 1928, £31 757, agst. £25 208. After providg. for two years' directors' fees and intm. divs., it is proposed to distribute £1 000 in div. among ord. and a similar amt. among dfd. shhldrs, to pay div. for six months ended Dec., 1928, on new 7% 2nd pref. shs., and to carry fwd. £2 000.

BROMPTON AND KENSINGTON ELECTRICITY SUPPLY CO., LTD.—Net rev. for 1928, £50 563, agst. £36 095. After provisn. for sinkg. and contingency funds, fin. div. is 10·706d., makg. standard div. for year. To specl. res. (ord. shhldrs.' proportn. of consumers' benefit for years 1926, 1927 and 1928), £5 303. Fwd. £16 579, agst. £11 557.

GENERAL ELECTRIC CO., LTD.—An official announcement has been made that the company is not engaged in any negotiations with Associated Electrical Industries, Ltd. The board is exploring every avenue to secure friendly agreement with the American shhldrs. but there is no plan under consideratn. which suggests transfer of the control of the G.E.C.

CAMBRIDGE ELECTRIC SUPPLY CO., LTD.—Blce. of net rev. acct. for 1928, after provsn. for int. and income tax and includg. amt. brt. in, £35 537. Intm. div. paid in Nov. 1928, 3%; to gen. res., £10 000; written off part cost of increased cap. and premium on debs. redeemed, £3 000; fin. div. on ord. shs., 4%; to staff benevolent fund, £1 500. Fwd. £5 839.

TYNESIDE ELECTRICAL DEVELOPMENT CO., LTD.—Net pft. for year ended Jan. 31, 1929, £7 421, agst. £4 508. Divs.: 6% on pfd. ord. shs. and 7% on dfd. ord. shs. To gen. res., £1 000. Fwd. £1 243. Surplus on realisatn. of investmts., £13 317, of which £4 485 has been applied in reducg. book values of certn. investmts., blce. of £8 831 being carried to cap. res.

CANADIAN GENERAL ELECTRIC CO., LTD.—Net pft., after provisn. for res., taxes and depreciatn., $3 694 665, increase $1 591 612. After deductn. of pfd. divs. at $599 042, there remained $2 095 623 (equivalent to $16 a sh. earned on the 188 845 shs. of common stk. outstandg.). Deductg. $2 865 871 for reductn. of plant and property values, leaves $229 752, which is added to surplus acct.

SOUTH LONDON ELECTRIC SUPPLY CORPORATION, LTD.—Rev. for 1928 £181 067, includg. £65 682 brt. in. Int. on 1st mtge. deb. stk. and tempy. loans, £1 424; to contingency fund, £6 620; to res. for taxatn. £15 000; to sinkg. funds £22 837. Fin. div. of 3% on 6% cum. pref. shs.; fin. div. of 5½% on ord. shs., makg. 8½% for year. Fwd. £95 396. Electy. sold, 19 580 122 kWh, increase 2 479 847.

PARA ELECTRIC RAILWAYS AND LIGHTING CO., LTD.—Gross receipts for year ended Nov. 30, 1928, £179 146, agst. £173 032; net. rev., £71 192, agst. £69 832, plus int., transfer fees, etc., £817. London exes. required £4 706, deb. int., £25 912, and deb. sinking fund, £12 587. Blce., with £5 698 brt. fwd., £34 501. After provisn. for pref. div. and placing £10 000 to depreciatn. and renewals fund, carry fwd. is £5 001.

SOUTH METROPOLITAN ELECTRIC LIGHT AND POWER CO., LTD.—Accts. for past year show credit blce. £192 441, plus £118 246 brt. in. Int. on deb. stk. subject to tax, £14 584; to superannuatn. fund £10 000; provisn. for diff. between issue and redemptn. price of deb. stk., £876; to contingency fund, £3 807; to res. for taxation, £20 000; depreciatn., £41 845. Fin. div. on ord. shs. 5½%, less tax, makg. 8½% for year. Fwd. £152 076.

WOKING ELECTRIC SUPPLY CO., LTD.—Blce. on workg. during 1928, £40 625, plus £1 344 brt. in. After paymt. of int. on deb. stk. and temp. loan, div. on 6% cum. pref. shs. and 7% B and 10% C cum. pref. shs. to Dec. 31, 1928, and income tax, and placing £10 000 to depreciatn. and renewals fund, £5 000 to res., £5 000 to change over acct. and £2 333 to cap. expenditure acct., a div. on ord. shs. at rate of 7½% p.a., tax free, has been declared. Fwd. £1 851.

WINDERMERE AND DISTRICT ELECTRICITY SUPPLY CO., LTD.—Rev. for 1928, £15 189, increase £485; workg. exes., £6 449, agst. £6 240. Blce. of rev. acct., £8 740; brt. in from last year £1 433; deb. loan int. recd. from Keswick Elec. Light Co., £1 305, and bank and loan int. £149. To depreciatn. £1 500; to res., £5 000. Div. of 6% p.a. recommended on 6% cum. pref. shs., makg. 9% for year and clearing arrears to Oct. 31, 1924, 5% on 7½% non cum. pref. shs., makg. 7½% for year. Fwd. £803.

COUNTY OF LONDON ELECTRIC SUPPLY CO., LTD.—Rev. for past year, £1 467 803, includg. £204 987 brt. in. Int. on deb. stk. and tempy. loans, £250 820; to deb. stk. sinkg. fund, £5 000; provisn. for diff. between issue and redemptn. price of deb. stk., £4 600; to contingency fund, £28 975; to res. for taxatn., £35 000; to res. for depreciatn., £257 469, to investmt. res., £15 000. Fin. div. on ord. shs. 7%, makg. 10% for year. Fwd. £364 209. Electricity sold 323 462 637 kWh, increase 75 151 048.

LLANDUDNO AND COLWYN BAY ELECTRIC RAILWAY, LTD. Traffic receipts for 1928, £20 663, decrease £1 842. Deficit for year £1 153. Proposed reconstructn. of a sectn. of track in the Colwyn Bay area, in conjunctn. with works which Colwyn Bay Ccl. proposes to carry out at the same point, has not been proceeded with, owing to attitude of Ccl. Co. still experiences difficulty in makg. reasonable arrangemnts. with Colwyn Bay Ccl., and loss of rev. due to bus competitn. accts. for unsatisfactory result of year's workg.

A. REYROLLE AND CO., LTD.—Pft. for 1928, £90 615, agst. £89 306, plus £65 430. Distributed among local charitable and other funds, £1 000. Div. on pref. shs., 7% p.a., of which intm. div. was paid in Sept., 1928; div. on ord. shs., 12½% p.a.; to res. for gen. purposes. £25 000. Fwd. £78 892, agst. £65 430. Output of co.'s mfres. was greater than in 1927. Staff pensn. fund was inaugurated on July 1, 1928, and £30 326 was paid to trustees, being co.'s contributn. in respect of employees' service prior to that date.

BRITISH ENGINE, BOILER AND ELECTRICAL INSURANCE CO., LTD.—Intm. div. of 14s. p. sh., less tax, was paid on June 30, 1928. After transferring £20 000 to pensn. fund and £10 000 to res. fund, blce. is £20 544. Directors recommend paymt. of fin. div. of 15s. p. sh., less tax, absorbing £12 240. During 1928, 2s. p. sh. was called up, resultg. in additn. of £40 800 to paid up cap., and a correspondg. sum was

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transferred from contingency fund by way of bonus div. Bonus to staff and other jubilee expenditure amtd. to £5 534, leavg. blce. in contingency fund of £3 666, which has been transferred to gen. res.

ELECTRIC FURNACE CO., LTD.—In a statemt. issued to comply with the requiremts. of the Stock Exchange, it is announced that the whole of the issued 80 007 pfd. ord. and 78 036 ord. shs. of £1 each are fully paid. As co. was only incorporated on Aug. 23, 1928, no divs. have yet been paid. Hldrs. of pfd. ord. shs. are entitled to fixed cum. preferential div. at rate of 7% p.a. Surplus pfts. which it is determined to distribute are applied as follows: 1st, a div. of 7% p.a. on ord. shs.; 2nd, a div. of 3% p.a. on all shs., whether pfd. ord. or ord. Particulars are also given of the constitutn. and objects of the co. and arrangements made with other cos. in regard to interchange of patents and experience, etc.

CABLES AND WIRELESS MERGER.—Definite informatn. is now available regarding the offer of the scrip of the new merger co., Cables and Wireless, Ltd., to stkhldrs. and shhldrs. in the Eastern and Associated Telegraph Companies and Marconi's Wireless Telegraph Co., Ltd. Hldrs. of Eastern Telegraph stk. will be offered for every £100 now held £299 18s. in three classes of stk. of the new co. (£165 of 5½% cum. pref. £1 shs., £108 18s. of 7½% non-cum. "A" £1 ord. shs., and £26 of "B" £1 ord. shs.); and hldrs. of Eastern Extension shs. and Western Telegraph shs. will receive a similar allotment for ea. £100 nom. of £10 ord. shs. Marconi's Wireless Telegraph Co. shhldrs. will be offered for ea. £100 nom. of 7% cum. participatg. pref. shs. of £1 ea., or for each £100 nom. of £1 ord. shs., £131 10s. of 5½% cum. pref. £1 shs., £205 8s. of 7½% non-cum. "A" £1 ord. shs., and £150 5s. of "B" £1 ord. shs; and hldrs. of Marconi 10s. shs. will be offered for ea. £50 nom. of 10s. ord. shs. £81 10s. of 5½% £1 cum. pref. shs., £205 8s. of 7½% non-cum. "A" £1 ord. shs., and £150 5s. of "B" £1 ord. shs. Not more than 25% of the shs. of any class may be held by foreigners. On April 8, Cables and Wireless, Ltd., and Imperial and International Communications, Ltd., were registered as public companies. The former, wh is formed to acquire the securities of the cable cos. and the Marconi Co., has nom. cap. of £100, with power to increase same to £53 000 000, and the latter (the Imperial and International Co.), formed to acquire the undertakings, assets, obligations, etc., of the same companies, also has nom. cap. of £100. The directors of Cables and Wireless, Ltd., are: Sir Chas. S. Addis, Mr. Fredk. R. S. Balfour, Sir Chas. C. Barrie, Sir Fredk. J. Barthorpe, the Earl of Bessborough, Sir Basil P. Blackett, Col. Arthur G. Broderick, the Earl of Clarendon, Mr. John C. Denison-Pender, Admiral Henry W. Grant, Mr. Henry C. Hambo, Viscount Inchcape, Lord Inverforth, Mr. Francis A. Johnston, Mr. Fredk. G. Kellaway, Major H. Lefroy, Senatore G. Marconi, the Earl of Middleton, Mr. John F. O'Malley, Mr. Geo. Peel, Dr. Lorcan G. Sherlock, and Lord Wester Wemys; Lord Inverforth being president, Mr. J. C. Denison-Pender governor and managing director, and Mr. F. G. Kellaway deputy-governor and managing director. The personnel of the court of directors of Imperial and International Communications, Ltd., is the same, but Sir B. P. Blackett is chairman, and Mr. J. C. Denison-Pender and Mr. F. G. Kellaway are managing directors. Mr. Edward Wilshaw is manager and secretary of both companies.

Company Meetings.

MIDLAND ELECTRIC CORPORATION FOR POWER DISTRIBUTION, LTD.—Mr. D. Sinclair, presiding at the recent meeting, said the profit for the past year amounted to £154 460, an apparent decrease of £40 462. These figures, however, were not a true comparison, as the company in 1927 owned the generating station at Ocker Hill. After making the necessary adjustments the financial result was very little different from the previous year. It was as yet too early to estimate the effect of purchasing all their supplies, as the interlinking of the various generating stations was not completed. The directors recommended a final dividend of 5%, making 8% for the year, and it was proposed to carry forward £24 549. An Order to extend the company's area to Swindon, Seisdon, Trysull, Bobbington and Claverley was confirmed on March 11th.

MERSEY POWER CO., LTD.—At the recent general meeting, Mr. George Henry Cox, chairman, said although the company was registered in 1911 this was its first public meeting, none of the share capital having been made available to the public prior to last autumn. Since their previous report, the share capital had been increased by £700 000, making the authorised capital £1 050 000, of which £1 046 475 had been issued. This increase of share capital had enabled them to pay off all the mortgages and loans, with the exception of £200 000 lent under the Trade Facilities Act on favourable terms. Working profit was £100 869, compared with £87 660 for 1927, and net profit was £64 169, against £52 144. It was proposed to pay a dividend of 5% on the ordinary shares, to place to depreciation reserve £30 000, and carry forward £17 080. The prospects of the company continued to be good. Their Percival Lane station was to become a selected station under the North-West England scheme.

The Clyde Valley Co.'s Prices.

CLYDE VALLEY ELECTRICAL POWER CO.—Sir Fredk. C. Gardiner, presiding at the meeting on April 3rd, said, having regard to the prevailing conditions, he thought the shareholders would agree that the result of the year's working was satisfactory. They had carried £120 000 to contingency fund, and they recommended that £30 000 be set aside for establishing a fund for staff pensions, etc. Receipts from sale of current had increased by approximately £32 000. They were enabled to carry £303 000 to net revenue account, and, subject to the recommendations they made being adopted, they carried forward £84 500. Their output for last year (240 000 000 kWh) was 21 000 000 higher than 1927. They were installing a 20 000 kW turbo-alternator at Yoker, to operate at 50 cycles. The recent readjustment of the company's domestic and shop rates was made in order to reach, if possible, relative uniformity. The changes proposed involved a reduction in revenue of about £5 000. They were designed to give an advantage to consumers who made full use of electricity for domestic purposes. They granted the option to all consumers to continue on the then existing basis of charge or to adopt the new basis. Already a large number had accepted the new proposals. Their average rate per kWh sold for the year was 0·749d., and combined average rate received by the company and its the subsidiaries from power, shops, and domestic consumers was 0·828d. These rates were lower than in the previous year. Moreover, they were lower than any other undertaking in Scotland, and there were few undertakings in the United Kingdom selling at so low an average price. The report and accounts were adopted, and payment of the 6% preference share dividend for the half years ending April 30th and October 31st, 1929, and the 8% 2nd preference share dividend for the half years ending June 30th and December 31st, 1929, was approved.

A. REYROLLE AND CO., LTD.—Mr. A. Scholefield, presiding at the meeting on April 4th, said two years ago their chairman, when addressing them, referred to the Electricity Act, 1926, by which supplies of electricity would be provided throughout the country, and he stated that he hoped in due course they would receive some share of the work. They did receive a large contract, one of the largest single orders which he believed had ever been placed in this country for switchgear only, in connection with the South-Eastern scheme. They had also received several smaller orders connected with the work of the Electricity Board in other districts. Their turnover during the year had been higher than ever before, and a considerable portion of it still represented switchgear exported to the colonies and elsewhere abroad. A contribution of £28 000 had been set aside for the staff superannuation scheme. A sum of £1 000 was voted to local charitable and other funds. The report and accounts were adopted, and dividends of 7% on the preference and 12½% on the ordinary shares were approved.

ERICSSON TELEPHONES, LTD.—Mr. W. M. Crowe, presiding at the meeting on April 3rd, said the net profit for the past year was some £4 000, or approximately 15%, better than the previous year, and the prospects were that the current year would show still better results. During last year and since the beginning of the present year they had received some large orders for automatic equipment, as well as for general material and manual exchanges. They had completed for the Post Office at Bath an automatic exchange with two satellite exchanges, and had orders for automatic exchanges at Walsall, Aldridge and Bloxwich. The installation at Shepherd's Bush had already commenced. Further automatic exchanges in hand were Crewe and Nantwich and "Gladstone," in the London area. Orders had also been secured for private automatic exchanges throughout this country and also abroad. It was proposed to pay the dividend on the 7% preference shares, 5%, less tax, to the ordinary shareholders, to place £5 000 to general reserve, and carry forward £18 236. The report was adopted.

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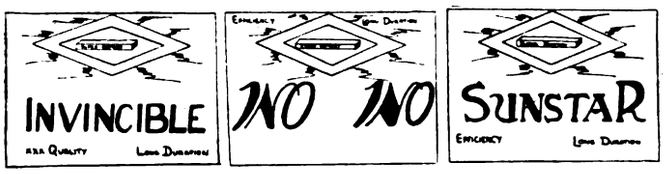
ELECTRICAL TRADE MARKS.

This list has been specially compiled for us from official sources by GEE AND CO., *Patent and Trade Marks Agents, 51 and 54, Chancery Lane, London, W.C.2, from whom further information may be obtained.*

SARE.—498 495. Class 8. Scientific instruments and apparatus. P. Kay, Ltd., 183, Old Street, London, E.C.2; merchants. December 27th, 1928. (To be associated with No. 498 496 and others (not yet advertised)).



Illustrating Marks 494 477, 494 478 and 494 479 reading from left to right.

LIMPET TAPE.—B496 270. Class 50. Electric insulating tape composed of cotton impregnated with india-rubber. Connollys (Blackley), Ltd., Blackley Vale Mills, Blackley, Manchester; cable manufacturers. October 24th, 1928. User claimed rom June 24th, 1925.

Opposition to the registration of the following trade marks can be lodged up to April 20th.

CLAROSTAT.—492 651. Class 8. Variable electrical resistances. Claude Lyons, Ltd., Old Hall Chambers, 76, Old Hall Street, Liverpool; manufacturers. June 23rd, 1928.

OBERON.—494 056. Class 8. Scientific instruments and apparatus. The Parlophone Co., Ltd., 1, Broad Street Place, London, E.C.2; manufacturers. August 13th, 1928.

SAREZITE.—498 496. Class 8. Scientific instruments and apparatus. P. Kay, Ltd., 183, Old Street, London, E.C.2; merchants. December 27th, 1928. (To be associated with No. 498 495 (2 659).)

SUNBEAM.—484 296.—Class 18. Electric lighting, power and ignition sets, all being parts of motor cars and other motor vehicles (except motor cycles and sidecars). The Sunbeam Motor Car Co., Ltd., Moorfield Works, Upper Villiers Street, Wolverhampton; manufacturers. September 24th, 1927. (To be associated with No. 484 297 (2,622) xxii and another.)

Opposition to the registration of the following trade marks can be lodged up to April 27th.

BUSY BEE.—497 618. Class 6. Electric vacuum cleaning machines. Drake and Gorham Wholesale, Ltd., 67, Long Acre, London, W.C.2; merchants. November 30th, 1928.

CHARIDE.—495 130. Class 8. Wireless telephonic instruments. Rupert May, 48, Canning Road, Croydon; manufacturer. September 18th, 1928.

IGRANOPHONE.—499 862. Class 8. Wireless telephonic apparatus in combination with gramophones and parts thereof. Igranic Electric Co., Ltd., 147, Queen Victoria Street, London, E.C.4; electrical engineers. February 8th, 1929. To be associated with No. 254 366 (1 316) and others.

OKOSCOPE. (Sign).—499 913. Class 8. Electrical resistances, fitted electrical switchboards, and electric accumulators (not for medical purposes). Okoscope and Camera Developments, Ltd., 10, Lancaster Place, London, W.C.2; dealers in scientific instruments. February 11th, 1929.

ETA.—497 286. Class 13. Electrical switches, electrical fusible cut-outs and electrical contact plugs, all being metal goods. Siemens-Schuckertwerke Aktiengesellschaft, 101 to 110, Nonnendamm-Allee, Berlin-Siemensstadt, Germany; manufacturers. November 21st, 1928.

TWELCO.—496 912. Class 13. Electric lamps (ordinary). John Massey Fairhurst, trading as The Western Electric Lamp Co., 122, Royal Exchange, Manchester; merchant. November 10th, 1928.

Opposition to the registration of the following trade marks can be lodged up to May 3rd.

494 477. Class 8. Electric batteries (not for medical purposes). August 27th, 1928. To be associated with No. 494 478 (2 662) and another. Registration of this trade mark shall give no right to the exclusive use of the letters "X X X," or of the word "Super" or of the device of an electric battery. 494 478. Class 8. Electric batteries (not for medical purposes). August 27th, 1928. To be associated with No. 494 477 (2 662) and another. Registration of this trade mark shall give no right to the exclusive use of the word "Super" or of the device of an electric battery. 494 479. Class 8. Electric batteries (not for medical purposes). Gas Light Fittings Co., Ltd., 322, Walworth Road, London, S.E.17; electrical and gas engineers. August 27th, 1928. To be associated with No. 494 477 (2 662) and another. Registration of this trade mark shall give no right to the exclusive use of the word "Super" or of the device of an electric battery.

DISTASET.—497 574. Class 8. Wireless telephonic apparatus. Truphonic, Ltd., Truphonic House, 121 and 123, Roseberry Avenue, London, E.C.1; manufacturers. November 29, 1928. (By consent.)

POLYFAR.—499 193. Class 8. Wireless telephonic and telegraphic apparatus, and parts thereof. Polyphonwerke Aktiengesellschaft, 76, Markgrafenstrasse, Berlin, S.W.68; manufacturers. January 19th, 1929. To be associated with No. 350 747 (1 833) and others.

GOTHIC.—500 032. Class 8. Loud speakers. M.P.A. Wireless, Ltd., 62, Conduit Street, Regent Street, London, W.1; manufacturers. February 14th, 1929.

OSRAM.—498 860. Class 8. Apparatus and parts thereof for use in connection with television and telegraphy. The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2; manufacturing electrical engineers. January 9th, 1929. To be associated with No. 330 828 (1 726) and others.

KELSTOM (sign). 499 987. Class 8. Instruments and apparatus for use in wireless telegraphy and telephony. Kells and Thompson, 100, George Street, Portman Square, London, W.1; manufacturers and merchants. February 13th, 1929.

THE LEAD MARKET.

Prices were, before Easter, according to James Forster and Co., a little firmer. After the holidays a firm tone was still in evidence, but on the Thursday a break occurred, prices falling from £26 15s. to £24 10s. for all positions. The American price was marked down to 7.50 cents per lb.

Closing prices on April 5th were £24 10s. for all positions, against £28 13s. 9d. to £29 a fortnight ago.

IMPERIAL TRAMWAYS CO., LTD.—After payment of deb. int. and pref. div. for 1928, div. of 5%, less tax, on ord. shs. is proposed. Fwd. £878.

NEW COMPANIES.

GRANGE ELECTRICAL AND RADIO SERVICES, LTD.—Cap., £1 000, Electricians, etc. Reg. office: 1, Grange Road, Edinburgh.

FRED HARTLEY, LTD.—Cap., £500. Electrical and mechanical engineers, etc. A director: F. Hartley, 7, Sunnyroyd Terrace, Colne.

A. E. MORRISON AND SONS, LTD.—Cap., £10 000. Electricians, electrical and general engineers, etc. Reg. Office: Gartree Street, Leicester.

NELSON BROTHERS, LTD.—Cap., £2 000. Electricians, manufacturers of and dealers in electricity, etc. Reg. office: 2, Regent Road, Blackpool.

MAVOR AND COULSON (SOUTH AFRICA), LTD.—Cap., £10 000. Engineers and electricians, etc. Reg. Office: 47, Redan Street, Mile End, Glasgow.

N. M. CLOUGHER AND CO., LTD.—Cap., £5 000. Electrical engineers, contractors, etc. A director: N. M. Clougher, 28, Craven Street, London, W.C.2.

J. LEWTAS, LTD.—Cap., £10. Manufacturers, merchants and factors of lamps, electric lighting goods, etc. Reg. Office: 22, Little Peter Street, Manchester.

SNAP SWITCHES, LTD.—Cap., £100. Manufacturers of wireless equipment, electrical and general engineers, etc. Reg. Office: 17, Mason's Hill, Bromley, Kent.

IOLA (RADIO-GRAM), LTD.—Cap., £400. Manufacturers, factors nd distributors of wireless receivers and instruments, etc. Reg. Office: 60, Chiswell Street, London, E.C.2.

EMERALD WELDING CO., LTD.—Cap., £100. Welders by electric arc, electric resistance, or other processes, etc. Reg. office: 21a, Brownlow Mews, Guilford Street, London, W.C.1.

BELLFREY, LTD.—Cap., £300. Manufacturers of and dealers in electrical, telegraphic, telephonic and wireless instruments, etc. Reg. Office: 9, Brunswick Place, City Road, London, N.1.

MOSS AND SMITH, LTD.—Cap., £10 000. To acquire business of wireless factors and importers, etc., carried on by W. Moss and W. M. Smith as Moss and Smith at Kensington House, Bolton.

TRUSLOVES, LTD.—Cap., £50 000. To acquire business of pump manufacturer, electrical engineer, etc., carried on by A. Webb as Truslove and Co. Reg. Office: 17, Victoria Street, Westminster, S.W.1.

MULTIDOOR, LTD.—Cap., £200 000. Manufacturers of and dealers in automatic machines, electricians, etc. Solicitors: Kenneth Brown Baker, Baker, Lennox House, Norfolk Street, London, W.C.2. (Public Co.)

ROTOR SIGNS (ENGLAND), LTD.—Cap. £5 000. To adopt an agreement with T. H. Read, and to develop and turn to account the patents referred to therein. Reg. office: 4, Dove Court, Old Jewry, London, E.C.

LATTIN ELECTRICAL PRODUCTS, LTD.—Cap., £3 500. Manufacturers and distributors of electric heating and cooking apparatus, electrical engineers, etc. Reg. Office: Alexandra Works, Limes Road, Croydon.

PERKINS AND POWELL, LTD.—Cap., £7 000. To acquire business carried on as "Perkins and Powell," at 2, 3, 4 and 5, Bartholomew Row, Birmingham, and to carry on business of manufacturers of electrical fittings, etc.

METAL AND CHEMICAL PRICES.

TUESDAY, April 9th.

		Price.	Inc.	Dec.
Copper—				
Best Selected ..	per ton	£99 0 0	—	£6 0 0
Electro Wirebars	,,	£107 0 0	—	£4 0 0
H.C. Wires, basis	per lb.	1s. 2¼d.	—	7/16d.
Sheet	,,	1s. 2 1/16d.	—	—
Phosphor Bronze—				
Wire (Telephone) basis	per lb.	1s. 5¼d.	—	7/16d.
Brass 60/40—				
Rod, basis ..	per lb.	9d.	—	—
Sheet ,, ..	,,	1s. 0⅛d.	⅛d.	—
Wire ,, ..	,,	1s. 0⅛d.	⅛d.	—
Pig Iron—				
Cleveland Warrants	per ton	£3 9 6	—	—
Galvanised Steel Wire, basis 8.S.W.G. ..	,,	£14 15 0	—	—
Lead Pig—				
English	per ton	£26 5 0	—	£1 10 0
Foreign or Colonial	,,	£25 0 0	—	£1 7 6
Tin—				
Ingot	per ton	£216 5 0	—	£4 2 6
Wire, basis ..	per lb.	2s. 10d.	—	½d.
Aluminium Ingots	per ton	£95 0 0	..	—
Spelter	,,	£26 17 6	—	12s. 6d.
Mercury	per bottle	£22 5 0	—	—

Sulphur—Flowers, Ton £12 0 0 *Sulphuric Acid*—
,, Roll ,, £10 10 0 (Pyrites, 168°) Ton £6 15 0
Copper Sulphate ,, £25 to £25 10 0 *Sodium Chlorate* per lb. 2½d.
Boric Acid (Crystals),, £30 0 0 *Sodium Bichromate* per lb. 3½d.
Rubber—Para fine, 1s. 0¼d.; plantation, 1st latex, 11½d.

∴ The metal prices are supplied by British Insulated Cables Ltd., and the rubber prices by W. T. Henley's Telegraph Works Co., Ltd.

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COMMERCIAL INFORMATION.

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debt. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

ARNOLD, H., AND SON, Chequers Inn, Stowe Street, Lichfield, electrical contractors. £14 8s. 4d. February 27th.

ASSOCIATED ELECTRICAL SERVICES, 84, Eden Street, Kingston-on-Thames, electrical engineers. £10 14s. 11d. February 1st.

CLARKE, Mr., 149, Seabank Road, New Brighton, wireless dealer. £17 11s. 9d. February 21st.

EDGINGTON, Henry John H., and OXLAND, William Henry (trading as WESTERN TRADING SYNDICATE), 34, Chapel Street, Plymouth, wireless engineers. £28 19s. February 19th.

ELECTRADIO CO., LTD., 25, Westbourne Grove, W., electrical engineers. £15 2s. 10d. February 1st.

HARRIS (A. and B.), LTD., 47, Victoria Street, S.W., electrical engineers. £20 15s. 10d., February 4th; and £14 17s. 4d. February 26th.

HINE, Mr. G., 17, The Promenade, Church End, Finchley, wireless engineer. £15 0s. 7d. February 20th.

HONEYMAN, Mr. V. L., 825, High Road, Leytonstone, electrical engineer. £15 0s. 6d. February.

HOWSON AND CO., 2, The Facade, High Road, Goodmayes, electricians. £17 10s. 8d. February 20th.

PAMPHILION, Charles, 54, Blackhorse Lane, Walthamstow, electrical engineer. £28 2s. 10d. February 15th.

PIRIE, Mr. S. R., 9, Arlington Street, Piccadilly, W., electrical engineer. £18 8s. 10d. January 29th.

WENDER BROS., 66, Georges Road, Holloway, electricians £101 3s. January 18th.

Receivership.

MACKAY (WESTCLIFF-ON-SEA), LTD. E. G. White, of 77, High Street, Southend-on-Sea, was appointed receiver and manager on March 21st, 1929, under powers contained in debenture dated May 5th, 1926.

Mortgages.

[NOTE.—*The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *— allowed by the date of the Summary, but such total may have been reduced.*]

BORDER ELECTRICAL FACTORING CO., LTD., Carlisle.—Registered March 20th, mortgage to Bank; charged on land and buildings in Collier Lane and Doughalls Court, Carlisle, etc.

KING (C. B.) (MAGNETOS), LTD., London, W. Registered March 14th, £1 100 debentures; general charge. *——. December 31st, 1928.

ROYCE, LTD., Manchester, electricians.—Registered March 20th, debenture for £5 000 and further advances to F. H. Royce, Elmstead, West Whittering; general charge. *£26 294. September 14th, 1928.

SIMMONDS AND STOKES, LTD., London, W.C., electricians.—Registered March 19th, £200 2nd debentures (2nd series) and £1 100 3rd debentures parts of £2 000 and £3 000; general charge. *£3 550. February 14th, 1929.

VOLTRON CO., LTD., Ponders End, wireless manufacturers.—Registered March 18th, £2 500 debenture, to Mrs. B. Ricketts, 14, Queen Anne Street, W.; general charge. *——. December 31st, 1928.

Satisfactions.

BRIDGWATER AND DISTRICT ELECTRIC SUPPLY AND TRACTION CO., LTD.—Satisfactions registered March 21st, £5 000, registered September 5th, 1922, and £2 150, registered May 4th, 1924.

ENGLISH ELECTRIC CO., LTD., London, W.C. Satisfaction registered March 14th, £43 600, part of amount registered October 3rd, 1919.

Private Meetings, etc.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

COCHRAN, Samuel King Young, wireless dealer, trading as the POPULAR WIRELESS STORES, 26, Moorfields, and 3, Byrom Street, Liverpool. A meeting of the creditors of the above was held on April 5th at the offices of Mr. Parkin S. Booth, accountant and auditor, 2, Bixteth Street, Liverpool, when the representative of the Chorlton Metal Co. was elected to the chair. The statement of affairs submitted showed ranking liabilities of £893 (trade creditors £669, cash claims £174, and bank overdraft £50), and assets of £330, less £150, or a deficiency of £713. Mr. Booth reported that the debtor commenced trading on his own account at 26, Moorfields, with a capital of £350, the whole of which was borrowed and was still owing. The business was satisfactory, and in February last the debtor opened a branch shop at Byrom Street. The rent at Moorfields was £180 per annum with rates of £130 yearly. The takings at that establishment had ranged from £50 to £60 per week. The rent at Byrom Street was £3 weekly, and the takings there had only averaged from £5 to £6 a week. The debtor's drawings had been at the rate of £6 a week. After a short discussion, a resolution was passed confirming the deed of assignment already executed to Mr. Booth and a committee of three of the creditors was appointed. It was also decided that the debtor should be given 14 days in which to submit an offer of a composition.

KLEIN BROS., LTD., wireless, etc., merchants, Bishopsgate, London, E.C. At the statutory meeting of creditors in the voluntary liquidation of this company the statement of affairs, as at March 14th last, disclosed total liabilities of £4 096, of which £3 654 was due to unsecured creditors; there were bills payable of £263, and £179 was owing to the directors. There were also debentures for £2 500 secured upon the assets of the company. The assets, including stock in trade, etc., as a going concern, £1 125, and book debts £893, totalled £2 028, and there is consequently nothing available to meet the claims of the unsecured creditors.

NEW STANDARD WIRELESS VALVE CO., LTD. This company, now in voluntary liquidation by reason of its liabilities, was only registered so recently as August last. Its directors, according to the latest official return, are Harry Worrall, holding 101 shares, Henry Shephard, with 100 shares, and William Shephard, 100 shares; four other shareholders with 60 shares, bringing the total number in issue to 381, out of an authorised capital of £500 in £1 shares.

London Gazette, etc.

Companies Winding-up Voluntarily.

ASHWORTH AND SMITH (ELECTRICAL SUPPLIES), LTD. By reason of its liabilities, March 26th. B. H. B. Eldridge, 52, Brown Street, Manchester, chartered accountant, appointed as liquidator. Meeting of creditors at the offices of the Manchester Chartered Accountants' Society, 60, Spring Gardens, Manchester, at 3 p.m., Tuesday, April 16th.

CERTAX, LTD. By Special Resolution, March 15th, confirmed April 3rd. W. Elles-Hill, Chartered Accountant, 41, Bedford Square, W.C.1, appointed as liquidator.

NEW STANDARD WIRELESS VALVE CO., LTD. By reason of its liabilities, March 23rd. J. Hedley Janes, incorporated accountant, 27, New Hall Street, Macclesfield, appointed as liquidator,

OXFORD WIRELESS TELEPHONY CO., LTD. By Special Resolutions, March 13th, confirmed March 28th. E. R. White, 55, Cornmarket Street, Oxford, Chartered Accountant, appointed as liquidator. Meeting of creditors at liquidator's office, Thursday, April 18th, at 11 a.m.

Bankruptcy Information.

RICHARDS, Stanley Wyndham, of the Blackwood Radio and Electric Supply Depot, High Street, Blackwood, Monmouthshire, radio engineer and electrical contractor. Receiving order, April 3rd. Debtor's petition. First meeting, April 19th, 12.30 p.m., 34, Park Place, Cardiff. Public examination, May 23rd, 2.30 p.m., Town Hall, Tredegar.

SMITH, Leonard John, 3, Lower King's Road, Berkhamsted, electrical, radio and cycle engineer. Receiving order, April 2nd, Debtor's petition.

Notice of Dividend.

WALLIS, Cyril Kenneth, Bedford Street, and then at Longford Road, Bognor, Sussex, electrical engineer. Supplemental dividend 3s. 8d. per £, payable April 12th, Official Receiver's office, 12A, Marlborough Place, Brighton.

Notices of Intended Dividends.

HYDE, Hubert Algernon, 2, East Street, Bromley, Kent, wireless dealer. Last day for receiving proofs, April 20th. Trustee, T. Gourlay, 29, Russell Square, London, W.C.1. Official Receiver.

LAY, Oliver Cecil, 83, Burntwood Lane, Wandsworth, London, accumulator specialist, trading as the HOME WIRELESS INSTALLATION CO. at 2 (c) and 2 (d) High Street, Wandsworth, London. Last day for receiving proofs, April 20th. Trustee, T. Gourlay, 29, Russell Square, London, W.C.1, Official Receiver.

SCOTT, Montagu James, 134, Regent Street, Middlesex, trading as MONTAGU J. SCOTT AND CO., electrical engineer and contractor, lately at 100, Jermyn Street, Middlesex. Last day for receiving proofs, April 20th. Trustee, D. Williams, Official Receiver, Bankruptcy Buildings, Carey Street, London, W.C.2.

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PATENT RECORD.

The following information is prepared from the Illustrated Official Journal (Patents) by permission of the Controller of H.M. Stationery Office. Printed copies of full Patent Specifications, when accepted, may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at 1s. each.

306 194 British Thomson-Houston Co., Ltd. and C. G. Mayo. Electric transformers. (29/8/27.)
277 991 C. E. Bennett. Electric fuses. (23/9/26.)
306 574 W. W. Whiffin. Delay-action mechanism for electrical switches, gas cocks, or the like. (18/11/27.)
280 948 G. Valensi. Low-pressure electric discharge apparatus. (18/11/26.)
306 470 A. Reyrolle and Co., Ltd. and B. H. Leeson. Electric vibratory relays. (19/11/27.)
306 436 C. Flannagan. Circuit arrangements for thermionic devices. (19/11/27.)
292 455 G. Valensi. Low-pressure electric discharge apparatus. (17/6/27.)
306 580 G. M. Wright. Constant-frequency control devices suitable for use in picture telegraphy. (22/11/27.)
306 500 H. A. Ewen. Apparatus for supplying power to the anodes of thermionic valves. (22/11/27.)
306 583 J. Shaw. Apparatus for the application of the constant electrical current in medical practice. (23/11/27.)
306 584 W. E. Beatty (Bell Telephone Laboratories, Inc.). Wire-drawing apparatus. (23/11/27.)
281 297 Siemens and Halske Akt.-Ges. Telephone systems. (24/11/26.)
287 515 Associated Telephone and Telegraph Co. Telephone systems. (23/3/27.)
306 592 Automatic Telephone Manufacturing Co., Ltd. and C. E. Beale. Telephone systems. (23/11/27.)
306 612 General Electric Co., Ltd., F. J. G. Van Den Bosch, and N. R. Campbell. Manufacture of gasfilled electric incandescent lamps. (28/11/27.)
306 626 J. K. Im Thurn and T. H. Baines. Constant-voltage dynamo-electric machinery. (1/12/27.)
289 846 C. Meyer. Automatic circuit-breaker arrangements for the protection of electric generators. (4/5/27.)
306 659 General Electric Co., Ltd., F. G. Quance and T. C. Freeth. Devices for taking up or absorbing cords or the like flexible bodies. (30/12/27.)
306 661 General Electric Co., Ltd. and J. R. Conchie. Electric bells. (3/1/28.)
306 662 W. C. Kennett and Hackbridge Electric Construction Co., Ltd. Electric transformers. (3/1/28.)
306 663 Tyer and Co., Ltd. and F. W. Leake. Selective switching-devices for electric circuits. (4/1/28.)
306 664 G. D. Peters and Co., Ltd. and H. R. Hockley. Tramcars and similar vehicles. (6/1/28.)
306 683 Siemens Bros. and Co., Ltd. and D. A. Christian. Sending or controlling apparatus set by electrical impulses. (7/2/28.)
306 707 N. R. Davis and Metropolitan-Vickers Electrical Co., Ltd. Electrical induction furnaces. (23/2/28.)
306 726 G. H. Fletcher, R. Brooks and Metropolitan-Vickers Electrical Co., Ltd. Electric motor control systems. (9/3/28.)
306 749 Birmingham Electric Furnaces, Ltd. and A. G. Lobley. Electrical gear for operating furnace and like doors. (5/4/28.)
289 816 L. M. Ericsson Telefonaktiebolaget. Automatic and semi-automatic telephone systems. (2/5/27.)
306 772 H. C. Compaan. Current motors and propellers. (5/6/28.)
292 469 Westinghouse Electric and Manufacturing Co. Radio-transmitting systems. (18/6/27.)
306 785 Weldrics (1922), Ltd. and A. D. Anderson. Electrodes for arc-welding and like purposes. (17/7/28.)
301 015 Falk, Stadelmann and Co., Ltd. Filaments for electric incandescent optical-projection lamps. (23/11/27.)
299 447 Marconi's Wireless Telegraph Co., Ltd. Aerial systems. (28/10/27.)
307 086 J. Neale. Light-sensitive apparatus for producing or amplifying alternating currents. (29/8/27.)
307 087 W. S. Smith, H. J. Garnett and H. C. Channon. Submarine telephone cables. (2/9/27.)
306 855 H. Andrewes and Dubilier Condenser Co. (1925), Ltd. Means for connecting electrical pick-up devices of gramophones and the like with radio receivers. (26/9/27.)
307 091 W. E. Clifton. Means for supporting electrical sound-recording or sound-reproducing or other like electrical vibratory devices. (27/10/27.)
281 243 British Thomson-Houston Co., Ltd. Electrical regulators. (24/11/26.)
307 093 R. Edgeworth-Johnstone. Electrolytic cells. (1/11/27.)
292 989 F. Brinkmann. Magnet systems of telephone instruments. (20/6/27.)
306 862 British Thomson-Houston Co., Ltd. and H. C. Heath. Enclosed electrical apparatus. (23/11/27.)
306 868 Electrical Apparatus Co., Ltd. and R. H. Barbour. Electric controllers. (26/11/27.)
306 919 J. A. Crabtree. Electric switches. (29/11/27.)
306 920 F. F. D. Davidson. Means for the winding of electric flex extensions. (29/11/27.)
282 727 Radiotechnique. Thermionic valves. (31/12/26.)
306 922 Siemens Bros. and Co., Ltd., C. Lambert and W. G. Patterson. Automatic and semi-automatic telephone systems. (29/11/27.)

Applications for Patents.

February 11th.

4 502 A. Allan and A. Reyrolle and Co., Ltd. Switchgear.
4 566 Associated Telephone and Telegraph Co. Automatic battery charging systems. (13/2/28, U.S.)
4 607 A. R. Bradburn. Securing leads to wireless apparatus, etc.
4 534 British Radio Corporation, Ltd. Loud speakers.
4 543 British Thomson-Houston Co., Ltd. Switches. (10/2/28, U.S.)
4 545 British Thomson-Houston Co., Ltd. Supply of operating current to electron discharge devices. (11/2/28, U.S.)
4 580 H. C. Channon, J. N. Dean, H. J. Garnett, B. J. Habgood, and W. S. Smith. Insulating materials.
4 612 H. C. Channon, J. N. Dean, H. J. Garnett, B. J. Habgood, and W. S. Smith. Insulating materials. (14/11/28.)
4 613 H. C. Channon, J. H. Dean, W. Gardner and H. J. Garnett, W. S. Smith, H. F. Wilson. Insulating materials. (14/11/28.)
4 565 S. G. S. Dicker (N. V. Philips Gloeilampenfabrieken. Incandescent lamps.
4 596 M. Gill. Electrical apparatus for reproduction of sound.
4 466 J. H. O. Harries. Transmission of modulated carrier currents, etc.
4 616 Hirsch, Kupfer und Messingwerke A.-G. Electric melting furnaces. (11/2/28, Germany.)
4 544 International General Electric Co., Inc. Overload couplings for electrically operated worm gears. (10/2/28, Germany.)
4 579 Marconi's Wireless Telegraph Co., Ltd. Energy supply systems for thermionic valves. (11/2/28, U.S.)
4 526 J. E. Sawyer. Time switches.
4 521 H. G. Taylor. Jibs for carrying overhead wires, etc.
4 530 R. N. Wellington. Switches.

February 12th.

4 621 Apparfillage Gardy Soc. Anon., and V. Kunz. Electrical cut-outs.
4 618 Automatic Telephone Manufacturing Co., Ltd., C. E. Beale, and R. Taylor. Telephone systems.
4 736 Automatic Telephone Manufacturing Co., Ltd., and R. N. Saxby. Imitation fires.
4 718 A. Avis and A. H. Seabrook. Overhead transmission systems.
4 719 A. Avis and A. H. Seabrook. Electric conductors.
4 720 A. Avis and A. H. Seabrook. Poles for overhead wires, etc.
4 696 British Thomson-Houston Co., Ltd., and C. G. Mayo. Electric protective arrangements.
4 658 H. W. Brown and T. A. Forrest. Supporting resistance elements in electrical apparatus.
4 628 Callender's Cable and Construction Co., Ltd., and A. E. Wilson. Connecting devices for electric circuits.
4 683 E. P. S. Cattle. Electric junction boxes, etc.
4 693 W. H. Edridge. Galvanic cells, etc.
4 654 Gramophone Co., Ltd., and R. B. Morgan. Glow discharge tubes.
4 688 G. Newton and Standard Telephones and Cables, Ltd. Impulse senders for telephone systems.
4 671 Oesterreichische Dynamit Nobel A.-G. Electric fuses. (20/6/28, Austria.)
4 725 J. R. Pullan. Electric lamp holders.
4 637 B. J. Sirilito. Alternating current dynamos.
4 710 Soc. d'Applications d'Electricité et Mécanique. Double torsion spindles. (21/12/28, France.)
4 689 Standard Telephones and Cables, Ltd., and E. P. G. Wright. Telephone systems.
4 640 A. T. Thompson. Inductance coils for wireless instruments.

February 13th.

4 803 Associated Electrical Industries, Ltd. Transformer cooling systems. (11/2/28, U.S.)
4 892 P. Baxter. Electrical driving means for talking machines.
4 847 A. and G. Bray, and G. Bray and Co., Ltd. Electric heating apparatus.
4 819 Callender's Cable and Construction Co., Ltd., S. W. Melsom, and F. Moor. Electric fuses.
4 820 Callender's Cable and Construction Co., Ltd., and J. Urmston. Telephone repeater arrangements.
4 873 Drake and Gorham, Ltd., A. F. Harmer, and P. J. Pengelly. Electric switches.
4 839 Edison Swan Electric Co., Ltd., E. Greetham and G. F. Shotter. Protecting devices for electric circuits.
4 881 Electrical Research Products, Inc. Continuously loaded cables. (5/3/28, U.S.)
4 827 M. E. Elliott. Variable inductances, etc.
4 893, 4 894 O. Fulton. Transmission of pictures, etc.
4 789 T. C. Graham. Signalling arrangement for tramcars.
4 814 A. Graham and Co., Ltd., W. J. Rickets, and W. Stott. Microphones.
4 851 C. Lorenz Akt.-Ges. Apparatus for picture telegraphy. (15/2/28, Germany.)
4 849 J. M. MacLulick. Wireless receiving apparatus.
4 628 Marconi's Wireless Telegraph Co., Ltd. Coupling devices for thermionic valves. (13/2/28, U.S.)
4 842 G. S. Marston and J. G. Statter. Electric switches.
4 860 E. G. Pynt. Electric motors.
4 869 E. G. Pynf. Device for controlling motors.
4 890 Schiele and Bruchsales-Industrie A.-G. Testing excess current releasing devices, etc. (13/2/28, Germany.)
4 877 Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories, Inc.) Radio antennæ.
4 809 Swiss Locomotive and Machine Works. Control of electrically driven compressors. (18/2/28, Germany.)
4 864 Telefunken Ges. fur Drahtlose Telegraphie. Aerial systems. (24/2/28, Germany.)
4 865 Telefunken Ges. fur Drahtlose Telegraphie. Thermionic valves. (3/3/28, Germany.)
4 866, 4 867 Telefunken Ges. fur Drahtlose Telegraphie. Aerial systems. (3/3/28, Germany.)

COMING EVENTS.

Friday, April 12th.

Royal Society of Arts.—John Street, Adelphi, London. Lecture by Mr. A. T. Cooper on "Recent Electrical Developments in India." 4.30 *p.m.*

Saturday, April 13th.

Association of Mining Electrical Engineers (Western Sub-Branch).—Swansea. Annual dinner.

Institution of Electrical Engineers (South Midland Students' Section).—Afternoon visit to Messrs. General Electric Co., Witton.

Monday, April 15th.

Institution of Electrical Engineers.—Savoy Place, Victoria Embankment, London. Informal meeting. Discussion on "Power Supply and Railway Electrical Signalling." (To be opened by Mr. M. G. Tweedie.) 7 *p.m.*

Institution of Electrical Engineers (Mersey and North Wales—Liverpool—Centre).—The University, Liverpool. Annual general meeting. Short papers by members. 7 *p.m.*

Institution of Electrical Engineers (South Midland Centre).—University, Edmund Street, Birmingham. Paper by Sir C. A. Parsons, F.R.S., and Mr. J. Rosen on "Direct Generation of Alternating Current at High Voltages." 7 *p.m.*

Tuesday, April 16th.

Electrical Association for Women.—Hotel Cecil, Strand, London. Conference, 11.15 *a.m.*; Luncheon, 1 *p.m.*; Ball, 9 *p.m.*

Institution of Electrical Engineers (London Students' Section).—Visit to the works of the British Electric Transformer Co., Ltd., Hayes, Middlesex. 2 *p.m.*

Institution of Electrical Engineers (North Midland Centre).—Hotel Metropole, King Street, Leeds. Annual general meeting. 7 *p.m.*

Institution of Electrical Engineers (Students' Section of the North-Western Centre).—Engineers' Club, Albert Square, Manchester. Annual general meeting. Paper by Mr. F. Roberts on "Errors in Current and Voltage Measurements at Radio Frequencies." 7.15 *p.m.*

Association of Supervising Electrical Engineers.—Junior Institution of Engineers, 39, Victoria Street, Westminster. Lecture by Mr. C. V. Hill on "Variable Speed A.C. Commutator Motors." 7.15 *p.m.*

Wednesday, April 17th.

Electrical Contractors' Association (Sussex Branch).—Midland Bank Chambers, Brighton. Ordinary meeting.

Institution of Electrical Engineers (Tees-Side Sub-Centre).—Cleveland Technical Institute, Middlesbrough. Annual general meeting. 7 *p.m.*

Institution of Electrical Engineers (Sheffield Sub-Centre).—Royal Victoria Hotel, Sheffield. Paper by Mr. F. H. Rosencrants on "Practice and Progress in Combustion of Coal as Applied to Steam Generation." 7.30 *p.m.*

Thursday, April 18th.

Institution of Electrical Engineers.—Institution, Savoy Place, Victoria Embankment, London. Paper by Mr. R. A. Chattock on "The Modern Use of Pulverised Fuel in Power Stations." 6 *p.m.*

Institution of Electrical Engineers (Irish Centre).—Physical Laboratory, Trinity College, Dublin. Paper by Mr. J. D. Ferguson on "Electric Time Signalling. 7.45 *p.m.*

Friday, April 19th.

Physical Society.—Imperial College of Science, Imperial Institute Road, South Kensington. Fourteenth Guthrie Lecture by Prof. P. W. Bridgman on "The Properties of the Elements Under High Pressures." 5 *p.m.*

Institution of Electrical Engineers (London Students' Section).—Institution, Savoy Place, Victoria Embankment, London. Address by Dr. A. H. Railing. 6.15 *p.m.*

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THE ELECTRICIAN

Established 1861. The Oldest Weekly Illustrated Journal of

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Bouverie House, 154, Fleet Street, London, E.C.4. Telegrams: "Benbrotric, Fleet, London."
Telephone: City 0244 (Ten lines).

[Closed on Saturdays in accordance with the "Five-Day Week" plan adopted by Benn Brothers, Ltd., and its associated organisations.]

No. 2655. [No. 16. Vol. CII.] **Friday, April 19, 1929.** Annual Subscription, 25s. Overseas, 30s.

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Current Topics.

The National Register.

WHILE there can be few within the electrical industry who are not aware of the existence of the National Register of Electrical Installation Contractors, the importance of the work which is being done by this voluntary body is not sufficiently widely appreciated. Its aims, it is true, have the official sanction of the I.E.E. and representative electrical trade associations, which are represented on the Registration Board, but those who do not come into actual contact with the evils which it is trying to remedy, lack the knowledge which would help them properly to assess the value of its work, and imbue them with a keen desire to give practical aid to the realisation of its ideals. Shoddy wiring is not only the concern of the reputable electrical installation contractor and of the supply authority, though they can best appreciate its menace. Sound electrical installation work in house and factory is of fundamental importance to the whole electrical industry. Upon such a foundation the industry can safely build progressive sales of energy-consuming devices; without it there can be no real advance. A body which can definitely improve the standard of electrical installation work is therefore to be encouraged. That the National Register has, in the five short years of its existence, definitely raised this standard is not to be denied. Vigorous denunciations of the "kerbstoner," and super-optimistic demands for compulsory registration of contractors, are all very well in their way. Much more practical and constructive is the scheme which has brought together, in the interests of good installation work, nearly 1 300 electrical installation contractors in all parts of the kingdom, all of them pledged to put in sound electrical installations. This fact alone would, we think, justify the existence of the National Register, for it has demonstrated that shoddy work is not, as some maintain, an essential to the making of a livelihood in the electrical contracting trade. It has also tended to raise the standard of work among many of the applicants for registration, and indirectly amongst those who have not yet applied. It has also given to contractors on the Register permission to use a badge which is intended to stand as a sort of hall-mark of good installation work.

Educative Publicity.

A HALL-MARK the existence and significance of which are unknown to the public is obviously of little use. How to make it useful has been a problem which has not been easy of solution. It would have been simplified if the registered contractors themselves had done more individually to draw the attention of their customers to this hall-mark; it would have cost nothing, and its cumulative effect would have been great. Many of the contractors, however, seemed to regard this work as a duty of the Register, overlooking the fact that its primary purpose is to act as a qualifying body and not as an agency for co-operative advertising. Progress was naturally impeded by such misunderstandings; but even if the wider sphere of activity had been fully acceptable to the Registration authority, little could have been done in the way of national publicity until such time as there was a fairly representative number of contractors enrolled on the Register.

Some six months ago, however, a stage of development had been reached which justified embarkation upon an educative publicity campaign. With but small financial resources at its disposal, and an enormous public to reach, the authority set itself a tremendous task, but, judging by what we have seen of the Press advertising, folders and other related campaign activities, its efforts have been very fruitful. The campaign has brought the existence of the Register to the knowledge of many thousands of people in all walks of life who had never heard of it before, and it has encouraged these people to think of better electrical installations. The Register has definitely taken its place among the established institutions of the electrical industry, and daily grows in influence. A contractor no longer needs to ponder whether or not registration will benefit him personally; a supply engineer, architect or builder rarely needs to know more about a contractor than that his name is, or is not, on the National Register. Such progress is really remarkable in a movement of such recent growth, and reflects very great credit on all concerned. Quite a number of reputable contractors are still among the ranks of the unregistered, but it is only a question of time before they realise that a contractor, in common with the rest of us, is judged by the company he keeps.

As every fresh admission to the National Register represents a further step in the direction of eliminating the curse

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of shoddy wiring, the next year or two should see a distinct improvement in this field.

Wiring Practice.

SUGGESTIONS that the National Register should draw up and enforce a wiring code have been resisted in the past, for the very good reason that, to compel the registered contractor to conform to standards considerably above present-day practice, would only serve to penalise him from a competitive point of view. In deciding what is good electrical workmanship, the authority has taken the basic principles laid down in the latest I.E.E. Wiring Regulations as a guide, but, as practice differs in various parts of the country, it has not felt justified in adopting them. While it is difficult to lay down hard and fast rules as to how installation work should be done, it is comparatively easy to say how it should not be done. Acting on this principle, the Registration Board, at Monday's meeting, sanctioned the issue to registered contractors of a list of faults in installation layout or workmanship which, if perpetrated by registered contractors, will be considered to furnish cause for removal from the Register. The application of these " don'ts " should lead to further improvement in the standard of wiring practice, and the list should prove an invaluable aid to the various Local Advisory Committees in adjudicating on the work of contractors in their own localities. Apart from its technical requirements, the document provides that contractors may be removed from the Register for the employment of inadequately paid labour, and the use of boys in unreasonable proportion to that of fully qualified wiremen. This is a point upon which many registered contractors have expressed very definite views in the past, and there is little doubt that this provision will accord with the desires of the whole body of reputable contractors. From the wireman's point of view it should also appeal to, and command increased support from, the E.T.U.

The Budget.

IT is impossible for the business man to look with enthusiasm upon a Budget which contemplates he continuance of Government expenditure at well over £800 000 000 and the maintenance of the standard rate of income tax at 4s. in the £. When he remembers the economic foundations of his own business he is amazed at the spectacle of a Chancellor of the Exchequer having to apologise to the House of Commons for venturing to mention the subject of economy. Still, things being as they are, Mr. CHURCHILL'S fifth and last Budget may be regarded as reasonably businesslike and sound. If the general trading community which is not obsessed by political programmes agrees, in present circumstances, to accept the position that no economies can be effected in Whitehall, and that it is the business of the State to provide a vast number of expensive benefits for all and sundry, then Mr. CHURCHILL may fairly be congratulated on his proposals for tax collection and remission. Even more important perhaps than his actual proposals was the doctrine which he inculcated on the essential soundness of the commercial and financial position of the country. It is absolutely certain, however, that British trade will never be restored to abounding health until there emerges a Minister with the courage to insist on national economy as the basis of sound finance. There are but few points in the Budget which have special application to the electrical industry. The further facilities for the development of rural telephones only touch the fringe of the enormous field open for intensive exploitation of the telephone service. The remission of the railway passenger duty, the capital value of which is given as £6 500 000, is conditional upon the use of the equivalent sum in the development and modernisation of railway transport. Certain activities are outlined, but the most important from the public point of view, the conversion of the remaining gas lighted stock, does not seem to be provided for. The electric vehicle receives no encouragement in the proposed new motor vehicle duties, for while the rates for electrics are unchanged a reduced rate of duty is given to non-electric vehicles. A curious point is involved in the proposal " to provide that for the purposes of the duties charged on mechanically propelled vehicles, a vehicle shall not be deemed to be an electrically-propelled vehicle unless the electrical motive power is derived either from a source external to the vehicle or from an electric storage battery which is not connected with any source of power when the vehicle is in motion." This can only be interpreted as excluding a petrol-electric vehicle from classification as an electric vehicle. Yet as recently as February 14th of this year the House of Lords allowed an appeal by Tilling Stevens Motors, Ltd., from a majority judgment of the Court of Appeal, and ruled that a vehicle propelled by electricity generated by an internal combustion engine on the vehicle is an electrically propelled vehicle within Clause 5 of the First Schedule of the Finance Act, 1926, and is, therefore, subject to a lower duty than a vehicle mechanically propelled otherwise than by electricity. It rather looks as if Mr. CHURCHILL'S scheme will have to be revised in this respect.

Our Overseas Trade.

THOUGH during March our exports and imports were lower in value than for the same month last year, exports improved by £2 958 382 on the February total, and imports by £7 243 986. The decline in last year's figures may be due in part to the fact that there were two fewer working days last month than in March of 1928, and to the fact that the Easter holidays invariably cause a slowing up of business far in excess of what should be occasioned by such a public holiday. Good Friday last year occurred during the first week in April, with the result that March trade was free from the holiday spirit which prevails at that time. This year the slowing up effect of the same holiday was felt not only in March, but it will also have some effect on this month's figures, and though our exports for the March quarter of this year show a decline of £769 065, when compared with the same quarter of last year, there is, nevertheless, an improvement on the same quarter of 1927, by £10 000 000. This general falling off of trade is also noticed in the electrical figures, details of which are abstracted elsewhere in this issue. Exports of electrical goods during March, 1929, were valued at £372 233 less than during the same month last year, while, for the first quarter, a similar comparison shows a decline of £324 460. Electrical imports during the same month and period increased by £56 527 and £110 160 respectively. Export items which contributed to the decline in values were chiefly railway, tramway, and other motors and generators, which, between them, accounted for £100 352, and submarine cables, with a decrease of £50 995. On the face of things, these figures are disappointing, but, when it is remembered that considerable sales in electrical machinery and cables were made to the Central Electricity Board during the month under review, the outlook is less unsatisfactory. The contracts to which we refer have nothing to do with overseas trade, but it is, notwithstanding this fact, interesting to realise that the Central Board last month placed in this country contracts valued at no less than £4 750 000.

Assisting Radio Sales.

A DISTINCT fillip to the sales of portable wireless receiving sets will probably result from the Postmaster-General's decision that in future a wireless reception licence shall cover, in addition to a home set, the use of one portable set at any place in Great Britain or Northern Ireland. While in many cases this concession seems already to have been assumed, the bestowal of legal sanction may suggest to many listeners the advantages of having portable as well as fixed receiving equipment. It may, however, be unwise to depend too strongly on the hope that a large percentage of licensees will in future maintain both fixed and portable equipment, for many listeners are finding that portability is a quality as useful in the home as it is outside, and therefore buy one portable set for all purposes.

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HIGH-VOLTAGE BUSHINGS.

Fundamentals in Electro-Statics—Faraday Tubes—Dielectric Refraction and the Design of Rainsheds—Geometric Capacity of Two Coaxial Cylinders.

By W. H. THOMPSON, A.M.I.E.E.

TO bring a conductor at high potential through an earthed plate is a problem in electro-statics, and one which to the present day has proved very difficult of satisfactory solution. Before proceeding further, it may be helpful to recapitulate a few of the fundamentals of electro-statics.

In virtue of its capacity, it is not possible for a conductor to be at a high potential—or any potential, for that matter—without carrying a charge. A charge immediately infers lines of force, and lines of force—or, better still, tubes of force—are the conception of Faraday to explain the action of force across space. They are consequently known as Faraday tubes, and have the property that their density over a given area is proportional to the intensity across that area. In other words, the intensity varies inversely as the cross section of the tube. Again, every Faraday tube takes its origin from a unit positive charge and ends on a unit negative one. Furthermore, the total charge on a conductor is represented numerically by the excess of the number of Faraday tubes that leave the conductor over the number that arrive on it; or vice versa. This is called the polarisation, and constitutes the mathematical equivalent of Maxwell's dielectric displacement.

The tubes exist in a state of tension, and lateral repulsion. The magnitude of the former is a variable quantity, which follows from the definition given above, since this tension varies directly as the density.

Such a system of tubes of force will represent energy, which proves that the energy that results from a charged conductor

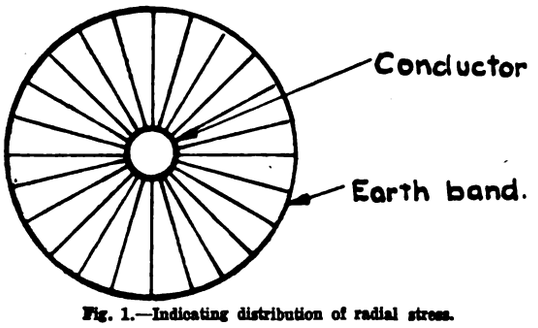

Fig. 1.—Indicating distribution of radial stress.

resides, not on the conductor, but in the surrounding dielectric medium.

The energy of a unit length of Faraday tube is equal, numerically, to the tension that exists along that unit length; or, again, to half the intensity of that unit length. Thus, it is well known that, if e equals the charge, and $V_1 - V_2$, the potential difference, the energy will be equal to

$$\tfrac{1}{2}\, e\, (V_1 - V_2)$$

From which, if e is unity—as it is for a Faraday tube, then the energy equals $\frac{1}{2}\,(V_1 - V_2)$; that is, to half the intensity.

Displacement Current.

An increase in the potential of the conductor must be accompanied by an increase in the charge on it, since $Q = CV$. Also, it is proved by Maxwell* that the charge resides on the surface of the conductor; therefore, an increase in the charge will result in a movement of the electricity outwards from the conductor. This is called a displacement current, and is equal to the intensity times $\frac{1}{4\pi}$ for air; or to the intensity times $\frac{K}{4\pi}$ for a dielectric with constant K.

According to the "Electron theory," a displacement current is the straining of the negative electrons from their central positive nuclei.

If the influential potential is positive, the electrons will be drawn towards the positive charge on the conductor surface, while the nuclei will be repelled from it. The extent of the resulting strain will depend upon the magnitude of the charge. There is a value of the potential at which this strain will become a maximum, and an increase on this will force the electrons and nuclei asunder, with the resulting development of heat, light, and the passage of a spark. Thus the dielectric medium is broken down.

* "Electricity and Magnetism," Clerk Maxwell.

It is to be remembered that in practically all dielectrics there will be a small conduction current due to the presence of a number of free electrons.

The tubes of force must leave the conductor normal to the surface, since the surface is necessarily an equipotential one. They will, therefore, endeavour to distribute themselves in accordance with the shape of the conductor. Thus, for parallel plates they will be parallel, while for a sphere they will radiate from a centre, and so on.

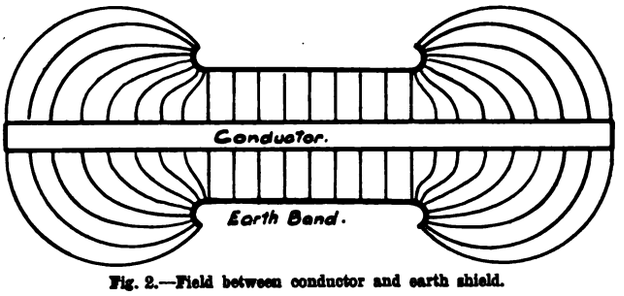

Fig. 2.—Field between conductor and earth shield.

As each tube of force represents a tension depending upon the density, the electrical stress which obtains through a medium will be governed by the number of such tubes that cross unit area, or on the flux density.

It is found experimentally that with air at 15° C. and under a pressure of 760 m/m, the maximum electrical stress it can withstand is equal to $10^4/8\pi$ dynes per sq. cm. This corresponds to a static flux density of $10^2/4\pi$ lines (or tubes) per sq. cm., which represents a tension in the tube of force of 50 dynes.

A density or tension above these respective magnitudes will result in the breakdown of the air.

Potential Intensity.

Coulomb's law states that, in air, the potential intensity is equal to 4π times the surface density of the charge, and from this it is easy to deduce that the intensity, or potential gradient, at any point in the air field is equal to 4π times the flux density at the point considered, or to $4\pi/K$ times the density for a dielectric that has a constant K. From this it follows that the potential intensity corresponding to a flux density of $10^2/4\pi$ lines per sq. cm. in air, is equal to 100 electrostatic units of potential. Or, stated in commercial units, the critical potential gradient for air under standard conditions, as stated above, is 30 000 volts per cm.

It will also be understood from above that the displacement current which flows through a dielectric as a result of an increase in the potential, is numerically equal to the number of Faraday tubes per unit area, or, to what is the same thing, the surface density of the charge.

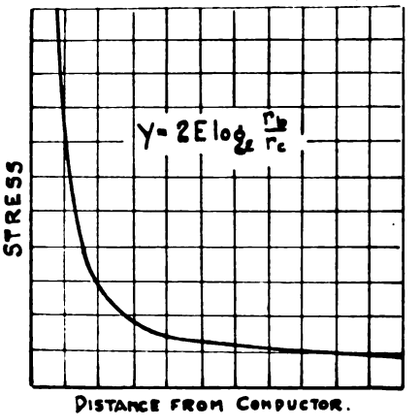

Fig. 3.—Stress near conductor.

It will again be understood from all this, that there is a real movement of electricity through the dielectric surrounding a conductor, whenever there is a variation of the potential of that conductor. Furthermore, a displacement current of this nature has all the characteristics of a conduction current.

It will also be appreciated that a conduction current is accompanied by a lateral movement of the Faraday tubes along the conductor, with the relationship that the magnetic field force is equal to $4\pi NV$; where N equals the electrostatic polarisation, and V equals the velocity of light.

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Again, it is to be remembered that these lines of force are subject to refraction when they pass from one medium to another, provided they are not incident normally to the plane of separation of the media. The law of this dielectric refraction can easily be proved to be :

$$\frac{K_1}{K_2} = \frac{\text{Tan } \theta_1}{\text{Tan } \theta_2}$$

where K_1 and K_2 are the permittivities of the media, and θ_1 and θ_2 the angles of incidence of the tangents to the lines of force at the surface of separation.

Important Refraction.

This refraction is important in the design of the rain sheds of all kinds of bushings, and it should not be ignored when considering the baffle tubes of the oil-filled bushing or the dielectric layers of the condenser type.

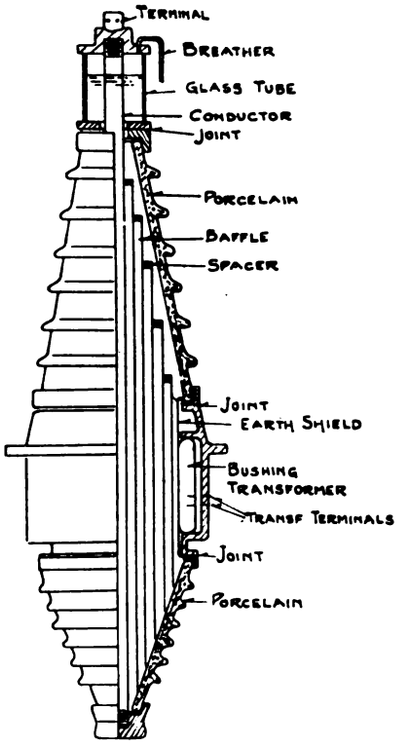

Fig. 4.—Arrangement of oil-filled bushing.

Before proceeding to the more detailed study of the two types of bushings, it may be advisable to consider the question of the geometric capacity of two coaxial cylinders, since all bushings conform to a condenser of that order. In any standard treatise on the subject the proof will be found that this capacity is equal to $\frac{1}{2 \log \varepsilon \frac{a}{b}}$; where "a" is the radius of the inner surface of the outer cylinder, and "b" the radius of the outer surface of the inner cylinder. In practical units the same capacity is given as $\frac{10^9}{2 \log \varepsilon \frac{a}{b} V^2}$ farads.

The additional factors—of which V is the velocity of light—being due to unit constants.

Distribution of the Flux.

If, then, a conductor at high potential be brought through an earthed plate, and the intervening dielectric be only air, the distribution of the flux will be something like that shown in Figs. 1 and 2. From these figures it will be observed that there is a much higher flux density at the ends of the earth band than on the surface of the conductor. Also, within the body of the earth band the flux density is less at the band than at the conductor surface. Altogether, the flux distribution is very unequal.

The earth band, and that portion of the conductor which passes through it, form the equivalent of two coaxial cylinders ; so that the capacity between them is $\frac{1}{2 \log \varepsilon r_b/r_c}$; where r_b is the radius of the earth band, and r_c the radius of the conductor. Consequently, if E is the charge on the conductor per unit length, the potential distribution will be $2E \log \varepsilon r_b/r_c$. This is the equation to the curve in Fig. 3 ; from which it will be seen that the potential gradient is much steeper near the conductor than farther away.

It is this inequality in the potential stress that creates the difficulty in practice, and it should be clear that anything that can be done to control the paths of the flux lines to make them tend to conform to the parallel arrangement will be a definite gain to equalising the stress in the dielectric field.

At the present time there are several types of high voltage bushing terminals. The two most important are the Oil-Filled and the " Condenser " types. These will now be considered.

Oil-Filled Bushings.

This bushing makes no attempt to control the static flux. It accepts the field formation as it is, and depends for its success upon the insulating quality of its oil dielectric to withstand the unequal strain set up within it. In practice, there is much to be said in favour of this, however weak it may seem from a scientific viewpoint.

Such a bushing consists generally of a central conductor passing through an oil-filled space which is bounded by a porcelain shell. If the bushing is designed for oil immersion at one end and the air at the other, the earth band will be fixed about one-third the way up from the oil end—since the flash-over in oil is roughly three times that in air. In the highest voltage ranges, there will be inserted cylinders of insulating material, concentric with the conductor and graduated in length. See Fig. 4.

It is sometimes claimed that the introduction of these insulated cylinders or baffles renders this type of bushing comparable to the condenser type. This is hardly true. Certainly the baffle tubes will have an effect on the distribution of the flux.

For instance, if the material of the baffle has a higher capacity constant than that for the oil, there will be a deflection of the lines, as a result of their crowding into the higher permittivity field. This will cause an increase of the flux density in the oil adjacent to the baffle tube, and precaution must be taken to deal with the risk of corona formation or breakdown will occur.

Purpose of Baffle Tube.

The main purpose of the baffle tube is much the same as that of the tank lining in an oil circuit breaker. It prevents particles of foreign matter, which accumulate in the oil, forming themselves, under the influence of the field force, into a continuous chain between the conductor and the earth band, thus providing a low resistance path to earth.

It is, of course, possible to obtain insulation tubes which will have a capacity constant the same as that for a given oil, and the employment of such tubes will achieve the above results with the additional advantage of leaving the static field undisturbed.

This is an advantage, since local flux concentration, from whatever cause, and in either oil-filled or condenser bushings, can be the cause of considerable trouble.

It is shown by Peek,* that for dielectrics in series, such as is formed by the introduction of insulating cylinders in an oil-filled bushing, the resulting potential gradients across the various dielectrics is given by the formula :

$$G_x = \frac{e}{K_x\left(\frac{x_1}{K_1} + \frac{x_2}{K_2} + \ldots + \frac{x_x}{K_x} + \ldots + \frac{x_n}{K_n}\right)}$$

G_x being the gradient at any point x ; e the applied voltage, and K the permittivity. This, however, assumes parallel flux distribution, which does not occur in the oil-filled bushing, except for the length of the earth ring between this ring and the conductor. The remaining portion of the field is formed of curved lines which suffer refraction for those that strike the insulating tubes, and distortion for those that pass near to the edges of the tubes.

(To be continued).

* " Dielectric Phenomena." F. W. Peek, Junr.

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BOOK REVIEWS.

Electric Wiring: A Handbook for the Use of Wiremen and Students. By W. C. CLINTON and E. H. FREEMAN. (London: John Murray). Pp. 260. 4s. 6d. net.

The fact that this primer has gone through three editions since the War, and that it is now in its eighth edition, testifies to the regard in which the work is held. The present edition represents a thorough revision and considerable enlargement of the seventh edition. In view of the increasing use of alternating current, the addition of chapters dealing in an elementary way with these developments is a desirable new feature, as is the new matter descriptive of the planning of complete installations. One notes also the extension of the worked examples, most of which are taken from papers set in the City and Guilds examinations. Those who share the authors' view that the usual continuity test of a conduit system, i.e., the ringing of a bell through the tubing with an ordinary dry cell, is not sufficiently reliable or definite, will find interest in the method used by the authors, who insist that a current of 5A shall be passed with a 4 V accumulator for each 1 000 ft. run of tube. A properly installed tubing system should pass this test without difficulty. In the interests of historical accuracy, it is a pity that on page 132, the authors should have fallen into the misapprehension that the first incandescent lamp filaments were of platinum. Actually, carbon was the first commercial filament, being incorporated in the earliest of lamps produced by the late Sir Joseph Swan.

L. H. C.

Automobile and Radio Batteries. By H. H. U. CROSS. A practical manual on the Construction, Charging, Maintenance and Repair of Automobile, Motor Cycle, and Radio Batteries: "Dry," Lead and Alkaline Types. (London: Crosby Lockwood and Son.) Pp. vii+128. 3s. 6d. net.

This little book by Mr. Cross is a welcome change from the style of most practical manuals, since it combines a measure of very clearly stated scientific information with a still larger measure of information based on practical observation, experiment, and proof.

Chapter one deals with dry cells, stressing particularly the factors which affect performance, and giving useful data on the measured output of some well known types. A useful dodge for recuperating flash-lamp cells is mentioned.

The general chemistry and construction of the lead cell are next described, followed by a careful review of available methods of charging. No doubt in future editions Mr. Cross will describe some of the modern rectifiers which have come into such wide use for this duty. True, the rectifier is mentioned, but recent advances of valve type units and the Westinghouse copper-oxide film apparatus are of great interest in this connection. There is a printer's error in describing the Nodon valve as Nocton.

Repair and upkeep are given due attention in Chapter IV, which is very clear and practical. There follows a *résumé* of the alkaline cell, both Edison and Nife (Jungner) types being clearly explained. A useful summary of the chemistry of the alkaline cell cycle on charge and discharge is also given. Mention is made of the utility of scrap Edison cell plates to supply the components for alkaline h.t. cells. This is a little known but most valuable type of h.t. unit, immune from most of the defects of the normal h.t. cell.

The remainder of the volume deals with accumulators from the service station standpoint. The illustrations are in the main very clear, and this little volume may be thoroughly recommended as an excellent example of compressed technology without too much "ology."

R. J. M.

Ultra-Violet Radiation and Actinotherapy. By E. H. RUSSELL and W. K. RUSSELL. (Edinburgh: E. and S. Livingstone.) Pp. 648. 21s. net.

The idea of obtaining artificially the beneficial effects of natural sunlight in a clime in which there seems to have been a considerable deficiency of late, has so taken hold of the public mind that the interest in and demand for ultra-violet ray apparatus has developed before its time, as scientific workers specialising in this field are only beginning to find out the real effects of irradiation on human bodies under various conditions. In this book Dr. Eleanor Russell and her husband, Dr. W. Keir Russell, whose work at the Sun-Ray Clinic at Newcastle-on-Tyne is well known, give a great deal of valuable information regarding the diseases in which irradiation has proved beneficial and the methods of application. From the non-medical standpoint, however, the chief practical interest of the work lies in the authors' personal experience with a large number of different models of ultra-violet lamps. Feeling it unwise to limit their interest in one type of lamp, they have described every well-known type of arc lamp and mercury vapour lamp, most of the appliances being illustrated. They have found many different types of lamp generally satisfactory, and the air-cooled mercury vapour lamp particularly so. The difficulty, they state, is not any inability to get sufficient ultra-violet radiation, but trouble in gauging the precise amount required by the patient; a fine tribute, this, to the perfection of the apparatus used.

Although, as members of the medical profession the authors might be thought to hold a biassed view, they are supremely right in stressing the importance that this valuable remedial agent shall not be carelessly allowed to pass wholly into unqualified hands. Even with the types of domestic equipment in which a time switch gives only measured doses of irradiation, there is, of course, nothing to prevent the user from taking another dose. In any case a harmless dose for one person may have unfortunate effects upon another.

There is no doubt that ultra-violet ray treatment, at present in its infancy, will increasingly take the place of medical treatment of many diseases, besides establishing a new and ideal form of procedure—preventive, rather than curative treatment. At no very distant date "sun-ray" lamps will have to be installed in all hospitals, especially those for diseases of the skin, throat, nose and ear, and eye. Ante-natal clinics, tuberculosis clinics and sanatoria, and mental hospitals will also require ultra-violet equipment. In surgical practice the value of ultra-violet radiation, as yet only rarely acknowledged, is bound to come into prominence when the results of the pioneer work at the Neckey Hospital in Paris are more widely known. Well printed on good paper, the book is very completely illustrated.

C. G. B.

Electric Lighting and Heating. By F. H. TAYLOR. (London: Chapman and Hall). Pp. ix+149. 7s. 6d. net.

Mr. Taylor's new book on electrical installation work claims to deal with practical applications, and definitely disclaims any attempt to explain the theory of electric currents, and whilst this treatment certainly simplifies the study of the subject it is doubtful whether some elementary explanations of electrical phenomena would not have increased the value of the work.

There is not much that is novel in the views put forward by Mr. Taylor, although there will probably be many who will not agree with all his views, as, for example, that the use of metal conduit must be avoided where "certain plasters and patent floorings" are in use. The chemical action on the tube in such cases is very temporary, and it is in practice impossible to avoid using tubes in such cases. A coat of paint in any event will give all the protection necessary.

Mr. Taylor's comments on the necessity for effective earthing, and on the desirability of some more reliable test than the ordinary bell and battery are very sound, but it would have been to the good had he further insisted on a similar test for the effective continuity and conductivity of the actual tubing.

The book covers the subject very completely, and deals with practically all aspects of the actual installation work, but some remarks on the apparatus to be connected to the installation when complete would have added to the value of the book.

The illustrations which form so prominent a feature of the book (perhaps too prominent, in that they occupy an undue proportion of the space) deserve a special word of praise, as they are excellently prepared and printed.

Books Received.

"The Engineer" Directory and Buyers' Guide, 1929. (London: "The Engineer.") Pp. 256.

"Low-temperature Carbonization Explained." By Murray Stuart. (London: Mining Publications, Ltd.). Pp. 56. 4s. net.

"Practical Geometry and Engineering Graphics." By W. Abbott. (London: Blackie and Son.) Pp. 304. 10s. net.

"Railway Electrification and Traffic Problems." By Philip Burtt. (London: Sir Isaac Pitman and Sons.) Pp. xvi+197. 10s. 6d. net.

"Science Abstracts." Secs. A and B. Vol. 32. No. 374. February 25th. Issued by the Institution of Electrical Engineers. (London: E. and F. N. Spon.) Single numbers, 3s.; annual subscription, 30s., or 50s. for both sections.

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AN INVESTIGATION OF SHORT WAVES.*

Scattering, Multiple Signals and Signal Mutilation—Results of D.F. Interception of Short Wave Commercial Stations—The Nature of "Skip Effects."

By T. L. ECKERSLEY, B.A., B.Sc.

THE paper contains a summary of investigations of short-wave transmission extending over the past two years. The greater part of the paper is devoted to a discussion of scattering, multiple signals and signal mutilation, following which the results of a nine months' direction-finding interception of short-wave commercial stations are given. Finally there is a general discussion of short-wave transmission and of the nature and constitution of the Heaviside layer, fading, polarisation effects, etc.

Echo and Scattering Effects.

Interest in short-wave transmission, from a technical standpoint, lies chiefly in echo and scattering effects. Signal distortion, accompanying echoes and scattering, imposes a severe limitation on high-speed sending. The time-lag of echoes and multiple signals may range from 0·001 to 25 secs., but it is mainly the short echoes up to 0·1 sec. which are associated with scattering. The author has previously given reasons for believing that considerable short-wave scattering exists, and this suggestion has since been verified. A balahcing test, utilising two vertical aerials set up in turn at 13 m. and 30 m. apart is described. The receiver was set up at Broomfield, near Chelmsford. Signals from local stations could be balanced almost perfectly, but those from stations within the "skip distance" (e.g., Bodmin, Grimsby and some Dutch stations) could not be balanced with any arrangement of the circuits. Long distance stations such as those in Canada, Australia, India, S. Africa and N. America, presented intermediate conditions.

Results indicate that close to the transmitting station the direct ray is predominant, but it is attenuated quickly, and at distances of a few miles is swamped by radiation scattered from the Heaviside layer, or from irregular objects on the ground or other causes. The scattered signal or "echo signal" travels by a different path from the direct signal, and there will be a time interval between the two.

Success with the two aerial system led to the development of a direction-finding apparatus, and the author describes this arrangment, which is known as the Adcock aerial. Results obtained with this apparatus are described in detail, and various experiments on scattering effects are discussed. One interesting conclusion is that scattering seems to be mainly confined to the horizontal plane. The phenomena of multiple signals, long and short echoes and dispersion are also discussed. Other problems treated are the degree to which scattering involves attenuation, the influence of wavelength on scattering, and polarisation effects. These experiments led to the conclusion that signal mutilation may arise from the following causes :—

(1) *Long echo*, due to the signals arriving by the two different great-circle paths round the world, or by one traversing an extra complete circumference of the world. These effects are easily recognisable, but, taking due account of them, there are, no doubt, other causes of signal mutilation.

(2) *Dispersion*.—Any signal changes shape when travelling through a dispersion medium, such as the Heaviside layer. The amount of mutilation depends on the distance travelled and the closeness of approach of the actual frequency to the critical frequency. Reasons are given for supposing that this effect is negligible on the short-wave band, although there is evidence of dispersion effects on very long waves, *e.g.*, musical X's.

(3) *Quick Echo*.—There are cases of quick echo with a lag of the order of 0·01 sec., which are probably due to long-distance scattering such as is evidenced by the observations on the local beams, where the source of scattering may be about 2 000 km. away.

(4) *Blurring*, due to multiple scattering.—This probably occurs mostly on local signals.

(5) *Double signals or multiple signals*, due to double or multiple paths.—These produce double or multiple signals with a time interval between signals of the order of 0·01 sec. They are brought to light by the picture-transmission result. They are not likely to mutilate Morse signals, but effect picture transmission unfavourably.

The effects under these last three headings are likely to contribute to signal mutilation in different proportions, according to the actual conditions of transmission.

The next section of the paper is devoted to direction-finding results, which are analysed in considerable detail. Diagrams are presented for various stations showing the relation between time and bearing degrees, and a comprehensive table of bearings of distant stations is presented.

The phenomena of fading are discussed, and the effects of polarisation, interference, and spacing of aerials are considered. There appears to be a marked connection between attenuation and magnetic storms, and the author presents the results of a year's interceptions which illustrate this. Of the 27 occasions when the magnetic disturbance was greater than 1 508, fifteen were associated with "fades" in the transmission, but there were occasions when a magnetic storm was unaccompanied by a fade, or vice versa. One very marked case was on October 10th, 1928, when, at the Somerton station in England, all stations faded out within about 2 minutes. Similar effects were reported in Germany.

In the final portion of the paper the theory of the subject and the nature of "skip effects" are discussed on the basis of the new conception of the Heaviside layer as a complex structure of scattering clouds. The chief alteration in conclusions previously reached is in the estimated height of the lowest levels of the Heaviside layer in the daytime. The accumulation of evidence from the time-lag experiments of Breit and Tuve, and the interference experiments of Appleton and those of Hollingworth have led the author to a revision of the mathematical result by which he obtained, from long-wave measurement, the effective height of the daylight ionised layer. In doing so he has found an error which makes the estimated height just double that previously obtained, for instead of the relation $d_0=4h^2/\lambda$, we have $d_0=h^2/\lambda$, making the estimated height lie between 80 km. for summer and 97 to 100 km. for winter.

Previously the value of τ, the mean time between collisions, was found to lie between the limits $0{\cdot}5\times10^{-6}$ and $0{\cdot}5\times10^{-7}$ (on the basis of magnetic storm effects). Calculations based on the kinetic theory would imply a height of between 76 and 92 km. for these values of τ in fairly close agreement with the above, and there is no necessity to make the rather forced assumption previously made that the electronic mean free path was some 10 to 50 times greater than that calculated from the normal kinetic theory on the assumption that the electron may penetrate the outer rings of the molecules without being appreciably deflected. Apparently this effect occurs only in inert gases, such as helium, and is not likely to occur in the upper atmosphere.

A Progressive Change.

With regard to scattering, the glancing angle for transmission great-circle bearings of the main rays, and the daylight attenuation, the author has found the previous conclusions to be on the whole well-founded. Some modification of the lower wavelength limit for night transmission is required, and the author finds that this lower limit depends on the time of the night, and season. Late-night regions behave very differently from early-night regions, thus confirming Appleton's results showing a progressive change in the Heaviside layer during the hours of darkness. The short-wave daylight limit appears to be close to 10 m., but sporadic long-distance transmissions have been observed on wavelengths shorter than this.

* Abstract of a paper read before the Institution of Electrical Engineers on April 10th.

ELECTRICAL INSULATING PAPERS.

In view of the necessity for rigid condensation, the report of the I.E.E. paper by Messrs. T. N. Riley and T. R. Scott on "Electrical Insulating Papers for the Manufacture of Power Cables" (see THE ELECTRICIAN, April 12th, 1929, page 441) may in one or two places lead to misapprehension as to the authors' views, and readers interested in the subject should refer to the valuable technical data embodied in the original paper. Owing to a printer's error, the word "beating" (p. 442, col. 1, line 73) was given as "heating," and a paraphrase of a reference to a paper giving all-round satisfactory characteristics (p. 442, col. 2, line 21) might be regarded as a contradiction of the authors' main purpose, which was to emphasise the importance of structure rather than fibre base.

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THE NATIONAL REGISTER.

Encouraging Progress Reported at Annual Meeting of Registration Board—Useful Results from Propaganda Campaign—E.C.A. and Local Advisory Committee Representatives.

THE annual meeting of the National Register of Electrical Installation Contractors was held at the Institution of Electrical Engineers, London, on Monday, Mr. P. V. Hunter in the chair.

The fifth annual report of the Executive Committee for the year ending December 31st, 1928, which was presented to the meeting, states that the figures in the accounts relating to expenditure show a considerable increase on those of last year, but this mainly centres round the items advertising and publicity literature, printing and stationery, and rent.

Special Publicity Campaign.

Taking the Income and Expenditure Account first, the first figure on the Dr. side, " advertising and publicity literature," includes the expenditure of part of the allocated sum of £400 on advertisements in the electrical, architectural, building and municipal Press, the printing and circulation of the lists of registered contractors, reprints of the article by Mr. Harry Moss entitled " The Need for Compulsory Registration," the first issue of the pamphlet " Hidden Risks," the brown cards, and certain local lists of registered contractors. The item " printing and stationery, dies and stamps " shows an increase of nearly £140 accounted for by the printing of the amended rules, shorthand notes transcript and copies of the proceedings at the special meeting of the Registration Board with members of the Local Advisory Committees, and the shorthand notes transcript and copies of the proceedings at the conference between the Executive Committee and the Electrical Contractors' Association Council (referred to later), the provision of better folders for files for the records of applications for registration, and the provision of a larger and better stock of stationery necessitated by the increase in the office work of the Register. The item, rent, includes the payment of a quarter's rent in respect of the new office which is referred to later. The item, office and petty expenses, includes the purchase of further filing cabinets, the installation of fittings for lighting and heating the new office, and the purchase of furniture and effects for its equipment.

There are two further items, legal expenses and engineers' fees for inspection of work done by registered contractors, which have not before appeared in the accounts. The former was incurred in relation to proceedings for an injunction against a firm of contractors who had improperly used the device of the Register granted to their predecessor before their application for registration had been adjudicated upon by the Executive Committee, and who, unfortunately for the Register went into liquidation with assets insufficient to pay a dividend to creditors. The latter item was a payment in respect of the fees and expenses of a firm of consultants who were instructed to report upon work by a registered contractor, the subject of a complaint which is referred to later.

On the other side of the account the figures show increases which speak for themselves, and with the foregoing explanation the figures on the balance sheet will be better appreciated. The item, sundry creditors, in the balance sheet includes amounts due for payment but not paid at that date, all of which were paid in the subsequent month.

On the other side the first item stands as before. Investments include an additional £500 War Loan purchased, but on the other hand the former item, cash on deposit, disappears. The item, " expenditure on advertising campaign carried forward," is the proportion of the £400 allocated which has been paid, and covers advertisements up to October, 1929. With regard to the rent item, the restricted accommodation of the old office had become wholly inadequate for carrying on the increasing work of the National Register, and the secretary was fortunately under exceptional circumstances able to secure a much larger room on the ground floor in the same building. The rent was higher, and the term commenced three months prior to the expiration of the tenancy of the old office, but the Executive had no hesitation in taking advantage of the opportunity, and securing the better accommodation, installing electric fires and up-to-date lighting arrangements. The work of the office is now carried on under much improved conditions.

The report gives figures showing applications for registration, acceptances, withdrawals, etc., at various dates. These show that 257 applications were received in 1928, and the total applications to December 31st were 1 584, a figure which was further increased to 1 658 by April 5th, 1929.

Taking the December total of 1 584, a deduction of 434—leaving a net number on the Register of 1 150—is made for the following reasons: Applications declined, 180; applications withdrawn, 31. Registrations were cancelled as follows: At applicant's own request, 4; bad workmanship, 2; failure to substitute duly qualified managers, 8; death and closing down of business, 36; failure to renew registration, 43; bankruptcy, liquidation, deeds of arrangement and assignment, 35; temporary registration, 1. There are also included applications under investigation to the number of 94. By April 5th the numbers under investigation had been reduced to 75, and the net number on the Register was 1 202, exclusive of 55 branch registrations.

ASSISTED WIRING SCHEMES.—To those authorities who had already confined installation work on assisted wiring schemes to contractors on the National Register, the following names were added during the year: Birmingham, Leeds, Oldham and Plymouth. On the other hand, the South Shields Corporation, for reasons which, the report states, are difficult to appreciate, and which in any case do not reflect adversely on the conduct of the Register, rescinded a prior standing order which placed them in the same category.

PUBLICITY.—As before mentioned the Executive Committee allocated the sum of £400 to the purposes of propaganda. Under able advice the money so allocated has been, in the view of the Executive Committee, well expended and made to go a long way. A reprint of an article in THE ELECTRICIAN by Mr. Harry Moss (a registered contractor), entitled " The Need for Compulsory Registration," has been circulated to consultants, supply engineers, architects, builders, contractors and others, to the number of approximately 15 000. A pamphlet entitled " Hidden Risks " was also similarly issued, and became popular to the extent that contractors alone have applied for copies for distribution to the number of 100 000, and requests for supplies are being continuously received.

Full-page, half-page and quarter-page advertisements have been inserted at stated intervals in the whole of the electrical Press, in the "Architect and Building News," the "Architects' Journal," the " Builder," the " Municipal Journal," and many encouraging editorials and notices in those papers as well as in the daily Press have brought the National Register and its aims and objects to the notice of a wide public. A large number of inquiries of a varied nature showing interest in the Register have been received from all parts of the United Kingdom and abroad, including India, Australia, and the United States of America, showing that the work of the National Register has penetrated far and near. The carrying out of this publicity campaign has made very considerable demands on the energies of the very limited staff of the Register, and the Executive Committee take this opportunity of acknowledging the services given, the extent of which it is not easy to appreciate.

Joint Meeting with E.C.A.

It is recalled that at the last annual meeting the subject of the Standing Order of March 14th, 1924, relating to the constitution of Local Advisory Committees was discussed, and a proposal put forward, to amend such Standing Order, so as to ensure that the representatives of the Electrical Contractors' Association on such Committees should be on the Register. The outcome of discussion on this proposal was a resolution " that the Executive Committee be given full power and authority in the name of the Registration Board to vary the Standing Order either in terms of the draft submitted, or in such other manner as they should think fit after they had obtained the views of the Electrical Contractors' Association on the subject, and that to this extent the present Standing Order of the Registration Board be suspended." The Electrical Contractors' Association representatives present promised that the subject should be discussed at the next Council Meeting of the E.C.A. and a joint meeting of the Executives arranged for the purpose of coming to agreement on the matter.

Owing to various causes this joint meeting of the Executive Committee and the Council of the Electrical Contractors' Association was not held until December 7th last. At this meeting the subject of Local Advisory Committee representatives and other matters were freely discussed and misunderstanding removed. The Executive ventures to say that such

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discussion disclosed the fact that its attitude had not been properly appreciated, and it is now clear that in the main the ideals of both bodies are common, although there must be differences in procedure.

With regard to Electrical Contractors' Association representatives on Local Advisory Committees, the following resolution was unanimously passed: "In nominating representatives on Local Advisory Committees the Electrical Contractors' Association will, where they are unable to nominate a registered Contractor, nominate a representative who will apply for admission to the Register, and who is not admitted to the Register within twelve months will be ineligible as such representative, and the Electrical Contractors' Association will forthwith proceed to make another nomination in conformity with this resolution." Discussion also took place as to the construction of certain of the Rules and Conditions of registration, at the conclusion of which it was agreed that the Electrical Contractors' Association would submit their suggestions in writing. Some time prior to this meeting the Executive Committee unanimously passed and forwarded a resolution inviting the President of the Electrical Contractors' Association for the time being to attend their meetings, so that they might know at first hand the difficulties that the Executive had to contend with, and better appreciate the conduct of the National Register's affairs.

The Executive Committee is happy to draw attention to the fact that it is receiving considerable help and encouragement from the Press, and the destructive criticism to which attention was drawn in the last report has given place to a constructive attitude, which is much appreciated, and greatly assists the Register's efforts to carry out the objects for which it was formed.

Wiring Rules.

The adoption of Wiring Regulations has been a constant subject of consideration and discussion, but the Executive Committee is still of opinion that the time has not yet arrived for making compulsory a set of such regulations. Recent events have, however, proved the necessity of some provision being made for bringing under the ban of the National Register certain unsatisfactory features in installation work, and Mr. Cash, at the request of the Committee, prepared a list of examples of faulty wiring work which it is recommended shall be the basis of a Regulation or Standing Order, and the employment by a contractor of such methods will be deemed to come within the causes detailed in Rule 10 (b) (c) and (d) and be cogent reasons for the exercise by the Executive Committee of the disciplinary powers conferred on them by such Rule. A draft of the proposed regulation has been circulated, and the Executive Committee invites the Registration Board's approval and adoption. It is felt that this regulation will be a real help to Local Advisory Committees in making reports and recommendations, and, as a copy will be sent to every contractor on the Register, it must act as a deterrent to any who carry out work on the lines condemned.

In this connection, the Executive Committee desires to state that recently a report from a certain Local Advisory Committee on an application for registration disclosed such a difference of opinion on the part of the members of that Committee as to their views and recommendation that it was necessary for a member of the Executive Committee to interview both the Committee and the applicants. Mr. Cash was good enough to undertake this duty, and made two special journeys to the town in question and interviewed the Local Advisory Committee and also inspected several wiring jobs carried out by the applicants. In the course of his inspections and investigations it appeared to be a practice in the locality to carry out wiring work in a manner that conflicted with the proposed regulation. As a result of these investigations the applicants were required, as a condition precedent to acceptance of their application for registration, to alter the installations in question, and to undertake to avoid repetition of such methods in the future. A greater result arises out of these investigations, viz., that in the area in question similar methods are henceforth banned, not only to Registered Contractors, but generally; as the attention of the supply authority and those who have the placing of orders has been drawn to such work on the part of any contractor, registered or not. The Executive Committee feels that it can claim this as a considerable step in the direction of achieving one of the objects of the constitution of the National Register, viz., the improvement and standardisation of electrical installation work.

Local Advisory Committees.—The seventeen London area Committees referred to in the last report have practically been filled and are now operating, and the lists of installation contractors within those areas are now in their hands for report on renewal of certificates. With one or two exceptions, the work of all Local Advisory Committees has proceeded smoothly and with reasonable despatch, and the Executive Committee again wishes to tender its great appreciation of the time and trouble expended by the various members of such Local Advisory Committees, as well as of the many helpful suggestions received from them. To those supply engineers on such Committees who have so strenuously supported, and are supporting, the National Register special recognition is due.

Scrutinising Committee.—The services of the two members of this Committee, Messrs. Cash and Purse, have as usual been ungrudgingly given, and without stint. The Executive Committee appreciates those services to the full, and expresses its grateful thanks.

Complaints Against Registered Contractors.

Complaints of bad workmanship against two firms were lodged during the year. In one case a member of the Association of Consulting Engineers was instructed to investigate and report, and his report fully substantiated the complaint made. The contractors concerned appeared before the Executive Committee, and their explanation was considered so inadequate that their certificate of registration was cancelled, and their name deleted from the Register.

In the other case the complaint was admitted, but the explanations tendered satisfied the Executive Committee that there were extenuating circumstances which justified them in taking less severe measures, and as a condition of remaining on the National Register the contractor was required to make good at his own expense the inadequate work which formed the subject of complaint, and also any other similar work carried out by him, and to give a satisfactory undertaking in respect of all future work.

Complaint was made against another Registered Contractor for employing an undue proportion of boy labour and the payment of inadequate wages. This contractor appeared before the Executive Committee and verbally agreed to increase such wages to a satisfactory rate. He subsequently, however, declined to carry out this undertaking, and his application for the renewal of his certificate was declined, his certificate cancelled, and his name removed from the Register.

Certain general complaints were also made against other firms, but as the secretary was unable to obtain any corroborating particulars from the complainants it was not possible to pursue them further.

Nominations to the Registration Board.—The I.M.E.A. nominated Mr. W. A. Walker as their representative in the place of Mr. C. H. Smyth who resigned, the E.C.A. of Scotland have nominated their President, Mr. J. Johnston Foggo, in place of Mr. Ure, their retiring President, and the remaining nominating bodies have nominated their retiring representatives to continue their representation on the Registration Board.

Secretaryship.—The Committee has to report that it has received an intimation from the secretary that, as the National Register now appears to be on a firm basis, he cannot continue to devote the large amount of time and attention he has hitherto given to the duties of that office, and asks for some arrangement to be made, as soon as convenient, to relieve him as far as possible. The Executive has the subject under consideration, and asks for authority to make such arrangements as seem right and proper.

Chairman.—The executive Committee again places on record its thanks to Mr. P. V. Hunter, the chairman, for his able conduct of their proceedings during the year under review.

Scottish Contractors' Views.

In the discussion of points on the agenda, Mr. R. A. Ure said that the registered contractors in Scotland would like to know if something could be done to establish some sort of local committee to make known to the Scottish people that there was such a thing as a Register of Electrical Contractors. Mr. P. V. Hunter replied that the Executive Committee would consider the proposal at its next meeting.

Mr. W. R. Rawlings, hon. treasurer, in seconding the adoption of the report of the Executive Committee—moved by Mr. Hunter—referred to the accounts, and said they were increasing their assets each year and also their expenditure; two points which were both desirable. Their investments were all in good securities, and were bringing in increased dividends each year. The resolution was carried unanimously.

The Secretary (Mr. T. Trimnell) announced that the

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following members of the Registration Board had been re-nominated: Messrs. G. Archer (Electric Supply Association of Ireland), A. G. Bruty (I.E.E. Irish Centre), H. R. H. Burstall (Association of Consulting Engineers), H. J. Cash (E.C.A.), J. S. Dow (Illuminating Engineering Society), A. E. Iliffe (B.E.A.M.A.), W. R. Rawlings (I.E.E.), and W. A. Walker (I.M.E.A.). New nominations were: Messrs. J. Johnston Foggo (E.C.A., Scotland), and D. Foster (E.W.F.). The whole of these nominations were accepted and confirmed.

Mr. F. W. PURSE proposed, and Mr. W. A. SHAW seconded, the re-election of Mr. P. V. Hunter as chairman, and the proposal was carried with acclamation.

Mr. W. R. RAWLINGS next moved, and Mr. R. A. URE seconded, the re-election of Mr. A. H. Dykes as vice-chairman, and this also was carried unanimously.

Mr. Trimnell then read a draft of a standing order which it was proposed to send out for the information of registered contractors and local advisory committees, and which read as follows: "*Re* National Registration Rule No. 10 (Removal of Names from Register) sub-sections (b), (c) and (d).—The Registration Board having through its Executive Committee from time to time been compelled to take disciplinary action in the cases of certain registered contractors, whose workmanship has not been found satisfactory, considers it advisable to inform all those whose names appear on the Register that any of the following faults in layout or workmanship will render the responsible contractor liable, at the discretion of the Executive Committee (subject to the right of appeal to the Board), to have his name struck off the Register. (1) Serious and inexcusable over rating of mains, submains, or subcircuits and all controlling apparatus connected therewith. (See I.E.E. Wiring Regulations 74 and 95.) (2) Inadequate methods of ensuring the electrical and mechanical continuity of metal-sheathed cables and conduit systems and lack of permanent earthing connections for such metal coverings. (See I.E.E. Regulations 87 and 96 to 103.) (3) Leaving the ends of tubes at switch points, lighting points, or distribution boards without suitable bushing by protective nipples or by a suitable outlet-box, or wood block. (Note.—Cutting a block over conduit in a manner which does not bush the end of the tube is a breach of this requirement.) (4) On concealed tube systems failure to provide a suitable outlet which will protect the wire right up to the surface of wall or ceiling; or, alternatively, failure to bring the tube through to surface of wall or ceiling. (5) In the case of metal-sheathed, tough rubber sheathed and similar cables, failure to bring the whole of the protective covering through to the surface of wall or ceiling. (6) Failure to keep clear of used or disused gas pipes in such a manner that they cannot be brought into accidental contact with the wiring or its conduits. (7) The insertion of more wires in a conduit than will allow of at least one more wire of the same size as the largest already in the conduit, being easily pushed in for a distance of 6 in. (Note.—I.E.E Table XII. is the best guide as to the capacity of the conduits.) (8) The absence of reasonable precautions to safeguard against risks of fire and shock. (9) The employment of inadequately paid labour and the use of boys in unreasonable proportion to that of fully qualified wiremen. NOTE.—As a guide, registered contractors are expected to follow generally the basic principles laid down in the I.E.E. Wiring Regulations (current edition), and all registered contractors are expected to make themselves conversant with those regulations which apply to the work on which they are engaged. Where specific regulations are referred to in paragraphs 1 and 2 above, they will be found to make clear in detail arrangements which should be adopted for the purpose of avoiding the faults enumerated."

Mr. TRIMNELL also read a letter from Mr. J. Johnston Foggo expressing the opinion that the Board's proposed warning did not go far enough. The I.E.E. Regulations Nos. 74 and 95 did not give adequate protection against overloading and heating, and he suggested that each power socket should be wired for a 15A, and should have a 15A fuse. Neither Regulation 25 nor Regulation 124A gave sufficient protection. At present several appliances were supplied from one circuit, on the assumption that not more than one socket was likely to be used at one time, but occupiers would think they could use as many appliances as there were sockets. He also recommended the use of screwed steel conduit and the provision of iron outlets at each point. The I.E.E. Table XII should be insisted upon. If provision were made for fireproof installations, regulations would become better recognised than at present.

Mr. H. J. CASH moved that the notice as drafted be adopted, and said what Mr. Foggo asked for was not practical politics. His proposals were desirable, but they must move cautiously.

Importance of Good Jointing.

Mr. F. W. PURSE said he endorsed the proposal thoroughly. He suggested an addition after No. 7 as follows: "Inefficient and unsatisfactory jointing of cables and flexible cords or connections between cables and flexible cords and failure to protect such connections." I.E.E. Regulation 93 dealt with the methods which should be adopted for jointing cables and connecting them. It required a proper mechanical connector to be used, and where joint boxes were used, they should be of durable non-ignitable material. If a man did not joint his cables properly he certainly should not be on the Register.

After further discussion, Mr. Purse withdrew his motion, and it was resolved that the document be remitted to the Committee with powers to issue it forthwith.

Messrs. Hunter, Dykes and Cash were re-elected members of the Executive Committee.

Mr. T. Trimnell, who is resigning the office of secretary, but has promised to continue to give the Board all the assistance possible, was accorded a hearty vote of thanks for his valuable services to the Register.

ON Tuesday members of the Electrical Association for Women held a one-day Conference in London. After a meeting in the morning, a lunch was held at the Hotel Cecil (Mrs. Wilfrid Ashley in the chair) at which the speakers included Sir John Snell, Lt.-Col. K. Edgcumbe, and Lady Emmott. The afternoon was devoted to a visit to the works of Belling and Co., and the day's proceedings concluded with a ball and cabaret at the Hotel Cecil, at which about 250 members and friends were present. The photograph reproduced above was taken during the luncheon.

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ADVERTISING FOR CONTRACTORS.

Practical Hints on Newspaper Advertising—Utilising Manufacturers' Sales Helps—Importance of Shop Sales—Planning the Campaign.

By "PUBLICITY CONSULTANT."

TO say that the great majority of electrical installation contractors do not yet appreciate the value of advertising in their own business, and that the efforts of those who do make occasional attempts at advertising are the reverse of attractive, may be brutal; unfortunately, it is also true. The number of electrical contractors who do conduct a reasonable amount of advertising, in a skilful manner, can almost be counted on the fingers of one hand, but as advertising, in one form or another, is so essential to the proper development of retail electrical sales, I propose to offer some practical hints, based on extensive experience of retailer advertising, which it is hoped will put contractors' advertising on a proper basis. As it is commonly recognised that advertising, if not a science, is an art, and calls for a certain amount of specialised knowledge, many potential retail advertisers are apt to conclude that it is beyond their capabilities, and calls for the employment of an expert.

Where the size of the business justifies the employment of a man trained in advertising methods, it is certainly a good thing to be able to command the services of an advertising expert. But in the average small business, where the employment of one man for advertising purposes only would be sheer extravagance, it is fairly easy, as I hope to prove later, for the proprietor or other responsible member of the staff of a contracting firm to assimilate the basic principles underlying all successful advertising effort, and to conduct his own advertising in a way that is both pleasing and profitable.

Common Sense Principles.

The principles are founded on ordinary common sense, and when the subject is approached in this light, many of the apparent difficulties become extremely simple. For the benefit of those contractor-readers of THE ELECTRICIAN who are desirous of receiving advice on their advertising problems, the Editor has arranged to forward to me any advertisements which readers may submit for criticism, and any help I can render in the planning of campaigns and the preparation of booklets, folders, posters, etc., will be freely available to regular subscribers to THE ELECTRICIAN.

At the outset it may be pointed out that in few trades is the retailer so well served with manufacturers' sales helps as he is in the electrical trade. There is hardly a product in the electrical contractor's stock which has not been well and consistently advertised on a national scale by the manufacturers. On the hoardings, and in the great daily newspapers, these articles are brought to the notice of countless thousands of the public, and in such a way that a distinctly favourable impression is created towards the products advertised.

This ready-made interest in the goods which he has to sell is of incalculable benefit to the electrical contractor-retailer, and this fact cannot be over-emphasised. Thousands and thousands of pounds sterling are spent by electrical manufacturers annually in familiarising the public with their wares, but a considerable proportion of this expenditure is ineffective, and will continue to be so long as the last link in the distributive chain, the electrical retailer, fails to make the fullest possible use of this valuable assistance.

There is no cure without diagnosis, and the surgeon's probe sometimes hurts. But it remedies the diseased body. Applying the probe in this case, we find conclusive proof that the British electrical manufacturer not only makes a superlative product, and sells it to the trade, but he also sells it *for* the trade to the general public and pays the retailer for doing something he might almost as easily have done himself. It is useless to shut our eyes and ears to facts of this kind, for unless the retail side of the electrical industry can make itself an efficient re-seller of the manufacturers' goods, the manufacturer will one day decide that it is better and cheaper to complete the chain of distribution of his products without the intervention of the factor and retailer.

The stupid notion that selling things in a shop is an undignified proceeding for an electrical engineer has been responsible in the past for most of the inertia on the retail side of the industry, and it is remarkable that the idea still persists in many cases.

Quite recently, for instance, I had occasion to enter a shop of an electrical contractor for some small requirements. The shop, situated in a busy thoroughfare, was tended by the contractor's wife, who divided her activities between the house and the shop, and knew practically nothing about the business, or the disposition of the meagre stock that was in evidence.

Her husband, I learnt, in conversation, was out seeing to a wiring job which he had secured at a cut price on a Council's housing estate, and in any case he didn't bother much about the shop side, as the average week's takings only amounted to a pound or two!

Although I believe this to be an extreme case, I do believe that there are many electrical contractors up and down the country who do not look upon shop sales as a lucrative and important part of the business, and regard it as a side-line.

Now, this will not do. As electricity becomes available to more and more people, the manufacturers will produce and seek to sell ever increasing quantities of domestic electrical appliances. At the same time, many supply engineers who have hitherto been mainly concerned with generating problems, will cease to generate, and will turn to the marketing of energy-consuming devices. If, therefore, the electrical contractor wants to keep his place in the sun, he must sell electrical appliances, and he must sell them on a scale far beyond anything he has done before. Otherwise someone else will do the selling for him—but without passing him a commission for work he has not done.

How to increase sales of domestic electrical apparatus? There is but one answer—advertising, and yet more advertising. I use the word advertising in its proper sense of "making known," and though I count newspaper advertising as a very necessary feature, I also consider window dressing, circular letters, the circulation of pamphlets, etc., to be important branches of advertising. All should be used and incorporated in a co-ordinated sales policy to secure best results. It is, for instance, a waste of money to advertise refrigerators in the local newspapers, and show fires in the shop window. The window display should always link up with any Press advertising that is proceeding, as people who have noticed an advertisement are pre-disposed to examine the goods advertised if they are prominently displayed in the window. Although I intend to deal more particularly in these articles with newspaper advertising, I would like to emphasise that window space, if properly used, is a valuable advertisement. It is free in the sense that its cost is included in the rent of the premises, and it costs nothing to advertise in such a way that it will actually sell goods. If it is not so used it represents a real monetary loss, and a definite addition to the total overhead charges. Readers should, therefore, bear in mind that their windows should always reflect in some way, the work that is being done in the newspaper.

The Advertising Appropriation.

I am often asked to give a figure which would represent the sum which should be spent on advertising by a retailer. Without knowing the individual's turnover and other particulars, such as the extent of local competition, the potentialities for increased trade according to the state of saturation of the market, the price of electricity, and so on, it is extremely difficult to arrive at a figure.

Some advertisers can get remunerative publicity by a mere expenditure of only 1% of their annual turnover; others require to expend 10% or more. The exact proportion which you will require to be put aside for advertising must be determined by the local conditions. The only thing to fear in making the decision, is that you may spend too little—and not too much.

One thing, however, is important. You cannot get good results from occasional and spasmodic advertising. Much of the value of publicity lies in its cumulative effect, and, if you fail to carry on the work, a proportion of the expenditure already made will prove useless.

It is important, therefore, to plan a series of advertisements to cover a definite period and decide on a plan of campaign at a definite cost, and adhere to it strictly. A percentage of the main sum should be put on one side for contingencies, so that

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the unexpected holding of a local exhibition or some other unexpected item calling for special publicity, will find you prepared to take a special advertisement without interfering with the pre-determined campaign.

When the extent of the advertising campaign has been decided, it is necessary to determine the papers to be used, and the space to be occupied in each. As to choice of media, the advertiser's knowledge of local conditions makes this a fairly simple matter, though it is sometimes possible to be led into unprofitable expenditure by taking space at uneconomically cheap rates in the weaker of two newspapers. The paper asking higher rates for its space may, and usually can, justify itself in larger and more suitable circulation, better printing, etc. Placing an order in advance for a series entitles the advertiser to a useful reduction on the unit rate, and is to be recommended; pre-payment of the whole series, when possible, also provides a further discount in many cases.

The size of the space to be taken again depends on individual conditions and requirements, but it must not be thought that advertising in comparatively small spaces will necessarily be ineffective. The full-page advertisement can hardly fail to produce results, however badly it may be filled. Intelligent use of smaller areas will also produce results.

[*To be continued.*]

ELIMINATING THE UNFIT IN CONTRACTING.

The "Fishy" Electrical Contractor—More Publicity Wanted—Supply Authorities' Lack of Inspection—Warning to Fire Insurance Companies—Cotton-covered Bell Wire for Lighting Installations—More Examples of Shoddy Work.

By HARRY MOSS, A.M.I.E.E.

IN prosecuting my campaign for the elimination of the unfit and for the uplifting of the electrical contracting industry, it daily becomes more evident that the process of cleansing the trade has been far too long delayed, and the evidence in favour of the prosecution is piling up by leaps and bounds. The National Register is now doing a good deal through its publicity campaign to educate architects, builders, and the public, generally, to the importance of having electrical work done by skilled and competent firms or individuals, and it is anticipated that the long overdue publicity campaign of the E.C.A. will shortly be launched.

This organisation has been lacking in its duty in not entering the field long before now, but, as the old saying is "Better late than never," it is to be hoped this big national organisation will not lose any more time, but will get to work on the all-important question of preaching the gospel to the public, of the absolute necessity of all electrical work being done by reputable firms, and condemn publicly the shoddy, cheap, and dangerous work of the "jerry" contractor and kerb-stoner.

If this is done in a vigorous manner, it may not be too much to hope that E.D.A. will also enter the field in one of its campaigns, and bring some of its guns to bear on the common enemy.

"Codding" the Public.

A few days ago I passed a small shop with the man's name over the door, and on one side of the name it said "High Class Fish and Fruit Stores"; on the other side, "Electrical Contractor." It made me wonder how long he had been "codding" the public! There was no visible sign in the shop that the title "Electrical Contractor" should have had a "plaice" there at all. I wondered what was the wording of his trade cards and memos., and how many so-called factors and agents were calling on him weekly, and if his electrical business was 5% of his total turnover.

There must be some weeding out done, as, with the great developments now proceeding throughout the country, there is likely to be a larger influx of these incompetents into an industry which properly belongs to the trained electrical engineer.

Case after case keeps coming up where work is done by the "jerry" man, simply because he is cheap, and the customer does not realise, until it is too late, that he has got a very poor job, consisting of the cheapest class of wire and accessories, put together by an amateur.

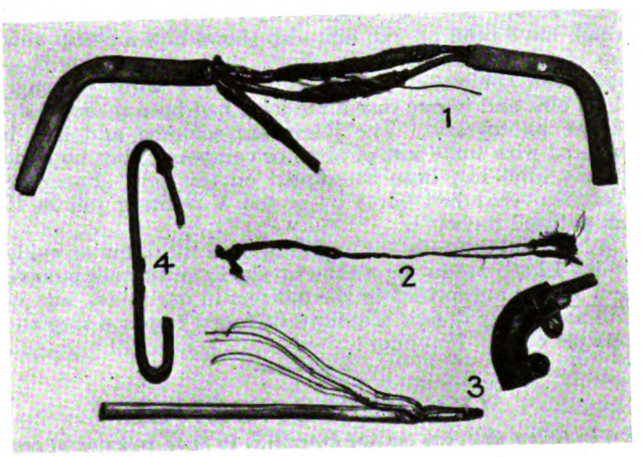
An argument often used by these people is the one that "I can fit your place up and give you electric light for, say, 9s. 6d. or 10s. per light, so why pay more?" and the prospect, not knowing any better, gives the work to the lowest-priced man or firm.

There will have to be a very intensive propaganda campaign by the recognised associations, to educate the public, and combat this cheap, shoddy work.

Some supply authorities are helping very much already, but it is high time they all came into line and did something more, because it is very detrimental to the industry as a whole to have these low-grade faulty installations put in, which cause irritation and annoyance and often considerable further cost to the customer, which reflects detrimentally on the trade.

It is no credit to any supply authority to connect "shoddy" and unreliable installations to their mains. It is not "all right" to keep on adding these installations for the sake of increased output, if danger is present. The supply people have a duty to the industry in this matter, and should not shrink from it. When exposures come about through faults occurring, they should take steps to find who the culprit is and "warn him off."

The examples and illustrations accompanying this article



Figs. 1 to 4.—Some newly discovered examples of bad installation work.

are evidence of what is being done, and which ought to be put a stop to.

Fig. 1 on the first photograph is an example of how a 3/029 L.C. wire was tapped and connected up to a radiator plug, taking 15 A, the only insulation at the joints being a little black adhesive tape. No bonding had been attempted or done, and a burning out was the result. Is it fair or reasonable that electricity consumers should have to run these fire risks?

Fig. 2 shows the result of running a 1 kW radiator on a thin V.I.R. 14/0·0076 flexible. Can you wonder at fuses blowing or fires occurring?

Fig. 3 is a twin 1/0·044 metal sheathed wire which had an earthing wire connected to the earthing pin of a heating plug. The earthing wire was passed through the ⅝ elbow shown, and connected to the gripping screw. The tube, however, was not earthed, nor was the sheathing of the twin wire, with the result that a fault on the heating apparatus made the sheathing alive, the current taking the nearest path to earth, via a gas pipe, with the usual disastrous results, as the gas was soon ignited. This would, I expect, be called an electrical fire.

Closer Inspection Needed.

Fig. 4 is not shown as bad electrical work, but is a metal sheathed wire that has been pierced with a nail by a careless joiner. The nail was in contact with the neutral conductor and the sheathing, causing a dead earth on that side, but as the supply authority did not trouble to test—which, of course, shows a lack of inspection on their part—the job was connected

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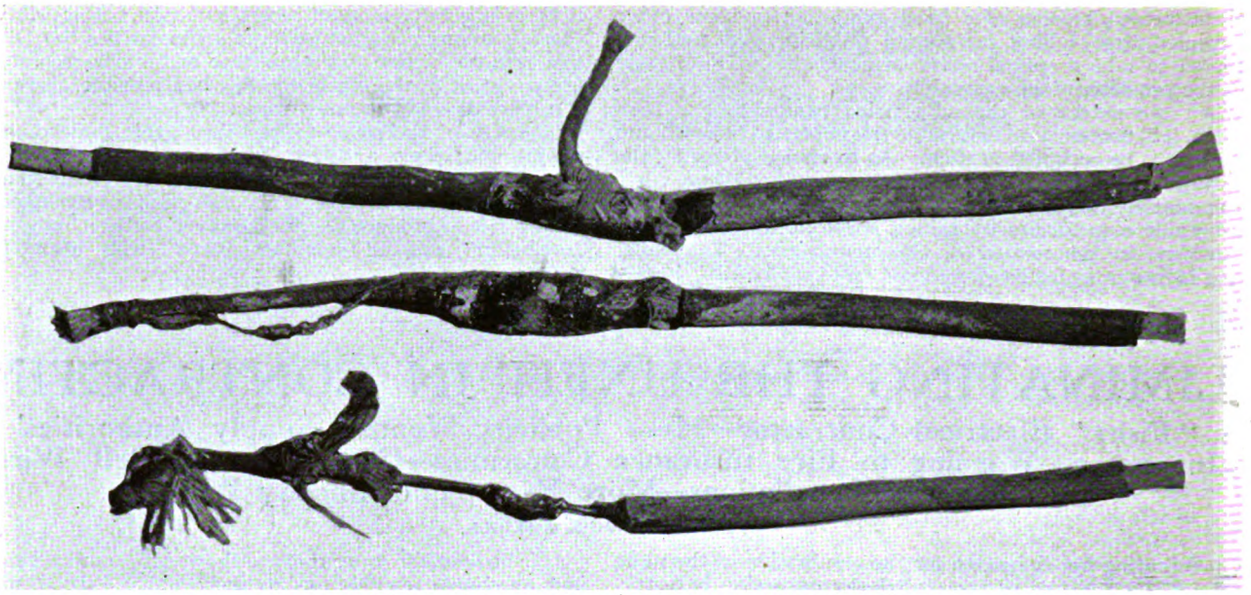

Fig. 5.—Showing further examples of shoddy wiring on a 100 V installation.

up, and worked for some time before being found out. It is also safe to assume that the cheap "jerry" contractor who did the job did not test, either—otherwise he would have found it—but it is also possible that his "plant" does not include a testing set more advanced than a bell and dry battery.

The illustration, Fig. 5, shows wires from a 100 V installation, which have been buried, and also shows how a cheap, shoddy job is done when wire runs short. The cotton-covered wires had been connected to the lead-covered wires to lengthen them out, and in one case a tee joint had been made as shown in the photograph. The joints are soldered, and had been covered with some sort of pitch or compound, but no bonding of any kind had been attempted on this job. Fancy using cotton-covered bell wires on a 100 V lighting job in these enlightened days!

When will the constant exposures and the damning evidence which I keep producing waken up the fire insurance companies and supply authorities to the dangers in our midst, and when will some very drastic measures be taken to put a stop to this terrible evil? I wonder!

CORRESPONDENCE.

The Editor welcomes the free expression in these columns of genuine opinion on matters of public interest, although he disclaims responsibility alike for the opinions themselves and the manner of their expression.

Fool-proof Chargers.

[To the Editor.]

Sir,—I note in "Current Topics," in your issue of March 29th, a paragraph dealing with home chargers for wireless accumulators, in which you call attention to the necessity of making such devices as simple as possible to handle. This has always been a point on which we hold decided views, and I think that we can claim that our standard trickle charger fulfils your requirements. In one respect it is possible that the

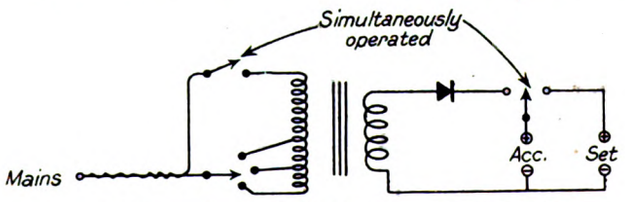

Diagram of connections of the trickle charger referred to in the accompanying letter.

apparatus is not entirely fool-proof; in order to cope with variations of supply voltage, it is necessary for the user or the retailer who supplies it, to select one of three terminals marked with the mains voltage.

It is also necessary that the purchaser refrain from connecting the instrument to direct-current mains. Otherwise, we are of the opinion that the instructions sent with the apparatus do make it substantially fool-proof. You will notice from the accompanying diagram of connections that even in the event quoted by you, of the instrument being left switched on to "Charge" while disconnected from the mains, the accumulator cannot discharge back through the rectifier, owing to the high "back resistance" of the Westinghouse rectifier employed. Further, the switching is so arranged that there is no possibility of the mains being connected to the set, except, of course, in the case of a complete breakdown of the whole apparatus, which would probably then blow the fuses, and so still be safe.

It may be noted that since the use of 2 V valves usually calls for rather larger discharge rates from the accumulator than the use of 6 V valves, the charger is arranged to supply rather greater current to a 2 V accumulator. The actual values are, when the correct a.c. voltage is applied, approximately 0·45 A for 2 V and 0·32 A for 6 V. A 10% rise or fall in applied voltage causes approximately a 10% rise or fall in the charging current, and cannot, in any way, injure the charger or the accumulator. I have pleasure in enclosing a sample of this instrument for your inspection.—I am, etc.,

P. K. Turner
for Graham Amplion, Ltd.

Slough.

[We have examined the charger submitted, and agree that so long as the instructions as to terminal arrangements are observed, no harm can be done to an accumulator during charging, discharging or stationary periods. The charger is fitted with a substantial knob, by means of which the accumulator may be connected "to set" or "charge," or "off," which thus reduces to a large extent the possibility of the instrument being left switched on to "charge" while disconnected from the mains. In the event of such a case, however, the resistance of the Westinghouse rectifier circuit is such that the accumulator will not be harmed.—Ed.]

Educating the Public.

[To the Editor.]

Sir,—In view of the excellent work that is being done by the National Register in the direction of educating the public about the dangers of shoddy wiring installations, it is difficult to understand why the April issue of the official journal of the Electrical Contractors' Association should feel the necessity to announce "that the E.C.A. has a special committee sitting at this moment to consider ways and means whereby architects and others might be persuaded to see the folly of encouraging the shoddy worker to continue his evil malpractices." The E.C.A. must surely be aware that the National Register has already put in hand a plan on these lines, and that it has met with gratifying success.—I am, etc.,

Regtract.

London, S.W.11.

Every shareholder is a potential customer.—*Sir Hugo Hirst.*

* * *

It is a good thing for a country, when its own capital resources are limited, to have foreign capital at its disposal.—*Mr. F. G. Kellaway.*

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NEWS IN BRIEF.

Stockholm's Profitable Public Utilities—Swansea's Hire and Hire-Purchase Schemes—The Ashchurch Railway Accident—Paignton Summer Illuminations.

A NEW type of telephone instrument is to be introduced by the Post Office.

A telephone engineer is required by the Egyptian State Railways Telegraphs and Telephones Administration.

Ten million kroner, instead of the estimated sum of three and a half, were returned to the Stockholm City from its municipal electricity, gas, and water works.

Swansea Electricity Committee has adopted a hire and hire-purchase scheme.

A set of traffic light signals is to be placed at Morriston Cross, Swansea, at a total cost of £110, including wiring and installation.

The Farringdon Dispensary's clinic for artificial sunlight treatment, at Parker Street, Kingsway, London, was opened on April 10th.

Stretford Electricity Committee has discussed the possibility of obtaining an electrical showroom in the Old Trafford area, and has adjourned the matter, pending consideration by the chairman.

At a public meeting of the North Wales Ladies, at Colwyn Bay on April 11th, it was resolved to promote the idea of the all-electric home, and to advocate the teaching in the day-schools of domestic electrical methods.

The first meeting of the Bristol and District Branch of the Electrical Association for Women, was held on April 11th, when Mr. G. S. Francis, of the E.D.A., gave a lantern lecture dealing with architecture and lighting. The Birmingham and Midlands Branch of the Association visited the Birchills power station on April 11th.

LOOKING BACKWARDS.

FIFTY years ago the issue of THE ELECTRICIAN, *dated April 19th, 1879, recorded that :—*

The Society of Telegraph Engineers was recommended to enlarge the scope of its proceedings to include those of an Electrical Society.

M. Ader claimed to have made a telephone speak without a diaphragm.

The Council of the Royal Albert Hall was organising an exhibition to be "historically illustrative" of the subject of electric lighting.

Edison's search for an incandescent electric lamp had brought him to the stage where a lamp containing a regulator for "turning the electricity on or off" was incorporated, "the expansion of the air in the globe serving to work it." It was admitted that the "invention" was not ready for the public.

* * *

TWENTY-FIVE years ago, according to THE ELECTRICIAN *of April 22nd, 1904 :—*

For using a ship fitted with wireless telegraphy apparatus, "The Times" Russo-Japanese war correspondent was threatened by the Russians with treatment as a spy should the vessel come within the zone of operations of the Russian Fleet.

Papers announced for the ninth annual convention of the I.M.E.A. at Derby included one on "The Commercial Practicability of Electric Traction by Surface Contacts."

The A.E.G. English Manufacturing Co., Ltd., was a new company formed to acquire United Kingdom rights in the "Nernst" lamp.

There are now 790 electricity consumers in Skipton.

Alderley Edge and Wilmslow Electricity Board has invited tenders for the erection of an electricity sub-station at Wilmslow.

The Western Union Telegraph Co. commenced a new service of postal letter telegrams on Monday between Great Britain and Ireland, and Canada, Newfoundland and St. Pierre Miquelon. The charge is 1½d. per word, minimum 2s. 6d.

Paignton Entertainments Manager has been instructed to obtain a quotation for strip lighting for extra illumination at the band enclosure during the summer season.

Birkenhead Museums Committee has had drawings prepared showing a scheme for diffused lighting at the exterior of the gallery entrance, and the Committee has asked for the Electrical Engineer's observations on the proposals of the architects.

At the North-East Coast Exhibition, which will be opened by the Prince of Wales on May 14th, the exhibits will include inventions in regard to electrical engineering, telephony, telegraphy and radio, and demonstrations will also be given of electric lamp manufacture.

The annual meeting of the Mersey and North Wales (Liverpool) Centre of the I.E.E., was held on Monday, when Prof. E. W. Marchant was elected chairman. Mr. T. B. Morgan, vice-chairman; Mr. L. Breach, hon. treasurer; and Mr. Oscar C. Waygood, hon. secretary. Messrs. R. G. Devey, J. Hamilton, H. H. Harrison, and F. B. Mercer were elected committee members.

In his report on the accident which occurred on January 8th at Ashchurch, on the L.M. and S. Railway, Lieut.-Col. A. H. L. Mount states that he is satisfied that the electrical signalling, light repeater, and interlocking equipments were in order.

Members of the Birmingham and Midlands Branch of the Electrical Association for Women visited the works of the Electric Construction Co., Wolverhampton, on March 20th. The printing works of Kenrick and Jefferson, West Bromwich, were visited on March 25th.

At the meeting of the Overhead Lines Association on April 24th, at the Institution of Electrical Engineers, Mr. W. Fennell will give a "Review of Ferro-Concrete Poles in other Countries." This is to meet the convenience of Lt.-Col. W. A. Vignoles, who will give his lecture on "Getting Consumers in Rural Areas" on May 8th, at the same place.

At the annual general meeting of the Paisley Association of Electrical Engineers, on April 9th, Mr. Jas. Orr was elected president for 1929-30, Mr. Jas. E. Adam vice-president, Mr. J. M. Barbour, hon. secretary, Mr. G. H. Fisher, hon. treasurer, and Messrs. H. Aberdein, G. U. Campbell, J. Durell, J. S. Kilpatrick, F. E. Moss, and Alex Todd were appointed members of the committee.

An official statement was issued last week, following a conference between employers and representatives of the E.T.U., stating that the Electrical Trades Union had agreed to instruct members on strike in the federated engineering establishments to resume work pending a conference being arranged at an early date to consider an application for an advance of wages for men engaged on the electrical installation of lifts. It was also announced that the E.T.U. were instructing members who were out in connection with lift strikes and Grosvenor House to return to work forthwith.

At a meeting of the Association of Mining Electrical Engineers, at the South Wales Institute of Engineers, Park Place, Cardiff, on April 20th, Mr. H. T. Gregory will read a paper on "Three-phase Induction Motors and their Control Systems."

The New York Telephone Company announces that it will in future issue a five-volume telephone directory, one for each of the city's five boroughs. Greater New York has in the past issued its telephone directory in two volumes, containing more than 500 000 names.

Plans for the erection of a building to be occupied by the new X-ray department, consisting of an extension of the present buildings of the Western Infirmary, were passed last week by the Glasgow Dean of Guild Court. The cost of the building, about £18 000, has been raised by public subscription, and Mr. Wm. Teacher has given £5 000 for the X-ray equipment.

The income of Guernsey States Telephone Department for 1928 was £19 219, working expenses were £5 463, and after provision for employees' pension fund, reserve for depreciation, sinking fund, etc., the surplus for the year was £718. The number of subscribers' and public telephone calls during the year was 2 607 855, an increase of 103 848. The number of subscribers at the end of the year was 3 636, increase, 158.

In a report on the North of Ireland telephone service in 1928, it is stated that the number of telephone stations on the system at December, 1928, was 21 404, the new stations connected numbering 1 205. The total number of residential stations was 4 514, an increase of 687. The rural areas received special attention. The department has decided to provide small automatic exchanges in suitable rural districts, and several of these will be completed this year.

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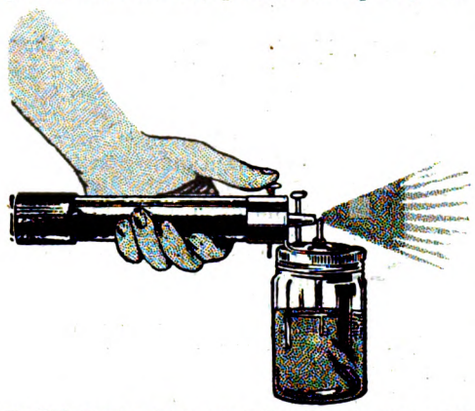
DOMESTIC ELECTRICAL APPLIANCES.

New Equipment for Domestic Use—Items of Interest to Electrical Contractors—Further Lines for the Radio Stockist.

WE have received from L. G. HAWKINS AND CO., LTD., 30/35, Drury Lane, Kingsway, London, W.C.2, particulars of an electric cleaner spray attachment which may be used for paint, disinfectant, germicidal liquids, etc. The unit is sold under the trade name of "Vio Ray" and may be attached to the hose extension of any good make of vacuum cleaner without further adjustments. The spray obtained from the nozzle is controlled by a conveniently placed trigger situated on the top of the connecting tube. The sprayer is of interest to all owners of vacuum cleaners and may be used for touching up furniture, internal decorations, damaged paint work on motor car bodies, fenders, etc.



The "Vio Ray" paint sprayer, by L. G. Hawkins and Co., Ltd.

LECTRO-LINX, LTD., 254, Vauxhall Bridge Road, London, S.W.1, have introduced to their already extensive range of hook and ring terminals two other types supplied in nickel plated and lead coated finishes. The latter type is of particular value for use on l.t. leads from accumulators to wireless receivers, as the lead coating will tend to reduce to a large extent, much of the unpleasant sulphating at the accumulator terminals. A condition which though unnecessary is, unfortunately, only too common.

A device for bonding and fixing metal sheathed cables is manufactured by Mr. H. H. LEAGE, of 46, Lincoln's Inn Fields, London, W.C.2, under the name of "Bonfix." This unit, which may also be used as a junction box for rubber insulated cables, is fitted with springs in such a way that they form part of the box. The cables are slipped under the springs without any further fixing, thus dispensing with binding clamps and screws. The box is provided with five positions for mounting while the cover is secured to the base by means of small springs.

Among the recent additions to the range of valves offered by the MULLARD WIRELESS SERVICE CO., LTD., of Mullard House, Charing Cross Road, London, W.C.2, may be mentioned the "pentode" valve P.M. 24. As its name implies, this is a five electrode valve designed for use in the last stage of low frequency amplifiers. It has three grids, that nearest the filament being the usual control grid. The next, or auxiliary grid, is connected to a terminal on the side of the valve base, and should be maintained at approximately the same potential as the anode. The third grid, nearest the anode, is connected internally to the filament. The control grid and anode, as in three-electrode valves, are connected to the grid and anode pins of the cap, so that the valve can be used in any set, the only addition necessary being a wire to connect the auxiliary grid to h.t. positive. This can be done by taking a flex lead from the auxiliary grid terminal on the side of the cap to the h.t. positive terminal of the set which supplies the h.t. to the last valve. By this arrangement, an high amplification factor of 62 has been obtained in conjunction with a mutual conductance of 2.3 mA/V. This makes the P.M.24 a useful valve for the last stage or output valve in low-frequency amplifiers. Used for this purpose, it gives an amplification and output almost equivalent to two l.f. stages employing normal three electrode valves. It must, however, be borne in mind that the P.M.24 should not merely be substituted for a super-power valve in the output stage of an l.f. amplifier where full loud-speaker volume is already obtainable. In such a case, the valve would be overloaded, and the preceding l.f. stage should therefore be omitted. The filament voltage is 4, the consumption 0·15A, anode voltage 150, auxiliary grid voltage as h.t., impedance 28 000 Ω, amplification factor 62, mutual inductance 23mA/V. We have tried one of these valves in a conventional a.c. mains 3-valve receiver and the volume obtained was in accordance with the manufacturer's claims. The valve appears to be able to carry a reasonably heavy load without distortion, while on distant, and consequently weaker, stations the amount of amplification was a little under that given by two normal l.f. stages.

R. PEARSON AND SONS, 369, Holcombe Road, Greenmount, near Bury, have introduced a new lamp holder which, fitted with two sockets besides the usual bayonets, can be used as an adaptor with the lamp still in circuit. The device is made with two sockets so situated in the body of the contrivance that a special two-pin plug, supplied by the makers, may be used for connecting any domestic appliance into the circuit. The holder normally carries a two-pin bridge which can be used, if desired, for controlling the lamp circuit. Removal of this bridge, permits the two-pin plug of the appliance to be inserted. The holder is also fitted with a firm cord grip of novel design.

A new cooker added to the range offered by the MANOR ELECTRIC OVEN AND FIRE CO., of 303, High Road, Chiswick, London, W.4, is a 1 200 W model giving a cooking space of 12 in. by 12 in. by 11 in. Three heat control is included, while the oven elements, of the enclosed type, are situated in the corners. The boiler-grill of 1 800 W loading is of the

Examples of the range of fittings offered by Camille Espir, Ltd., 19, Hanover Square, London, W.1. The centre fitting is made in wrought iron and the remaining two are of wood.

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standard "Manor" plug in type and is also arranged with three-heat control. The overall dimensions are 19 in. by 28 in. wide, and 15 in. deep.

An electrolytic type of condenser has just been placed on the market by the TELEGRAPH CONDENSER CO., LTD., Water Farm Road, North Acton, London, W. The chief use for this type of condenser is for smoothing a.c. ripple when such current is used for the direct heating of valve filaments. They may also be used for eliminating ripple in the case of moving coil loud speakers. The minimum capacities are 4 000 μF and 2 000 μF, for double and single types respectively, measured at 50 cycles. The minimum working peak pressure is 12 V at which the maximum leakage is said to be 10 mA. The condensers are of the dry polarised variety, fitted in the usual metal boxes, and provided with small terminals. The latter are clearly marked as to polarity and a substantial base for baseboard or other mounting is provided in each type.

A new electric cooker offered by BERRY'S ELECTRIC (1928), LTD., Touchbutton House, 85–87, Newman Street, London, W.1, is of such a type that grilling can be normally carried out in the oven, thus eliminating to some extent any fumes and smell. It is claimed that the efficiency of the totally-enclosed hotplates used is higher than normal, while the cooker is fitted with a separate compensating thermometer for controlling the temperature of the oven. The boiling plates are adjustable and removable pull-out type elements are fitted.

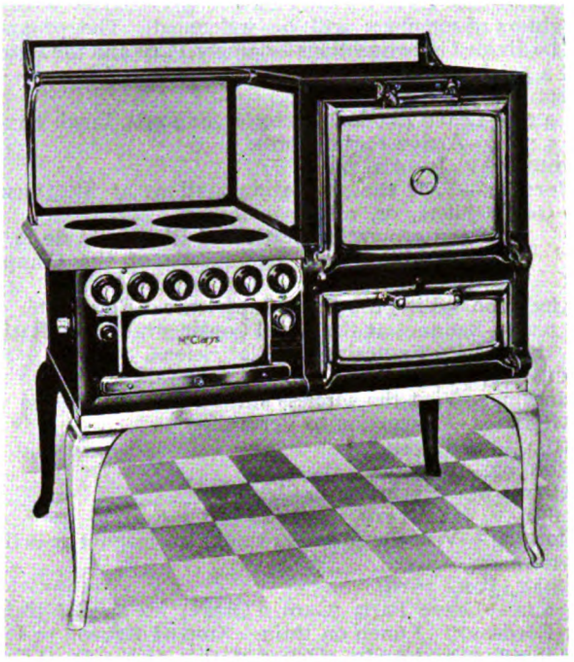
In connection with the recent discussion of the value of ray therapy it is interesting to note the sale by METRO-VICK SUPPLIES, LTD., 155, Charing Cross Road, London, W.C.2, of a massaging device which is termed a companion apparatus to artificial sunlight appliances. This is the "Savage" health motor, which consists of a small electric motor arranged to oscillate a belt, whose surface is applied to the lightly-clad body of the person requiring treatment. Ordinarily, both ends of the belt are attached to the machine, and the operator slips into its embrace; an alternative method is to remove one end of the belt from the hook, and hold it in the hand with the belt twined round the body. The appliance is designed as a body conditioner and a corrective of specific ailments, and is recommended to all who do not obtain sufficient physical exercise. Its use is also suggested as a remedy to obesity. The degree of severity of the vibratory action is proportional to the force applied against the belt. The motor can be run from any lamp socket, and the machine is entirely portable, a leather case with a handle being provided for packing it. In weight and size it is comparable with a portable electric sewing machine.

CAMILLE ESPIR, LTD., of 19, Hanover Square, W.1, have in their showrooms two ranges of lighting fittings in period designs in wrought iron and wood, and modern, French glass pendants and wall brackets. In addition, there are fittings of British manufacture, and, as an example of these, one can cite the "ball" fitting, which is sold in three sizes. A shell bracket offered is mounted with oxidised silver castings, and is provided with a ceiling plate to match. Another hanging model caters for 8 lamps: 4 inside the double-concave glass panels, and 4 20 W lamps outside, supported by brackets. There are also many fittings to suit those desiring the ultra-modern, the soft appearance of the glass used by this firm being particularly attractive.

The EXCELSIOR COMMERCIAL CO., LTD., of 112–113, Fenchurch Street, London, E.C.3, is putting on to the market a cleaner which is in several ways superior to the old model, and though the new improved "Praefix" is not yet available to the public, the following particulars have been obtained. Like the former model, the cleaner is of the small, lightweight, non-bag type. The body can be had in leatherette or in corrugated aluminium. The $\frac{1}{4}$ H.P. motor is suitable for a.c. or d.c., has a suction power of 580–600 mm. (watergauge), and is provided with ball bearings of the tightly enclosed type, requiring no oil or grease. All parts are accessible, and as the field and the armature bearings are clamped to crossbars connected to the housing, vibration is claimed to be practically nil. The accessories consist of carpet and furniture nozzles, a polishing brush, and a small triangular-shaped brush for corners and picture rails; to these is added a fish-tail piece made of vulcanite. The external suction pipe is of light and durable construction; the pipe can be supplanted by a metal tube 4 in. long, and the machine then operated with the handle on the motor housing. The weight of the machine is approximately $7\frac{1}{4}$ lb.

HOBBIES, LTD., of Dereham, Norfolk, are offering a new electric motor for driving their "A1" or "Triumph" fretwork machines. The method of changing from foot treadle to electric drive consists merely of changing the belt. The starting switch is in a foot box to be set on the floor and 12 ft. of flex with the necessary wall plug are supplied ready for connection to the mains.

The "Photomirenta" lamp, manufactured by PHILIPS LAMPS, LTD., Philips House, 145, Charing Cross Road, London, W.C.2, is an innovation designed both to simplify and lessen



One of the new "McClary" cookers of Berry's Electric, Ltd.

the cost of night portraiture for the amateur and professional photographer, by largely taking the place of magnesium and arc lamps. It consists of a 500 W gasfilled opal lamp, having half of the bulb silvered inside to form a mirror, this increasing the intensity of the light in one direction. The bulb itself is made of "Argenta" opal glass, and renders the use of diffusing screens unnecessary. The "Photomirenta" lamp can be plugged into the ordinary lighting mains, and be used without a fitting of any kind, as all the light is directed towards the sitter and no rays fall on the camera lens. With a fast panchromatic film, and a 4·5 F lens, an exposure of only one second is necessary, while a little experiment enables the photographer to estimate with accuracy the exposure required for different subjects.

The ELECTRICAL FITTINGS CO., the agents for the ARTISTIC LAMPSHADE MANUFACTURERS (of 58, Pentonville Road, London, N.1), is exhibiting in the showrooms at 58, Newman Street, London, W.1, a variety of attractive pendants, standard lamps, and table lamps. "Nacrolaque" appears to be employed in all the designs, and the table lamps are particularly novel, traditional designs being abandoned completely in many cases. One model is in the form of a lily, open at the top and with no conventional shade; the outer leaves of the lily shield the lamp from the eye. The octagonal base is made of the same material, and contains a concealed metal weight heavy enough to ensure the stability of what would otherwise be a featherweight lamp. Another model represents a vase with a flared opening. There is a fuchsia, available as a pendant or table lamp, with outstanding colouring. The stamens add to the realistic appearance of these flower-like standards. The columns of larger lamps are also worthy of notice, since externally they are made entirely of Nacrolaque in pleasing colours. Some of the pendants have an appearance resembling that of mother-of-pearl.

A new feature is incorporated in the "Labor" industrial lighting fitting of BRITISH B.A.G., LTD., 23, Farringdon Avenue, London, E.C.4, whose "Pearlite" diffusers have recently attracted attention. The "Labor" fitting is made of heavy gauge sheet metal, vitreous enamelled white inside and either black or grey outside. The innovation consists of a removable diffuser, in shape partly spherical with a flat base, which is placed over the lamp and attached to the upper part of the fitting by chains. The lower half of the diffuser is internally silvered, so that it acts as a partial reflector.

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I.E.E. SUMMER MEETING.

Preliminary Details of the Meeting in France Next June.

AS has been already announced in THE ELECTRICIAN, the summer meeting of the Institution of Electrical Engineers will this year be held in France at the invitation of the Société Française des Electriciens, and the presence of wives and daughters of members will be welcomed. The programme will be divided in two sections—namely, Paris and the Pyrenees, and a brief outline of the arrangements is as follows :—

TUESDAY, JUNE 11TH.
9 a.m.—Leave London (Victoria) for Paris, lunch en route.
4.5 p.m.—Arrive Paris (Nord).

WEDNESDAY, JUNE 12TH.
Morning.—Visit the generating stations at St. Ouen and Gennevilliers, or, alternatively,
Visit the generating station of Electricité de la Seine and the Milton-Volt Laboratory of the Compagnie Electro-céramique.
Afternoon.—Visit the Ecole Supérieure d'Electricité.
8 p.m.—Banquet at the Hotel Continental by invitation of the Société Française des Electriciens.

THURSDAY, JUNE 13TH.
Morning.—Visit the wireless station at Sainte-Assise.
Afternoon.—Excursion to Versailles.

FRIDAY, JUNE 14TH.
Morning.—Free.
Afternoon.—Excursion to Chantilly.

SATURDAY, JUNE 15TH.
Morning.—Visit the 46 000 gauss electro-magnet at Bellevue.
Afternoon.—Free.

SUNDAY, JUNE 16TH.
9 a.m.—Leave Paris (Gare d'Orsay) by special train for Bordeaux. Lunch on train. Stop at Eguzon to inspect the dam and hydro-electric station at the Paris-Orleans Railway, which is connected by a 150 000 V line to the Union d'Electricité and supplies the suburbs of Paris and the Paris-Orleans Railway. Dine on train and arrive at Bordeaux about 10 p.m. Sleep at Bordeaux.

MONDAY, JUNE 17TH.
12.30 p.m.—Train leaves Bordeaux for Pau. Lunch on train.
5 p.m.—Arrive at Pau.
Evening.—Dinner (morning dress) offered by the South-Western Local Centre of the Société Française des Electriciens. Sleep at Pau.

TUESDAY, JUNE 18TH.
9.am. Leave Pau by motor coach to visit the Houra generating station and an automatic sub-station. Lunch at Eaux-Bonnes.
4 p.m.—Leave Eaux-Bonnes by motor-coach and proceed to Lourdes via the Col. d'Aubisque. Dine and sleep at Lourdes.

WEDNESDAY, JUNE 19TH.
9 a.m.—Leave Lourdes by motor-coach for Pierrefitte-Nestalas. Excursion to and lunch at Gavarnie. Return to Lourdes about 7 p.m. Dine and sleep at Lourdes.

THURSDAY, JUNE 20TH.
12 noon.—Train leaves Lourdes for Toulouse. Lunch on train.
4 p.m.—Arrive at Toulouse. Dine and sleep at Toulouse.

FRIDAY, JUNE 21ST.
9.25. a.m.—Leave Toulouse by train for an excursion to the old city of Carcassonne. Lunch at Carcassonne.
Arrive back in Toulouse at about 7.30 p.m. Dine and sleep at Toulouse.

SATURDAY, JUNE 22ND.
10 a.m.—Leave Toulouse for Paris. Lunch and dine on train.
10 p.m.—Train arrives at Paris. End of meeting.

The Institution is informed that those members who so desire may take part in the concluding meetings of the International Conference on Large High-Tension Supply Systems at 9, Avenue Hoche, Paris, on Thursday, June 13th, and Friday, June 14th, on payment of a reduced entrance fee of £1, which should be sent direct to M. Tribot Laspiere, Secrétaire Général, Conférence Internationale des Grands Réseaux Electriques à Haute Tension, 25, Boulevard Malesherbes, Paris.

For those ladies who do not wish to take part in the technical visits, arrangements will be made for visits to some well-known dressmakers' shops and jewellery establishments, where models (mannequins, etc.) will be on view.

PERSONAL.

ALD. J. Thickett has announced his resignation from Walsall Electricity Committee of which he has been chairman since November, 1922.

The telephone department of the Bicester, Oxon, Post Office presented a case of spoons to Miss Ada R. Wainwright on the occasion of her marriage to Mr. Fred Inwood.

Chester Electricity Committee has appointed Mr. E. F. Humphrey, of Birmingham, as an additional mains superintendent, at a basic salary of £324 7s. 11d. per annum.

Ald. T. G. Lumb, chairman of Blackpool Electricity Committee, has congratulated Mr. C. Furness, the borough electrical engineer, on the success of the last autumn illuminations.

Mr. W. L. Hambly, late heating and cooking representative with the British Electric Transformer Co., has joined the staff of Credenda Conduits Co. as sales engineer for London and South-West England.

The Earl of Midleton has been elected chairman of the Globe Telegraph and Trust Company. Mr. Francis Alexander Johnston has joined the board to fill the vacancy created by the death of Sir John Denison-Pender.

Kingston-on-Thames Town Council has granted an honorarium of £500 to Mr. T. A. Kingham, borough electrical engineer, for himself and certain members of his staff, in recognition of services rendered in connection with the laying of a cable from the borough boundary to Walton-on-Thames.

Wrexham Town Council has increased the salary of Mr. J. W. Williams, borough electrical engineer, from £455 to £500 per annum; that of Mr. E. O. Jones, station superintendent, from £5 per week to £300 per annum; and that of Mr. J. Archer Tippett, consumers' engineer, from £4 10s. to £4 15s. per week.

Mr. D. L. Thornton has been appointed editor of the "Mechanical World and Engineering Record." He served part of his apprenticeship with Cole, Marchent and Morley, Ltd., and has designed, among other plant, condensers of 46 000 sq. ft. capacity for use in power stations. Mr. C. N. Pickworth, who occupied the editorial chair for 40 years, retired last month.

Mr. Robert Shaw, who for 35 years has represented British Insulated Cables, Ltd., in the Manchester district, has just retired on pension. After an early training in the textile and calico printing industry, Mr. Shaw went into the electrical business. He was for some years on the staff of the International Okonite Co., Ltd., and left them in 1894 to start a branch office in Manchester for the British Insulated Wire Co., now British Insulated Cables, Ltd. Mr. W. H. Clift, who has been his chief assistant for 33 years, has been appointed to succeed him.

At a meeting of Aberdeen Tramways Committee last week, the following five were chosen as a short-leet for the vacant post of general manager of the corporation tramways:—Mr. W. W. Clark, engineer and manager of the Nottingham and Derbyshire Traction Co., and Midland General Omnibus Co., Ltd.; Mr. J. L. Gunn, manager of the Greenock and Port-Glasgow Tramways; Mr. H. H. Lancaster, traffic manager of Blackpool Corporation Tramways; Mr. Charles Symon, traffic superintendent, Aberdeen Corporation Tramways; and Mr. Alfred Smith, chief clerk and accountant, Aberdeen Corporation Tramways.

As a result of the Entrance Scholarship Examination held at Faraday House Electrical Engineering College on April 9th, 10th and 11th, the following awards have been made by the Governors of the College:—J. Rosenkrantz, Central Foundation School, London, the "Faraday" Scholarship of 50 guineas per annum, tenable for two years in college and one year in works; H. T. Horsfield, Erith County School, the "Maxwell" Scholarship of 50 guineas per annum, tenable for one year in college and one year in works; J. Ruston, Borden Grammar School, Sittingbourne, an exhibition of 40 guineas per annum, tenable for one year in college, and one year in works; J. Salomovitch, Central Foundation School, London, an exhibition of 40 guineas per annum, tenable for one year in college and one year in works; P. G. Chick, King Edward VI School, Norwich, an exhibition of 30 guineas per annum, tenable for one year in college and one year in works; A. M. Midgley, University College School, an exhibition of 30 guineas per annum, tenable for one year in college and one year in works; H. R. Rowbotham, Aldenham School, Herts, entrance prize of 20 guineas; R. W. Partridge, Repton School, entrance prize of 20 guineas; G. S. Pillans, Brighton College, entrance prize of 10 guineas.

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OBITUARY.

MR. J. J. COOK, on March 28th, aged 29 years. He was manager of Darlington Corporation electricity showrooms.

MR. HERBERT SMITH, on April 6th, aged 46 years. He was for some years a member of the E.C.A. but gave up contracting a year or two ago and confined himself to accumulator work, and built up a big business in making and repairing motor car and other batteries and also magnetos.

MR. WILLIAM WORBY BEAUMONT, on Sunday, aged 80 years. He was for ten years joint editor of "The Engineer," but resigned from that position 25 years ago. He was vice-chairman of the London Electric Vehicle Committee, and among his published works are "Industrial Electric Vehicles," "Electric Motor Boats and Motor Cars" and "Modern Electric Practice."

MR. ARTHUR ERNEST ANGOLD, in a Birmingham nursing home on April 10th, in his 57th year. His death removes from the electrical profession a most gifted and brilliant engineer. Although he had not for many years enjoyed good health, he was engaged in his usual duties as recently as the previous Monday, and it was only within comparatively few hours of his passing away that serious symptoms were manifest, necessitating an emergency operation, from which he failed to recover. He was educated at the Birkbeck School, and received his earliest engineering training with Richardson of Gray's Inn Road, London, subsequently proceeding to Binko of Leadenhall Street, who traded largely in lightning conductors and bells. In 1890 he designed and made his first arc lamp at home, and as it met with the approval of Torr Todman, who had an engineering works in Bermondsey, he joined him and inaugurated an arc lamp department. The Todman-Angold arc lamp was first shown at the second Crystal Palace Exhibition. An early contract was for lighting the shops of a ready-made tailor in London, the installation comprising some 70 lamps, each taking 10 A on a 50 V 83 cycle circuit. This was the biggest arc lamp load on the mains of the old Deptford station, and probably the biggest electric shop lighting installation in London at that date. In 1892, the General Electric Co., desirous of developing its arc lamp work, arranged to take over the arc lamp department of Torr Todman, and thus Mr. Angold joined the firm to which he gave 37 years' service. He was first associated with Mr. Max Railing, in charge of the then existing Thames Street works, where, apart from arc lamps, various accessories were made, such as small transformers, choking coils, and liquid resistances, while one of their specialities was the Swinton-Angold cigar lighter. Some of the earliest Angold arc lamps made in the Thames Street works were for an exhibition in Bristol, while another installation about the same period was in Spiers and Pond's shops in Ludgate Hill. An interesting contract was that for liquid resistances controlling stage arcs in the Savoy Theatre. The three sets of liquid resistances for controlling respectively the red, white and blue batteries represented the biggest installation of its kind then existing in London. The original "Angold" open type arc lamps soon became known, and, in due course, the enclosed and flame type arcs were produced. He subsequently originated the idea of the magazine arc. He was also responsible for special studio and photographic arcs, but his most valuable contribution to this subject was made during the war, when his unique experience was applied to the development of special searchlight arcs for the Services. In particular, he devised mechanisms for simplified control, and developed a lamp capable of burning a "Beck" arc, whose essential feature was the use of flame carbons, with their burning ends surrounded by methylated spirit flames. Throughout his career, and more especially since the war, Mr. Angold contributed to the development of electrical machinery, switchgear and instruments in wide variety. Mention may also be made of his work in connection with automatic sub-stations. From many of his relays he abolished the moving coil, introducing moving magnets. His high-speed circuit breaker has also won warm commendation, while just prior to this death he had completed the design of a new line contact circuit breaker and was engaged in preparing a paper on line contacts as applied to circuit breakers, for presentation to the I.E.E., of which he was a member of long standing. See page 485.

Mr. Henry Nimmo, electrical adviser and superintending electrical engineer to the Government of Burma, has proceeded on eight months' leave, and Mr. J. H. Eades is officiating in his stead. His address while in England will be "Wingates, Matching Green, Harlow, Essex."

OVERSEAS TRADE.

Three Months' Exports of Electrical Goods Exceed Imports by £2 770 422.

UNITED Kingdom exports of electrical machinery, apparatus and material during March, 1929, amounted to £1 372 691, or £372 233 less than for the same month last year. Imports for the month under review amounted to £572 024, representing an increase of £56 527 when compared with the corresponding month of 1928. For the three months of this year, the total electrical exports amounted to £4 449 357, a decline of £324 460 when compared with the corresponding period of 1928. Total imports of the same goods during January, February and March of this year, amounted to £1 678 935, an increase of £110 160, when compared with the total for the same months of last year.

Electrical exports for March last exceeded imports by £800 667, while for the first three months of this year they were £2 770 422 in excess of imports.

Items which contributed to the decline of exports during March, were railway and tramway motors, with a decrease of £64 951, when compared with the same month last year, and other motors and generators with a decline of £35 401. Submarine telegraph and telephone cables were also responsible for a share in the lower total for the month, the decline under that item being £50 995.

On the import side, increases were chiefly due to materials such as rubber insulated wires and cables, £10 259, while telegraph and telephone instruments increased by £166 864.

The following are detailed figures:—

	Month of March		Three Months.	
IMPORTS.	1928.	1929.	1928.	1929.
	£	£	£	£
Electrical Machinery	157 772	149 803	446 244	427 237
Electrical Wires and Cables, Insulated,—				
Rubber insulated (not being Telegraph or Telephone Wires or Cables)	16 378	15 412	43 859	47 088
Insulation other than rubber (not being Telegraph or Telephone Wires or Cables)	45 327	44 035	135 032	145 291
Telegraph and Telephone Wires and Cables (not being Submarine Cables)	11 422	3 531	29 451	15 804
Submarine Telegraph and Telephone Cables	—	—	—	—
Telegraph and Telephone Instruments and Apparatus (except wireless valves)	49 045	98 297	150 582	317 446
Carbons, Electric	10 372	18 585	34 372	44 749
Electric Lamps and parts thereof—				
Electric Glow Lamps	42 542	49 101	169 231	92 350
Arc Lamps and Electric Searchlights	301	731	1 185	3 107
Parts Thereof (except Carbon Rods)	2 163	100	3 303	2 876
Batteries and Accumulators (including parts)	42 717	44 788	129 301	144 102
Electrical Instruments (other than telegraphic and telephonic): Commercial (including ammeters, voltmeters, etc.), House Service Meters, and Scientific	22 488	22,927	71 853	62 303
Switchboards, other than Telegraph and Telephone	328	157	394	1 208
Electrical Goods and Apparatus, all other Sorts	114 642	124 557	353 968	375 374
Total of Electrical Goods and Apparatus	515 497	572 024	1 568 775	1 678 935
EXPORTS.				
Electrical Machinery—	£	£	£	£
Railway and Tramway Motors	70 634	52 411	174 714	109 763
Other Motors and Generators	226 390	140 247	618 253	582 852
All other Sorts	347 408	293 597	942 733	968 856
Electrical Wires and Cables, Insulated—				
Rubber Insulated (not being Telegraph or Telephone Wires or Cables)	115 142	101 305	354 830	360 899
Insulation other than Rubber (not being Telegraph or Telephone Wires or Cables)	137 834	127 137	382 284	359 938
Telegraph and Telephone Wires and Cables (not being Submarine Cables)	71 133	40 525	295 252	187 161
Submarine Telegraph and Telephone Cables	19 109	2 614	71 008	20 813
Telegraph and Telephone Instruments and Apparatus (except wireless valves)	332 270	218 600	813 351	671 061
Carbons, Electric	2 383	158	6 835	1 730
Electric Lamps and Parts—				
Electric Glow Lamps	38 543	39 648	118 554	137 003
Arc Lamps and Electric Searchlights	952	631	3 569	3 088
Parts thereof (except Carbon Rods)	118	—	560	1 941
Batteries and Accumulators (including parts)	102 744	77 190	262 693	258 814
Electrical Instruments (other than Telegraphic and Telephonic): Commercial (including ammeters, voltmeters, etc.), House Service Meters and Scientific	38 419	26 049	97 788	83 655
Switchboards, other than Telegraph and Telephone	2 304	5 631	27 276	19 774
Electrical Goods and Apparatus, all other Sorts	239 541	246 948	604 117	682 009
Total of Electrical Goods and Apparatus	1 744 924	1 372 691	4 773 817	4 449 357

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COOKING IN AIRCRAFT.

Specially Designed Electric Cooking Equipment for the R101.

THE Automatic Telephone Manufacturing Co., Ltd., Strowger Works, Liverpool, has just completed the manufacture of a special lightweight electric cooking and water heating installation for the new British airship, R101, now under construction at Cardington. The problem set by the Air Ministry, by whom the equipment was ordered, was no light one. Cooking accommodation for 100 persons was specified, the complete installation being restricted as to maximum permissible weight, and electric power available for this specific duty. Furthermore, due to the proximity of large volumes of hydrogen, all elements had to be rated for low current density, ensuring " black " heat at full load, and an absence of risk of ignition of any escaping gas. To this end also, all switch controls had to be of special design, in flame-proof enclosures, following the usual procedure for safeguarding electrical apparatus in collieries. The equipment—into the construction of which duralumin, the lightweight alloy, largely enters—comprises five separate items. The cooking range has four boiling plates, and an oven, 24 in. by 24 in. by 18 in. The two back boiling plates are each 8¾ in. diameter and of 1 500 W loading, whilst the front plates are each 7 in. diameter and loaded to 1 000 W. All are totally enclosed, and the hob plate is surrounded by a guard rail to ensure the stability of utensils placed upon it. The oven has two heating elements, each of 1 250 W, and the entire range is wired for three-heat control through the medium of a totally enclosed control switchbox, the supply being at 220 V, 100 cycles. There are three sliding rack shelves in the oven.

Steaming and Hot Water Systems.

A vegetable steamer with a capacity 18 in. by 22 in. by 24 in., is equipped with elements giving a total loading of 1 500 W, and is furnished with single heat control. It is fitted with removable wire tray baskets. A ball-valve tank is attached to the right-hand side of the steamer for maintaining a continuous supply of water to compensate for the evaporation loss. A hot cupboard measuring 3 ft. 6 in. by 1 ft. 10 in. by 2 ft. 8 in., is heated by elements totalling 2 000 W, and is equipped for single heat control. It has sliding doors, perforated metal shelves, and the top is recessed to function as a carving table and to facilitate the retention of plates, etc., placed upon it. To ensure a supply of hot-water for dish-washing, etc., a 40-gallon cylindrical hot water storage tank is provided. It is equipped with three immersion heaters, one of 1 000 W and two of 750 W loading, making a total of 2·5 kW. Smaller demands, for tea, etc., are met by a 3-gallon urn, equipped with two 750 W units, protected against burn-out in the absence of water by a thermal cut-out connected in series with their common junction.

Having regard to the importance of weight limitations it is interesting to record that the total weight of the completed equipment worked out within 10 lbs. of the limit set by the Air Ministry.

LEGAL INTELLIGENCE.

Judgment in Dispute Concerning Clutches for Electric Motors.

IN the King's Bench Division, on April 12th, Mr. Justice Talbot gave judgment in the action tried last term, brought by the Cooper Roller Bearings Co., of King's Lynn, against the Power Plant Co., of West Drayton. (See THE ELECTRICIAN of April 5th.)

His Lordship concluded his remarks by saying that there would be no formal judgment entered now, but ultimately plaintiffs would be entitled to judgment on the claim and counterclaim with costs. He left the parties to move for judgment when the actual amount to which it was found, after the reference, they were entitled had been ascertained. He did not know whether the case was going further or if the parties were likely to agree as to figures, but the result was to leave the parties to move.

Mr. Cyril Atkinson said he should in due course, after the amount had been determined by the Official Referee, apply for judgment for the plaintiffs on the claim and counterclaim with costs.

North Wales Power Co.

Mr. Justice Maugham in the Chancery Division on Monday, sanctioned a petition by the North Wales Power Co., Ltd., asking for a reduction of its capital.

Mr. Lionel Cohen, K.C., for the company, said the proposal was to cancel 10s. per share on each of the 383 883 issued ordinary £1 shares. The reduction was part of a scheme to reorganise the company with a view to raising fresh capital to enable it to carry out its duties under the new regional power arrangements. The company's capital was £1 000 000 divided into 500 000 each of ordinary and preference shares. Resolutions had been passed to sub-divide both classes of shares into 10s. shares, and converting the preference into ordinary shares. The capital would then be increased to the original amount by the creation of new ordinary of 10s. each. Among the terms involved in the reorganisation was one that the company should buy the hydro-electric undertaking of the Aluminium Corporation under certain conditions.

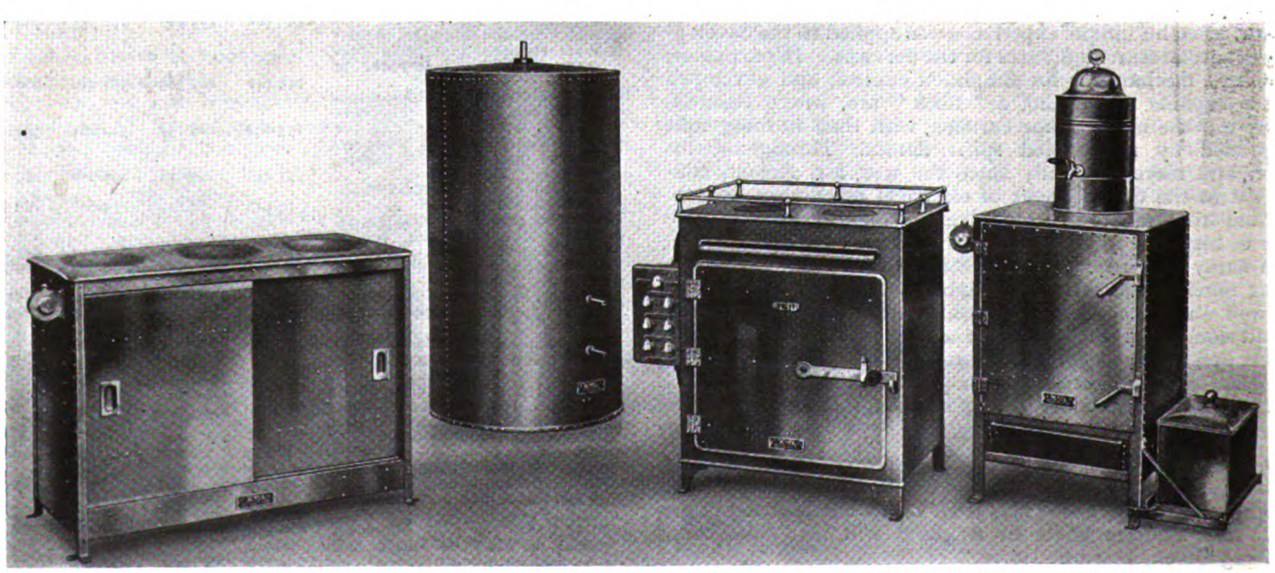
Marconi Company's Petition.

Mr. Justice Maugham in the Winding-up Court on Monday, made an order for the compulsory liquidation of the Zone Wireless Co., Ltd., on the petition of Marconi's Wireless and Telegraph Co., Ltd.

Lamp Patents.

In the Chancery Division on Tuesday, before Mr. Justice Luxmoore, the British Thomson Houston Co., Ltd., moved for judgment in default of appearance and defence against Harris's, of Shudehill, Manchester, in respect to the infringement by the defendants of letters patent concerning incandescent electric lamps, which patents have been upheld by the House of Lords. The plaintiffs asked for an injunction to restrain the defendants from infringing the patent, and also applied for an order that infringing articles be given up, and an inquiry as to damages.

The order asked for was made, with costs.



Some of the electrical equipment which was designed and manufactured by the Automatic Telephone Manufacturing Co., Ltd., for use in the airship R101.

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RADIO TRADERS' MEETINGS.

An Approved List of Wholesalers—Date of Radio Exhibition Under Discussion—Valves at Cut Prices—The W.R.A. Making Progress—New Rules for Retailers—Improper Discounts.

TWO annual meetings of radio trade associations were held in London on April 10th. The first was the first annual general meeting of the Radio Wholesalers' Federation, which was preceded by a luncheon at the Connaught Rooms.

The chairman (Mr. E. W. Houghton), proposing the adoption of the annual report, mentioned that the membership was already practically 50, although this number might well have been doubled had not the Council paid strict regard to the principles upon which the Federation was founded.

One of the most important features of the Council's work was the compilation of an approved list of wholesalers which it was intended would ultimately contain the names of all genuine radio wholesalers. A large number of applications for inclusion on this list had been received, and one of the first duties of the new Council would be to go through these with a view to the preparation of the list.

The Chairman dealt with the R.W.F.'s negotiations with the B.R.V.M.A. upon a variety of subjects affecting the relationship between the members of these two organisations, and then passed to a review of the " reciprocal understanding " which had been effected with the W.R.A. The Federation's relations with the R.M.A. were upon an excellent footing, but somewhat hampered owing to the constitution of that body, which precluded joint negotiations upon several aspects of trade vital to radio wholesalers. The Federation was thus placed in the position of having to negotiate separately with manufacturers.

The adoption of the report was seconded by Mr. B. R. Banks. In the discussion that followed Mr. C. Orgel (Superlamp, Ltd.) urged that efforts should be made to secure that the Radio Exhibition should be held on a more suitable date from the trade point of view, or, alternatively, assuming that to be impossible, that a preliminary trade show should be held in May or June, a restriction being imposed that no goods be shown at the public exhibition not previously shown at the trade show. Such a scheme as this would afford wholesalers adequate time to arrange their season's programmes, and to have their catalogues up to date. Another suggestion by Mr. A. J. Rudd (The Esco Co., Norwich) was that there should be a trade day at the Radio Exhibition.

Mr. A. E. Harris (Harris and Russell, Ltd.) called attention to the fact that valves were still being sold at cut prices, which were obviously being obtained through irregular channels, and suggested that valves should be marked and boxed in a manner as to leave no doubt as to the source from which they emanated.

The constitution of the Council of the Federation is such that three members fall out each year. There were five nominations for the three seats, and on a ballot the following were declared elected :—Mr. E. H. Burris (Messrs. F. Burris and Sons, Bristol), Mr. E. U. Redway (Southern Motor Factors, Ltd., Eastbourne), Mr. J. W. Riddiough (Messrs. F. Riddiough and Son, Bradford).

Mr. A. G. Beaver initiated a discussion upon methods of investigating the status of retail applicants for trade terms. With a view to making it difficult for all but bona fide traders to obtain supplies of radio goods, the Federation has in mind to offer the trade a standard form for this purpose, supplemented by a suggested system of tests and checks.

WIRELESS RETAILERS' ASSOCIATION.

The annual general meeting of the Wireless Retailers' Association was held at St. Bride's Institute. The hon. treasurer, commenting upon the report and accounts for 1928, remarked on the fact that so much had been accomplished with so little funds. It was a matter of disappointment to the Council that so many members allowed their membership to lapse by the non-payment of subscriptions, and he hoped that they would realise the necessity of their continued support. Funds were necessary to the successful functioning of the Association, and to enable it to take its place as a representative body of retailers along with the manufacturing and factoring organisations. He stressed the need of close and effective co-operation between the R.M.A., the R.W.F., and the W.R.A. Until these bodies were all in line, satisfactory trading conditions could not be enforced. Although the formation of local associations deprived the headquarters of the *per capita* grant, he welcomed the extension of the movement as a very gratifying sign, and expressed the belief that efforts in this direction would have greater success in the future.

In proposing that Mr. Horsey be elected Vice-President of the Association, Mr. A. de Villiers remarked that Mr. Horsey had officiated as Chairman of the Association almost from its inception. Mr. Lightfoot seconded the resolution, which was carried unanimously.

Mr. Horsey proposed that Mr. A. de Villiers should be appointed Chairman. The proposal was seconded by Mr. Hammond and carried unanimously. It was proposed by Mr. Lightfoot, seconded by Mr. Wright, and unanimously resolved, that Mr. Botambeau be elected Vice-Chairman.

The Chairman read the names of the retiring members of the Council, and it was unanimously resolved that the following members be re-elected :—Messrs. F. W. Doughty ; J. W. Lightfoot ; C. F. Jacoby ; A. J. Morgan ; C. L. Elliott ; S. R. Wright ; L. S. Davis ; S. G. Beeson ; J. E. Morley ; H. T. Morgan ; E. J. Hammond ; F. Chidsey ; G. C. Kentish ; L. T. Dobbin ; B. J. Turner ; R. C. Gilbert ; W. Moody ; W. Jennings ; and E. W. Burnett.

The following members were unanimously elected additional members of the Council :—Messrs. Shearman Dyer ; A. H. Edridge ; C. F. Thatcher ; A. E. Firmin ; Herbert Smith ; L. H. Collings ; and S. Dagnall.

It was proposed by Mr. de Villiers, seconded by Mr. Davis and unanimously resolved, that Mr. Willard be re-elected hon. treasurer for the current year.

Speaking for his firm upon their re-election as secretaries, Mr. H. M. Clifford said they derived great satisfaction from the steady progress made by the Association in membership, in influence and in prestige. The co-operative action which must, in due course, arise between the three associations representing the manufacturers, wholesalers and retailers respectively, must be of great benefit to all.

The proposed new rules were considered at some length, and motions for several alterations which were suggested were subsequently withdrawn. It was finally proposed by Mr. H. T. Morgan, seconded by Mr. Davis, and unanimously resolved, that the new rules as printed and circulated to the members be and are hereby adopted *en bloc* as the Rules of the Association in substitution for the old rules.

Some discussion followed on general matters during which the secretary of the South Wales W.R.A., Mr. H. T. Morgan, instanced some flagrant cases of price-cutting and the improper allowance of discounts which had recently come under the notice of his Committee, and in concluding he stated that the support received by his organisation from the W.R.A. was a matter of satisfaction to them.

A member expressed the hope that, in course of time, the R.M.A. would only supply the R.W.F., and that both bodies would only supply retailers approved by the W.R.A.

TRADE PUBLICATIONS.

THE April stock list of T. HARDING, CHURTON AND CO., LTD., Atlas Works, Leeds, has been received.

A bridge marker, illustrated with views of the Prescot works, has been sent to us by BRITISH INSULATED CABLES, LTD.

The A.E.G. ELECTRIC CO., LTD., 121, Victoria Street, London, S.W.1, has issued X 1100 E and X 1106 E, dealing with domestic electrical appliances.

L.445, entitled " Lighting in Industry," has been received from THE BRITISH THOMSON-HOUSTON CO., LTD., of Mazda House, Newman Street, London, W.1.

The MIDLAND ELECTRIC MANUFACTURING CO., LTD., Barford Street, Birmingham, has issued a leaflet relating to the " Mem 8 " double-pole switch and fuse unit.

The BRITISH THOMSON-HOUSTON CO., LTD., Rugby, has sent us list No. 1 105–A* which deals with steam turbines of large pressure type. This list cancels D.6 No. 1 105.

The TUNGSTONE ACCUMULATOR CO., LTD., of Salisbury Square, London, E.C.4, has published a special folder devoted to the merits of accumulators bearing the Tungstone trade mark.

SIEMENS ELECTRIC LAMPS AND SUPPLIES, LTD., 38–39, Upper Thames Street, London, E.C.4, have sent us leaflet No. 257, dealing with the new reduced prices of " Pearl " and " Silvalux " lamps.

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BUSINESS OPENINGS.

Latest Particulars of Electrical Engineering and Wiring Installation Contracts for which Tenders are being Invited at Home and Abroad.

WE give below the latest particulars of contracts for which tenders are invited. The closing date is given, when available.

CARLISLE CORPORATION.—Supply of lead covered, and lead covered and paper insulated, cables, for one year. Specification, etc., from Mr. C. W. Salt, city electrical engineer.

RENFREWSHIRE EDUCATION AUTHORITY, April 19th.—Electrical work in connection with alterations and additions to North Public School, Paisley. Schedules, etc., from Mr. J. H. Pullar, 16, Glasgow Road, Paisley; deposit £1.

CENTRAL ELECTRICITY BOARD, April 22nd.—Supply and erection of 33 000 V and lower voltage transformers. Specification (No. N.W.E.-ST.2) and form of tender from Mr. R. H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

Government Lamps Contract.

COMMISSIONERS OF HIS MAJESTY'S WORKS, ETC.—April 22nd.—Supply of incandescent lamps. Forms of tender, etc. from the Controller of Supplies, King Charles Street, Westminster, S.W.1.

EDINBURGH EDUCATION AUTHORITY, April 22nd.—Electric lighting work, in connection with erection of Saughton Mains School. Specifications, etc., from Mr. J. A. Carfrae, 3, Queen Street, Edinburgh.

GLASGOW CORPORATION, April 22nd.—One year's supply of electrical fittings and accessories, etc. Specifications from the Lighting Department, 20, Trongate, Glasgow.

NEWMILNS AND GREENHOLM CORPORATION, April 22nd.—Electric lighting work in 17 houses. Particulars from the surveyor, Mr. James H. Gilmour.

GLASGOW CORPORATION, April 23rd.—Twelve months' supply of various stores and materials to the tramways department. Specifications, etc., from the General Manager, 46, Bath Street, Glasgow.

DUNDEE CORPORATION, April 24th.—One year's supply of stores to transport department, including armature and field coils, carbon brushes, etc. Specifications from Mr. D. P. Morrison, Transport Office, Dundee.

HOLBORN (LONDON) GUARDIANS, April 24th.—Supply of electrical fittings, for one year. Forms of tender from the Clerk, 53, Clerkenwell Road, E.C.1.

MANCHESTER CORPORATION, April 24th.—Twelve months' supply of dry batteries, adhesive tapes, cable covers and tiles, fuse boxes, junction boxes, insulators, tinned copper wire, etc. Forms of tender, etc., from Mr. H. C. Lamb, Electricity Department, Town Hall, Manchester.

NORTHERN IRELAND GOVERNMENT, April 25th.—Installation of electric light, bells and power wiring at Stranmillis Training College, Belfast. Form of tender, etc., from the Ministry of Finance, 15, Donegall Square West, Belfast.

SALFORD CORPORATION, April 26th.—Supply of e.h.t. and l.t., paper insulated, lead covered cable. Particulars from the City Electrical Engineer.

DUNDEE HARBOUR TRUSTEES, April 27th.—Supply and erection of two 3-ton, electric, travelling jib, portal cranes at King George V. Wharf, Dundee Harbour. Specifications, etc., from the General Manager and Engineer, Harbour Chambers, Dundee.

CENTRAL ELECTRICITY BOARD, April 29th.—Supply and erection of electricity meters, in connection with the Central Scotland Electricity Scheme. Specification (No. C.S.-S.S.14) and form of tender from Mr. R. H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

MANCHESTER CORPORATION, April 30th.—Supply and erection of one 33 000 V, 11 500 kVA, self-cooled, outdoor auto-transformer (specification No. 250) and one 6 600 V switch, etc., and a neutral earthing resistance (specification No. 251). Specifications from Mr. H. C. Lamb, Electricity Department, Town Hall, Manchester; deposit £1 1s. for each.

SOUTHAMPTON CORPORATION, April 30th.—(1) Steel framed building, platform for fans, overhead bunkers, etc.; (2) two water tube boilers with superheaters, economisers, stokers, fans, soot blowers, etc.; (3) steam, feed water and other piping, etc.; and (4) water softener, at Electricity Works, Western Esplanade, Southampton. Specification, etc., from Mr. W. G. Turner, borough electrical engineer; deposit £2 2s.

STAFFORDSHIRE EDUCATION COMMITTEE, April 30th.—Electric light installation in the Girls' High School, Stafford. Specification, etc., from Messrs. Moffett, Rosher and Mann, Union Chambers, Temple Row, Birmingham; deposit £3 3s.

STAFFORDSHIRE EDUCATION COMMITTEE, April 30th.—Electric light and power installation in new High School for Girls, Wellington Road, Bilston. Specification, etc., from Messrs. Moffett, Rosher and Mann, Union Chambers, Temple Row, Birmingham; deposit £5 5s.

DEVIZES RURAL DISTRICT COUNCIL, May 1st.—Electric light installation in houses at Market Lavington, Potterne, and Rowde. Particulars from the clerk, Mr. P. R. Trapp, Maryport Chambers, Devizes.

HEYWOOD CHAPEL, NORTHOWRAM, May 1st.—Electrical installation in chapel, school, manse and caretaker's house. Tenders to Mr. F. Rushworth, 24, Back Clough, Northowram.

EPPING GUARDIANS, May 2nd.—Electric light installation at the Institution. Specification, etc., from the Clerk, High Street, Epping.

WALTHAMSTOW EDUCATION COMMITTEE, May 3rd.—Electrical installation in Billet Road School, Walthamstow. Specification, etc., from Mr. G. R. Spurr, Electricity Works, Exeter Road, Walthamstow, London, E.17; deposit £1.

CENTRAL ELECTRICITY BOARD, May 4th.—Supply and erection of 33 000 V and lower voltage cables, under the South-East England electricity scheme. Specification (No. S.E.E.-G.C.1) and form of tender from Mr. Richard H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

EDINBURGH EDUCATION AUTHORITY, May 6th.—Electric lighting installation in Gorgie New Special School and Annexe to Trinity Academy, Bangholm Recreation ground. Schedules etc., from the Education Offices, Castle Terrace, Edinburgh.

ISLINGTON (LONDON) BOROUGH COUNCIL, May 6th.—Supply and installation of two lead batteries for Edison refuse collecting vehicles, having carrying capacity of 3½ to 4 tons, Further particulars from the Cleansing Superintendent, Liverpool Road, N.1.

WEST MIDLANDS JOINT ELECTRICITY AUTHORITY, May 10th.—(a) Main 33 000 V switchgear, each circuit breaker having rupturing capacity of not less than 1 500 000 kVA; (b) auxiliary 33 000 V switchgear, each circuit breaker having rupturing capacity of not less than 500 000 kVA, with group feeder reactors, for Ironbridge power station. Specification (No. 4) and form of tender from Mr. E. F. Hetherington, chief engineer and manager, Phœnix Buildings, Dudley Road, Wolverhampton; deposit £2 2s.

WEST MIDLANDS JOINT ELECTRICITY AUTHORITY, May 10th.—(1) One 50 000 kW turbo-alternator, with step-up transformers, etc.; (2) condensing plant, boiler-feed pumps, evaporators, etc.; (3) circulating water pumps, etc., for Ironbridge power station. Specifications (No. 2) and form of tender from Mr. E. F. Hetherington, chief engineer and manager, Phœnix Buildings, Dudley Road, Wolverhampton; deposit, £2 2s.

Overseas.

UNLESS otherwise stated, particulars of overseas contracts are to be had from the Department of Overseas Trade (Room 52), 35, Old Queen Street, Westminster, London, S.W.1. *Note.—An asterisk denotes that local representation is, in practice, essential.*

LOURENCO MARQUES PORT AND RAILWAYS BOARD, April 22nd.—Supply of electric hanging and ordinary lamps. (Reference B.X. 5 188.)

DUBLIN PORT AND DOCKS BOARD, April 23rd.—Supply and erection of three electric, overhead, travelling cranes and gantries, at new tobacco warehouse, Custom House Docks, Dublin. Specification, etc., from the Engineer, East Wall, Dublin.

PORT ELIZABETH MUNICIPALITY, April 25th.—Supply and erection of 22 000 V switchgear, h.t. and l.t. switchboards (specification No. 20). (Reference B.X. 5 194.)

PORT ELIZABETH MUNICIPALITY, April 25th.—Supply of 200 kVA transformer, earth resistance and various lamps (specification No. 22). (Reference B X. 5 195.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, April 25th.—Supply of three electrically-driven wheel lathes (tender No. 1 410). (Reference A.X. 7 621.)

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JOHANNESBURG MUNICIPALITY, April 27th.—Supply of steel tramway poles (contract No. 154). (Reference A.X. 7 728.)

IRISH FREE STATE ELECTRICITY SUPPLY BOARD, April 29th.—Supply and laying of 40 000 V cables in the county and city of Dublin. Specification, etc., from Mr. P. J. Dempsey, 60–62, Upper Mount Street, Dublin; deposit £5.

VICTORIAN ELECTRICITY COMMISSION, April 29th—Supply of two or three steam turbo generator sets, with condensers, etc., for Yallourn power station extension (specification 29/7). (Reference B.X. 5 062.)

VICTORIAN ELECTRICITY COMMISSION, April 29th.—Supply of two swing hammer mills, with electric motors, for brown coal (specification 29/9). (Reference A.X. 7 434.)

CAPETOWN MUNICIPALITY, May 1st.—Supply of 30 ft. steel poles, cross arms, insulators, fly fuses, etc. (specification 459/1929). (Reference A.X. 7 697.)

LOURENÇO MARQUES PORT AND RAILWAYS BOARD, May 6th.—Supply of electric motors, turntables, drilling machine, etc. (Reference A.X. 7 765.)

STATE ELECTRICITY WORKS, MONTEVIDEO, May 6th.—Supply of electric cables and accessories. (Reference B.X. 5 178.)

BRAY URBAN DISTRICT COUNCIL, May 7th.—Supply and erection of (*a*) steam crane, and (*b*) electric crane, to lift three tons, at Bray Harbour. Further particulars from Mr. E. M. Murphy, 27, Molesworth Street, Dublin.

NEW ZEALAND PUBLIC WORKS DEPARTMENT, May 7th.—Supply of two electric motor-driven centrifugal pumps. (Reference A.X. 7 738.)

NEW SOUTH WALES PUBLIC WORKS DEPARTMENT, May 13th.—Supply and erection of synchronous condenser (contract 257, 28). (Reference B.X. 5 205.)

EGYPTIAN MINISTRY OF PUBLIC WORKS, May 15th.—Supply and erection at Government Printing Office, Cairo, of 120 kW d.c. Diesel electric generating set, with foundations, artesian well, electrically-driven water cooling pump, etc. Forms of tender, etc. (10s. 6d.), from Chief Inspecting Engineer, 41, Tothill Street, London, S.W.1.

MELBOURNE AND METROPOLITAN TRAMWAYS BOARD, May 15th.—Supply of 500 kW sub-station rectifier unit, arranged for automatic control, with necessary switchgear (contract 677). (Reference B.X. 5 206.)

MELBOURNE AND METROPOLITAN TRAMWAYS BOARD, May 15th.—Supply of sub-station units for automatic control, comprising two rotary converters of 1 000 kW and one of 500 kW (contract No. 678). (Reference B.X. 5 210.)

VICTORIAN RAILWAY COMMISSION, May 15th.—Supply of one geared, three-phase, electric winding engine (contract No. C.M. 778). (Reference A.X. 760.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, May 16th.—Supply and installation of electric signalling apparatus at Johannesburg. (Reference B.X. 5 165.)

BLOEMFONTEIN MUNICIPALITY, May 18th.—Supply and erection of (*a*) turbine and generator, condensing plant and auxiliaries and switchgear and cables; (*b*) cooling spray pond equipment, or cooling tower (contract No. 1). Reference B.X. 5 192.)

PLOVDIFF (BULGARIA) PROVINCIAL COUNCIL, May 20th.—Supply of two Francis turbines, two 5 000 kVA generators, two 5 000 kVA, two 1 000 kVA and two 150 kVA transformers, for Votscha-Kricim power station.

SOUTH AFRICAN POSTS AND TELEGRAPHS, May 23rd.—Supply of rubber covered wire and telephone cable (contract No. 153.) (Reference B.X. 5 229.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, May 28th.—Supply of telephone jacks and number plates (schedule C.417). (Reference B.X. 5 202.)

Telegraph Materials for South Africa.

SOUTH AFRICAN POSTS AND TELEGRAPHS, May 30th.—Supply of telegraph materials, tubular arms, crossheads, bases, stay plates, etc. (tender No. 152). (Reference A.X. 7 767.)

TANGANYIKA GOVERNMENT, June 1st.—Concession for utilisation of Pangani River Falls for the development of electric power. Copies of the draft concession may be obtained from the Crown Agents for the Colonies, 4, Millbank, London, S.W.1.

NEW SOUTH WALES PUBLIC WORKS DEPARTMENT, June 4th.—Supply of 18 electrically operated water level indicators (contract No. 61/1928–29 W.S. and S.). (Reference B.X. 5 233).

VICTORIAN ELECTRICITY COMMISSION, June 4th.—Supply of 22 000 V transformers and spares (specification No. 29/36). (Reference B.X. 5 216.)

POSTMASTER-GENERAL'S DEPARTMENT, Melbourne, June 18th.—Supply of switchboard cable (contract C. 427). (Reference B.X. 5 228.)

NEW SOUTH WALES PUBLIC WORKS DEPARTMENT, June 22nd.—Supply and erection of transformers, with certain spares, for Burrinjuck hydro-electric development (contract No. 29/29). (Reference B.X. 5 230.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, June 25th.—Supply of protected type, telephone cable terminal boxes (schedule C.430). (Reference B.X. 5 231.)

STATE ELECTRICITY WORKS, MONTEVIDEO, July 8th.—Construction and equipment of 50 000 kW power station.

NEW ZEALAND PUBLIC WORKS DEPARTMENT, July 16th.—Supply of 250 galvanised steel transmission line towers to carry copper conductors, or 190 towers to carry steel-core aluminium conductors. (Reference A.X. 7 735.)

Tenders Accepted.

GENERAL POST OFFICE.—Edison Swan Electric Co., Ltd., distribution boards.

WATFORD CORPORATION.—W. T. Henley's Telegraph Works Co., Ltd., supply of cable.

CANTERBURY GUARDIANS.—J. Elvidge, electrician's work at the Institution for six months.

CHESTER GUARDIANS.—F. J. Jones and Son, supply of electrical goods for three months.

BURTON-ON-TRENT CORPORATION.—Arthur Talbot, electric organ blower at town hall, £96 4s.

HENLEY-ON-THAMES CORPORATION.—Thames Valley Electricity Supply Co., street lighting for five years.

WATFORD CORPORATION.—J. W. Russell, house wiring, at schedule prices, for 12 months. (Recommended.)

BELFAST CORPORATION.—Siemens Electric Lamps and Supplies, Ltd., one year's supply of electric lamps.

GLASGOW CORPORATION.—English Electric Co., Ltd., ten 50-period a.c. motors, £545; Thos. Bolton and Son, Ltd., trolley wire.

EDINBURGH CORPORATION.—Carron Company, supply and erection of traffic lamps at various points in the city, £400. (Estimated.)

HOLBEACH URBAN DISTRICT COUNCIL.—Boston and District Electric Supply Co., Ltd. public lighting, with 76 standards, £263 2s. 6d. per annum.

CAMBRIDGE GUARDIANS.—Siemens-Schuckert (Great Britain), Ltd., installation of automatic telephones, £178, with two years' free maintenance.

BASINGSTOKE CORPORATION.—Hackbridge Cable Co., Ltd., supply of cables, £1 339; Taunton Brick and Tile Works, supply of conduits, 2s. 3d. per yard.

HULL CORPORATION.—Bruce Peebles and Co., Ltd., supply of three 1 500 kW motor converters, £13 115 5s.; Drysdale and Co., Ltd., circulating water pump, £3 363.

YORK CORPORATION.—Barber and Colman, installation of automatic signals at Spurriergate, Gillygate, King's Square, Lawrence Street and Rougier Street, £523 19s. 9d.

GRAVESEND CORPORATION.—Dictograph Telephones, Ltd., installation of internal telephones at electricity offices, £94; W. T. Henley's Telegraph Works Co., Ltd., overhead mains along canal, £1 273 4s. 4d.

CAPE TOWN CORPORATION.—Switchgear and Cowans, Ltd., supply of 24 1 000 A double-bladed, quick break knife switches, £310 7s. 6d.; S.A. General Electric Co., Ltd., supply of motor and starting equipment, at Walmer brickworks, £285. (Both recommended.)

PLYMOUTH CORPORATION.—A. Reyrolle and Co., Ltd., switchgear; British Insulated Cables Ltd., and Metropolitan Electric Cable and Construction Co., Ltd., cables; Ferranti, Ltd., a.c. and d.c. meters; British Electric Transformer Co., Ltd., transformers. (All recommended.)

CENTRAL ARGENTINE RAILWAY. — Metropolitan-Vickers Electrical Co., Ltd., supply of 20 000 V transformers and switchgear of large capacity, for extensions to power station, complete equipment for five new sub-stations, extension equipment for four existing sub-stations, and electrical equipment for 145 coaches, in connection with the extension of the electrification of the Buenos Ayres suburban lines.

BRADFORD CORPORATION.—Indented Bar and Concrete Engineering Co., Ltd., supply of reinforced steelwork for new cooling pond; Mather and Platt, Ltd., supply of two feed pumps; J. Blakeborough and Sons, Ltd., supply of circulating water valves and atmospheric exhaust valve, for a turbo-alternator, and steam valves for a boiler and high pressure plant, at Valley Road power station.

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BUSINESS ITEMS.

THE address of the registered office of the NORTHERN ELECTRIC WIRE CO. is now Mill Brow, Blackley, Manchester.

The GREENWICH CABLE WORKS, LTD., has removed to Mitcham Road, Croydon. Telephone : Thornton Heath 2882

The offices and stores of the STERLING VARNISH CO. have been transferred to Fraser Road, Trafford Park, Manchester.

A PHOTOGRAPH illustrating the simplified range of glareless lamps which has been adopted by members of the E.L.M.A., showing in front the lamps replaced. This stand is being employed this week by Mr. W. J. Jones and Mr. H. E. Hughes in the glareless lamp lectures, of which details were published in our last issue.

The FOSTER ENGINEERING CO., LTD., Morden Works, Wimbledon, London, S.W.19, has opened a new London service depot at 11, Fitzroy Square, W.1.

PRITCHETT AND GOLD AND E.P.S. CO., LTD., with whom are incorporated Messrs. Peto and Radford, inform us that their Glasgow depot has moved to 45, Clyde Place, Glasgow.

The D.P. BATTERY CO., LTD., Bakewell, Derbyshire, has received orders through the English Electric Co., Ltd., for seven batteries in connection with the South East England Electricity Scheme.

One of the largest storage batteries in use in Australia at the present time for telephone exchange work has just been put into commission at Brisbane Automatic Exchange. The battery was supplied by the D.P. BATTERY CO., LTD., of Bakewell, Derbyshire—Australian Agents, T. K. Steanes and Son, Sydney.

The Italian Broadcasting Co. has authorised the MARCONI'S WIRELESS TELEGRAPH CO., LTD., to proceed with the manufacture of a short wave broadcasting transmitter for Italy. The station will to a large extent follow the design of 5SW, and will enable the Italian Broadcasting Co. to carry on a broadcasting service for the Italian Colonies.

FERGUSON, PAILIN, LTD., announce that Mr. J. Reed Wilkinson has been appointed chief sales engineer and manager of the company's London office, situated at Bush House, London, W.C.2, in succession to the late Mr. Frank Thorp. Mr. Wilkinson has had many years' experience in the various departments of the company's head office, and for the last three years has been chief of the sales and estimating departments.

A notable long distance record has just been achieved on the Montlhéry track, Paris, by a 348 c.c. Dunelt Majestic motor cycle, selected by the A.C.U. from a stock of similar machines (each fitted with a B.T.H. magneto) at the manufacturer's works. The machine was driven day and night under A.C.U. observation for between 23 and 24 days, a distance of 25 000 miles being covered. During the run the magneto made over fifty million sparks.

The Swedish Government has placed an order with the MARCONI'S WIRELESS TELEGRAPH CO., LTD., of Marconi House, Strand, London, W.C., for the supply of a 60 kW, aerial energy, transmitter for installation at Stockholm. This contract was obtained by the Marconi company in the face of keen competition, and is a tribute to the design and performance of British broadcasting transmitters which have now been installed in over 20 countries outside Great Britain. The new Swedish broadcasting station will be operated on the low-power modulation system, with deep and distortionless modulation ; and will be worked direct off a three-phase power supply.

ELECTRICITY SUPPLY.

SHIPLEY Electricity Committee has obtained a site in Clarence Road for a sub-station.

Brierfield U.D.C. has received sanction to borrow £10 000 for an electricity conversion scheme.

Colchester T.C. has applied for a loan of £50 000 in connection with an extended area of supply.

Bromley (Kent) T.C. has applied for a loan of £15 000 for general mains and services for the ensuing two years.

Chichester Corporation has applied for a loan of £1 657 in connection with a supply in bulk to Bognor.

The Dalmarnock (Glasgow) generating station will be operated for the Central Electricity Board on and after May 1st.

Driffield R.D.C. has decided to offer no objection to the scheme of the Holderness Trust, Ltd., to supply the whole of the Buckrose area.

Application for a Special Order to extend the area of supply so as to include Warburton, Agden, and High Legh has been made by Warrington T.C.

Leeds Electricity Committee has obtained sanction to borrow £400 000 for mains, £50 000 for sub-station equipment, and £50 000 for assisted wiring.

Runcorn R.D.C. has received notice from the Mersey Power Co. of its intention to extend the supply to Halton by means of overhead cables.

Eastbourne Electricity Committee is to erect 27 new lamps, with Paisley fittings and rings, for decorative lamps on the sea wall of the Royal Parade, and to lay cables at a cost of £1 949.

Pocklington (Yorks) U.D.C. recently decided not to oppose the application of the Holderness Trust, Ltd., for an Order to supply in a district including the Council's area.

The Somerset Drainage Commissioners have given permission to the Bridgwater Electric Light Co. to cut the embankment of the river Parrett in order to lay armoured h.t. cables.

Fulham (London) Electricity Committee proposes to lay new cables in Biscay Road, Claxton Grove, Garvin Road, Glencross Street, and Margravine Gardens, at an estimated cost of £715.

The terms of Luton T.C. for public lighting by electricity by 13 100 W lamps for a minimum period of 10 years, from September 1st to April 15th in each year, at £62 1s. 6d. per annum, have been accepted by Heath P.C.

Luton T.C. has applied for a loan of £153 267 for extensions of the power station, including a 12 500 kW turbo alternator, with condensing plant, etc., 6 600 V switch panel, with cables, etc., two boilers, evaporator, pipework, feed pumps, etc.

Swansea Electricity Committee is to extend mains to subsidy houses on the Birchgrove housing estate.—The Birchgrove Structural Co., Ltd., has asked Swansea Electricity Committee for a supply in bulk, and a supply is to be given, at an estimated cost of £1 000.

Weymouth Electricity Committee has entered into an agreement with the Weymouth Bay Estate as to a supply to Overcombe.—The Committee has obtained sanction to borrow £1 355 in respect of the Upway, Wyke Regis and Two-Mile Coppice sub-station buildings and sites.

Additional cables in the Shepherd Street area are to be laid by Hastings Electricity Committee at a cost of £460 and in Pevensey Road at a cost of £220.—The Committee has obtained sanction for a loan of £1 000 for mains and sub-station equipment for supplying Peasemarsh.

The ratepayers of the Shanghai International Settlement agreed on Wednesday to accept the offer of the American and Foreign Power Co. of £10 000 000 for the Shanghai electricity undertaking. Associated in the transaction is a British group, including Mr. F. Dudley Docker, Sir H. C. Holden, Lazard Bros. and Co., Whitehall Electric Investments, Ltd., and the Whitehall Trust Ltd.

The Central Electricity Board has decided that the question whether the Sculcoates (Hull) station should be retained as a three-shift station or not shall be left open to be decided when the Mid-East England scheme comes into operation. The Board recognises the importance of Hull, and, as a port, ought not to be too dependent upon long transmission lines.

The Central Electricity Board has intimated that Chesterfield may either remain a selected station under the Mid-East England Scheme, and bear the whole of the expense of the transmission line from Walton to Chesterfield, or become a de-selected or " temporary arrangement " station, and continue to take its supply from the Derbyshire and Nottinghamshire Electric Power Co. The Corporation has chosen the latter course.

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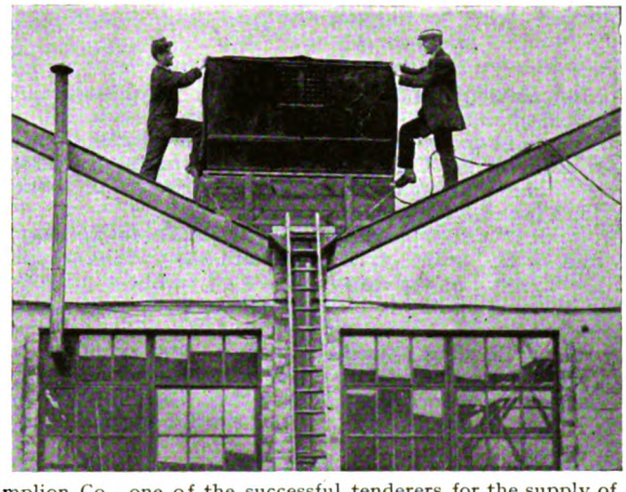
ELECTRICAL NEWS OF THE WEEK IN PICTURES.

Mr. A. E. Angold, whose death last week is referred to on page 479, was one of the early designers of electric arc lamps, and did considerable work throughout the war in designing searchlight arcs for the Services.

Since the coming of the " talking " picture, a new branch of the manufacturing side of sound reproducing apparatus has been developed, and in this picture of the Hawthorne Works of the Western Electric Co. may be seen a number of cinema amplifiers being assembled. Each edition of a talking film requires its own particular sound reproducing equipment, for, at the present time, the necessary apparatus is included in the hiring agreement of the film.



These photographs taken at the Slough works of the Graham Amplion Co., one of the successful tenderers for the supply of totalisators for the Racecourse Betting Control Board, show, left, the indicator in course of construction, and right, the electric recorder which will convey by means of lamps the necessary information to the betting public. The first " tote " is to be installed at Hurst Park, some time in August, and that part of the order secured by Graham Amplion, Ltd., is valued at £100 000.

The annual dinner of the staffs of Messrs. W. T. Henley's Telegraph Works Co., Ltd., and Henley's Tyre and Rubber Co., Ltd., was held at the Great Central Hotel, London, on April 13th, the guests numbering over 500. A concert and dance followed the dinner, a number of musical and variety artistes contributing to the evening's enjoyment. A brief report of the proceedings and speeches is given on page 486, while a photograph of some of the diners is shown above.

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THE SOCIAL SIDE.

THE annual dinner of the staffs of Messrs. W. T. Henley's Telegraph Works Co., Ltd., and Henley's Tyre and Rubber Co., Ltd., took place on April 13th at the Great Central Hotel, Marylebone, London. In addition to an excellent dinner,

THE illumination of St. Martin's-in-the-Fields, London, has been re-designed by Maxwell, Butcher and Co., Ltd., introducing a number of specially designed G.E.C. church lighting units, some of which may be seen in this photograph of the nave.

the entertainment included performances by a number of accomplished musical and variety artistes, with Mr. E. Shakespeare at the piano, and dancing in the Winter Gardens to the music of the Cabaret Band, conducted by Mr. Albert Kersey. Those present, numbering 500, voted the whole function a pronounced success.

Mr. W. G. Smale proposed the toast of "The Cable Company," and said he had seen service with both the Cable Company and the Tyre Company amounting in all to about 30 years, failing by nine months to qualify for one of the long-service awards.

Mr. Percy Rosling (general manager), who occupied the chair, dealt with the history of the Cable Co. He joined the company 42 years ago. The staff then was under a dozen. To-day they were somewhere in the neighbourhood of a thousand.

Sir George Sutton said he had not been well, and only decided at lunch time that day to attend the dinner. He came because he looked upon it as a unique meeting of the Henley Company. It was the first meeting of the kind at which the ladies and gentlemen employed by the company had sat down to dinner together.

Mr. W. F. Bishop proposed the toast of the Tyre Co., and Mr. J. Traxler, who responded, said 1928 had been a record year and they believed 1929 would eclipse 1928. Sir George was wrong in saying that was the first gathering at which ladies had been present. The Tyre Co. set the precedent.

Sir Montague Hughman proposed and Mr. P. Dunsheath acknowledged the toast of "The Ladies."

Mr. Ernest Lefeaux, in the absence of Mr. H. Savage, proposed the toast of "The Chairman," See page 485.

The St. Helens Cable Co. football team won the Slough Town Cup and is also the probable champion team of the Slough Junior League.

THE DIESEL-ELECTRIC OIL TANKER, "BRUNSWICK."

A recent inspection of the Diesel-electric oil tanker, "Brunswick," at Thameshaven, has revealed that the electrical machinery is in as good a condition to-day as when it was installed. The vessel is owned by the Atlantic Refining Co. of Philadelphia, and during the last seven months has covered 48 000 miles, trading between California and South Africa, Australia and New Zealand. Messrs. Scotts' Shipbuilding and Engineering Co., Ltd., Greenock, were the builders, and the British Thomson-Houston Co., Ltd., Rugby, the manufacturers of the electrical propulsion equipment, and auxiliary motors and control gear for all services.

S.E. ENGLAND SWITCHGEAR.

Details of "Indoor-Outdoor" Equipment for Inner London Network.

THE 66 000 V switchgear recently ordered from the British Thomson-Houston Co., Ltd., by the Central Electricity Board for the South East England Electricity Scheme is required in connection with the inner London network. This switchgear is of the "indoor-outdoor" type, and each oil-immersed circuit breaker is rated at 600 A, with a rupturing capacity of 1 500 000 kVA at 66 000 V.

The buildings housing the switchgear have three floors, the two upper being glazed, and provided with access facilities at each end, the lower being unenclosed, but having a retaining wall from end to end. The circuit breakers are located on either side of this wall, the busbars and busbar isolating switches being in the two enclosed floors above.

All busbars are in duplicate on each side, one set being enclosed on the first floor and the other set on the second. Oil-filled bushings of special construction are used where the connections pass through the floor of the top chamber, these bushings also taking the clip contacts of the busbar isolating switches for the first-floor busbars. In most instances copper tube is used for the connections, and all isolating switches are remote operated from ground level, a comprehensive system of interlocks preventing access both to the busbar and isolating switch chamber unless all associated equipment has been made dead. In addition, the interlocking devices are so designed that maintenance men can check the operation of isolators with safety in switch chambers which have been made dead for this purpose, special sequence interlocks being provided to meet this condition.

The oil circuit breakers are of the multi-break type, each phase being self-contained in a cylindrical tank mounted on a frame structure.

Purification of circuit breaker oil is carried out by equipments provided on each site, without removal of any single unit being necessary, but, by means of motor-operated tank trucks, circuit breaker tanks, and complete single-phase units can be removed for inspection.

Special electrical tubular heaters are also included to ensure that the temperature of the busbar chambers is kept above that of the surrounding atmosphere.

METAL AND CHEMICAL PRICES.

TUESDAY, April 16th.

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£83 0 0	—	£16 0 0
Electro Wirebars	,,	£89 0 0	—	£18 0 0
H.C. Wires, basis	per lb.	1s. 0½d.	—	2½d.
Sheet	,,	1s. 0¾d.	—	2½d.
Phosphor Bronze—				
Wire (Telephone) basis	per lb.	1s. 3½d.	—	2½d.
Brass 60/40—				
Rod, basis	per lb.	9d.	—	-
Sheet ,,	,,	11¾d.	—	1¾d.
Wire ,,	,,	11¾d.	—	1¾d.
Pig Iron—				
Cleveland Warrants	per ton	£3 11 0	1s. 6d.	—
Galvanised Steel Wire, basis 8 S.W.G.	,,	£14 15 0	—	—
Lead Pig—				
English	per ton	£26 0 0	—	5s.
Foreign or Colonial	,,	£24 7 6	—	12s. 6d.
Tin—				
Ingot	per ton	£203 10 0	—	£12 15 0
Wire, basis	per lb.	2s. 8½d.	—	1½d.
Aluminium Ingots	per ton	£95 0 0	—	—
Spelter	,,	£26 12 6	—	5s.
Mercury	per bottle	£22 5 0	—	—

Sulphur—Flowers, Ton £12 0 0 *Copper Sulphate*—Ton £25 to £25 10 0
,, Roll, ,, £10 10 0 *Boric Acid* (Crystals) ,, £30
Sulphuric Acid (Pyrites, 168°) Ton £6 15 0 *Sodium Chlorate*—Per lb. 2½d.
Sodium Bichromate—Per lb. 3½d.
Rubber—Para fine, 11⅜d.; plantation, 1st latex, 10⅝d.
∴ The metal prices are supplied by British Insulated Cables, Ltd.

THE LEAD MARKET.

The market rallied slightly last week to £24 18s. 9d. for April and £24 16s. 3d. for July, but according to James Forster and Co., prices later re-acted to £23 17s. 6d. and £23 10s. for the same positions. Later there was a recovery of about 12s. 6d. per ton from the bottom, the tone at the close being steady.

The American price was lowered on April 8th to 7·25 and again on the 11th to 7·15 cents per lb.

Closing prices on April 12th were £24 10s. for April, £24 6s. 3d. for May, £24 3s. 9d. for June, and £24 2s. 6d. for July, unchanged to 7s. 6d. lower on the week.

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COMPANY NEWS.

Telegraph Descriptions Variable—Manufacturing Holdings Unsteady—Electricity Supply Shares Decline—Electric Tractions Improve—Company Meetings, Reports and Dividends.

NO outstanding feature is shown this week in our usual tabular comparison of price changes in the electrical share markets, which have remained relatively quiet. Marconi's Wireless Telegraph shares have lost the half-crown gained last week, but Eastern stock is unaffected by deduction of the dividend. General Electrics are up 1s. 3d., and Ever Readies 6d.—a bigger proportionate improvement. English Electric shares have declined from 7s. 6d. to 6s. 10½d. Underground Electric Railways ordinary shares are 6d. higher, and Metropolitan 3½% preference stock is a point up. County of London ordinary shares have eased 6d.

Last Annl. Divd.	Description.	This Week.	Last Week.	1926 to 1928. Highest	Lowest.
%	**Electricity Supply.**				
(*d*)	Brompton & Kensington Ord. ..	27/-	27/-	35/6	23/9
4	Central Elec. Sup. 4% Deb. ..	94	94	95½	88½
(*a*)	Charing Cross Elec. Ord. (£1) ..	26/-	26/-	31/-	24/3
4½	,, ,, ,, 4½% C.P. (£1)	17/6	17/6	18/3	16/6
(*b*)	Chelsea Elec. Sup. Ord.	27/-	27/-	45/3	24/-
10	City of Lond. Elec. L'ting Ord. ..	31/10½	31/10½	52/10½	26/-
6	,, ,, ,, ,, ,, 6% C.P.	23/-	23/-	24/3	21/6
7½	County Lon. Elec. Sup. Ord. ..	52/-	52/6	68/6	25/9
6	,, ,, ,, ,, 6% C.P. ..	23/-	23/-	24/-	21/3
(*c*)	Kensington & K'bridge Ord. (£1)	26/6	26/6	27/6	23/9
1/9½	Lon. Elec. Sup. Ord. (£1).. ..	27/-	27/-	37/6	23/-
1/9½	Metro. Elec. Sup. Ord.	41/3	41/3	53/-	24/9
4½	,, ,, ,, 4½% C.P. ..	17/6	17/6	18/3	16/3
7½	N'castle & Dis. Elec. Ltg. Ord. ..	27/6*	28/1½	31/9	17/6
1/2½	N'castle-upon-Tyne Elec.Sup.Ord.	25/-*	25/-	30/3	19/3
6	N. Metro. Elec. 6% C.P.	23/-	23/-	23/9	20/10
6	Notting Hill 6% C.P. (£10) ..	10½	10½	11½	9½
(*c*)	St. James & P.M. Ord. (£1) ..	27/6	27/6	28/6	23/6
1/4½	Shrops.Worcs.&Staffs. Power B.Ord.	37/6	37/6	37/6	21/4
1/9½	W'minster Elec. Sup.Ord. (£1) ..	26/-	26/-	52/9	24/-
4½	,, ,, ,, 4½% C.P. (£1)	17/6	17/6	17/10½	16/7½
8	Yorks. Elec. Power Ord.	34/-	34/-	38/9	24/6
6	,, ,, ,, 6% C.P. ..	24/-	24/-	26/9	20/7
	Railways and Tramways.				
8	Brit. Elec. Trac. Pfd.Ord. Stk ..	128	128	152	117
6	,, ,, ,, 6% Pf. Stk.	128½	128½	133	103½
4	Cent. Lon. Ry. Ord. Stk. (asstd.)	72	72	72	54
4	,, ,, ,, 4% Deb.	80	80	83	77½
4	City & S. Lon. 4% Perp. Deb. ..	79½	79½	81	76½
5	Lon. Elec. Rly. Cons. Ord. Stk. ..	73½	73½	75½	42½
4	,, ,, ,, ,, 4% Pf. Stk.	73	73	77	68
4	,, ,, ,, ,, 4% Deb. ..	80	80	83	76½
5	Lon. & Sub. Trac. A. Deb. ..	95½*	97½	97½	74
4	Lon. Un. Trams, 1st Deb. ..	61	61	63	39
4½	Met. Elec. Trams,4½% Deb. ..	72	72	73½	62
5	,, ,, ,, 5% Deb. ..	67½	67½*	70½	65½
3½	Met. Rly. Cons. Ord. Stk. ..	61	61	81	54½
3½	,, ,, ,, 3½% Pf. Stk. ..	64	63	67	60½
3½	,, ,, ,, 3½% Deb. ..	70	70	73½	67½
5	Met. Dis. Rly. Ord. Stk.	76½	76½	77½	52½
4½	,, ,, ,, 4½% 1st Pref. ..	80½	80½	84	74½
6	,, ,, ,, 6% Perp. Deb. ..	116½	116½	118½	110
4	S. Met. Elec. Trams, 4% Deb. ..	70	70	70	64½
7	Uudergrouud Electric Rlys. Ord.	24/-	23/6	28/2	11/-
—	Yorks. (W.R.) Trams, Ord. ..	5/-	5/-	16/-	3/-
4½	,, ,, ,, 1st. Deb. ..	59	59	78	60
	Electrical Manufacturing.				
7	Brit. Elec. Transformer 7% C.P...	15/-	15/-	19/10	4/6
15	Brit. Insulated Cables Ord. ..	92/6*	92/6	86/3	56/-
6	,, ,, ,, 6% C.P. ..	22/6	22/6	23/10	21/-
7	British Thomson-Houston Pref. ..	23/9	23/9	24/9	19/7
7	,, ,, ,, 7% Deb.	105½	104½	109½	102½
10	Brush Electrical Ord.	27/6	27/6	30/9	24/-
15	Callender's Cable Ord.	87/6	87/6	91/3	66/-
6½	,, ,, 6½% C.P. ..	25/-	25/-	25/9	22/-
7½	,, ,, 7½% B. Pref. ..	27/6	27/6	28/3	25/-
8	Crompton-Parkinson 8% Cum. Pf.	25/-	25/-	27/-	14/-
6	,, ,, 6% Cum. 2nd Pf.	18/-	18/-	19/6	9/7
7½	Edison Swan Elec. 1st Pref. ..	25/7½	25/7½	13/-	7/4½
5	,, ,, ,, 1st Deb. Stk.	86½	86½	92	81½
7½	Elec. Construction Ord.	20/-	20/-	32/6	23/6
7	,, ,, 7% C.P. ..	22/6	22/6	22/9	21/-
—	English Elec. Ord.	6/10½	7/6	15/9	5/-
—	,, ,, 6% C.P. ..	9/4½	9/4½	18/9	7/-
7	Ericsson Telephones 7% Pref. ..	20/-	20/-	22/7½	17/6
35	Ever Ready (Gt. Britain) Ord. ..	23/-	22/6	92/3	18/1
6	Ferranti 6% Pref.	18/-	18/-	19/4½	16/9
7	,, 7% 2nd Pref.	21/3	21/3	19/3	13/9
10	General Elec. Ord.	61/3	60/-	46/6	26/6
‡25	W. T. Henley's Ord.	120/-	120/-	120/-	69/3
12½	Johnson & Phillips Ord.	36/3	36/3	67/11	34/-
7½	Lon. Elec. Wire. & Smith's Pref ..	23/9	23/9	25/-	22/3
7½	Siemens Bros. & Co. Ord. ..	27/6	27/6	36/6	24/9
10	Telegraph Const. Ord. (£12) ..	24½*	25½	30½	20
	Telegraph.				
3½	Anglo-Am. Tele. Ord. Stk. ..	61½*	61½	63½	56½
10	Eastern Ord. Stk.	282*	282½	273	135
3½	,, 3½% Pref. Stk.	67½*	68½	70½	59
4	,, 4% Deb.	79½	79½	81½	74
10	Eastern Extension Ord. (£10) ..	28*	28½	27½	14
22	Gt. Northern Telegraph (£10) ..	34	32½	43½	26
10	Indo-European (£25)	55½	55½	48½	30
20	Marconi's Wireless T. Ord. ..	83/9	86/3	84/4	12/-
15	,, Int. Mar.	62/6	62/6	90/-	16/6
10	Western Tel. Ord. (£1)	28½	28½	27½	12½

(*a*) 19 ⅘d. per share. (*b*) 1s. 9·3d. per share. (*c*) 1s. 6·949d. per share.
(*d*) 2s. 8·706d. per share. (*e*) 1s. 7·181d. per share. ‡ Including 1s. bonus.
*Ex dividend.

LANCASHIRE ELECTRIC LIGHT AND POWER CO.—Subscriptns. have been invited this week for an issue of 600 000 £1 shs. at 27s. p. sh.

INDO-EUROPEAN TELEGRAPH CO., LTD.—Fin. div. for 1928 4½%, plus bonus 3%, makg. 10%, tax free (same as last year).

WEST LONDON AND PROVINCIAL ELECTRIC AND GENERAL TRUST, LTD.—Fin. div. of 3½%, makg. 10% for year to March 31, agst. same div. and 50% sh. bonus last year. To res., £2 500. Fwd., £5 761, agst. £3 213.

SHROPSHIRE, WORCESTERSHIRE AND STAFFORDSHIRE ELECTRIC POWER CO.—Fin. div. of 4% actual, makg. 8% for year on "A" ord. shs. and div. of 7½% for year on "B" ord. shs., both subject to deductn. of tax at 4s. in £, are proposed.

BABCOCK AND WILCOX, LTD.—Accts. for 1928 show net blce., after providg. for all charges, of £734 902, agst. £743 820. Pref. div. absorbed £14 952. To res., £150 000, agst. £100 000; pensions fund, £20 000 (same). Ord. div. 15%, tax free. Fwd., £118 363, agst. £125 361.

BRITISH INSULATED CABLES, LTD.—Resolutns. have been passed increasing the cap. by the creatn. of 333 333 £1 ord. and 500 000 £1 "A" 5½% cum. pref. shs., to be allotted among the ord. shhldrs. in the proportn. of one ord. sh. for every four, and three "A" pref. in respect of every eight ord. held.

AMALGAMATION OF TRADE JOURNAL PROPRIETORS.—An amalgamation between the proprietors of "The Engineer," "The Ironmonger" and "The Chemist and Druggist" will take place on May 1. A new co., with the title of Morgan Bros. (Publishers), Ltd., and a cap. of £500 000, will acquire the properties from the present owners, "The Engineer," Ltd., and Morgan Bros. (Publishers), Ltd.

SOUTH WALES ELECTRICAL POWER DISTRIBUTION CO.—Rpt. of the Parliamentary Co. for 1928 states that credit blce., after paymt. of workg. exes. and includg. due maintenance of plant and machinery, was £89 059. Deductg. deb. int., leaves £24 990. To depreciatn. res., £15 000; div. on pref. shs., 5%, leavg. £3 724. The income of the limited co., included int. on investmts., £4 373, div. on pref. shs. of the Distribution Co., £6 255, and blce. of the Distribution Co.'s rev. acct., £3 724. Amt. brt. in from last year, £20 705, makes total of £78 910. Int. and sinkg. fund on 6% 1st mtge, deb. stk., £39 890; div. of 6½% on cum. pref. shs., £16 250, and directors', trustees', and auditors' fees, £1 587. Fwd., £21 182.

THE CABLES AND WIRELESS MERGER.—A statemt. has been issued by Cables and Wireless, Ltd., and the Imperial and International Communications, Ltd., in regard to inter-relation of the Imperial and International Communications Co., the Cables and Wireless Co., the old Cable Companies and the Marconi Co. Cables and Wireless, Ltd., will hold all, or nearly all, the shs. in the old cable cos. and the Marconi Co. All the communication assets held by the Cable and Marconi Cos. will be transferred to the Communications Co. in exchange for shs. in that co. Although the pref. shs. of the Eastern Co. and the deb. stk. of all three cable cos. will continue to be held directly by the public, both the old cable cos. and the Marconi Co. will, in fact, have little more than formal existence under the new régime. The Cables and Wireless Co., the head of which is Mr. Denison-Pender, will conduct all the non-communications business of the old cable companies and Marconi Co., particularly the mfg. business of the Marconi Co. For the conduct of this business, it is intended that a Management Committee shall be appointed consistg. of Mr. Denison-Pender, Sir Basil Blackett, Mr. Kellaway and Lord Inverforth. The chairman of the Communications Co. is Sir Basil Blackett, and the conduct of the Communications Co. will be in his hands and in those of the managing directors: Mr. Denison-Pender and Mr. Kellaway. The membership of the boards of all the cos. will be identical, but there will be a diffrntiatn. in the offices they hold in the different cos. The diffrntiatn. is important because of the necessity for drawing a clear distinction between the communicatns. business of the coy., in which the Govt. is interested through the Advisory Committee representg. the Govts. of the British Empire, and the non-communicatns. business of the coy., with which the committee is not concerned.

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MARCONI SHAREHOLDERS AND THE MERGER SCHEME.—The Protection Committee of £1 ord. and £1 pref. shholdrs. of Marconi's Wireless Telegraph Co., Ltd., issued a statemt. last week setting out Commte's. view of the positn. of the co's. sh. and stk. holdrs. It is stated that under the articles of assn. the rights of a £1 ord. sh. and (for all practical purposes) of a pref. sh. are double those of a 10s. sh. If, therefore, the normal method had been adopted of sellg. the assets of the Marconi Co. for shs. in the merger co., and distributg. these shs. in a windg.-up among Marconi shhldrs. accordg. to legal rights, each £1 ord. and each £1 pref. sh. wld. have been entitled to twice as many shs. of the merger co. as each 10s. ord. sh., whereas under the present offer the hldr. of a £1 sh. is only offered what amts. to a cap. sum of 10s. more than a hldr. of a 10s. sh. Ref. is also made to a proposed arrangemt. under which non-assentg. £1 ord. and pref. shholdrs. wd. deposit their shs. under a trust agreemt. with the Prudential Assurance Co., Ltd., and such shs. shd. be, in effect, split into four shs. each wh. wd. ensure a free market. A mtg. of £1 ord. and pref. shhldrs. has taken place, this week, but no information as to the result was available when we went to press. A committee formed on Tuesday representg. a number of hldrs. of 10s. shs. of Marconi's Wireless Telegraph Co. In a circular which is being sent to shhldrs,, it is stated that it has been felt desirable to form such a committee in view of the attitude adopted by the £1 shhldrs., who complain agst. the terms whereby they are to receive shs. to the nom. value of £4 17s. in the merger co., compared with £4 7s. to be received by the hdrs. of the 10s. shs. It is felt that the attitude of the £1 shhldrs. is unjustified, havg. regard to the fact that but for the sacrifice of cap. and div. made by the 10s. shhldrs. the £1 shhldrs. would have a practically worthless security to-day.

Company Meetings.

PINCHIN, JOHNSON AND CO., LTD.—At an extraordinary mtg. on April 10, a resolution that the 1 500 000 £1 ordinary shares be sub-divided into 3 000 000 10s. ordinary shares was carried unanimously.

PARKER, WINDER AND ACHURCH, LTD.—Sir William H. Bowater, presidg. at the mtg. on April 10, sd. the decline in the amt. of net profit was not due to any fallg. off in the volume of sales, but, in a measure, to lowerg. of values, wh. made sellg. prices bear a lesser gross pft. The directors recommended a div. of 7½%, wh. was only 2½% less than in the preceding year, £8 000 was being carried forwd., and the res. remained at £40 000.

SOUTH LONDON ELECTRIC SUPPLY CORPORATION, LTD.—Lt.-Col. Sir Frederick Hall, M.P., presiding at the meeting on Tuesday, in the absence of Sir Harry Renwick, said the total receipts for the past year were £258 367, against £241 450 for 1927. An amount of £15 000 had been set aside as reserve for taxation, preference dividend for the year absorbed £1 800, and they recommended a final dividend of 5½% on the ordinary shares, making 8½% for the year, which was practically the company's standard dividend. The amount carried forward was £95 397. There was an increase of 2 479 847 kWh sold and a substantial increase in the kilowatts applied for. The report and accounts were adopted, and the dividends recommended were approved.

GRAMOPHONE CO., LTD.—At an extraordy. mtg. on April 10, the shhldrs. apprvd. resoltns. increasg. the cap. to £1 720 000 and the max. number of directors to 15. The chn., Mr. E. Trevor Williams, sd. the proposed incr. of cap. by 20 000 £1 ord. shs. was to enable the co. to satisfy a portion of the purchase consideratn. payable to Marconi's Wireless Telegraph Co. under an agreemt. dated March 8 last. With regard to the second resolutn., with the recent additn. of Senatore Marconi and Mr. David Sarnoff, of the Radio Corporation, their complement of directors was full, and they wanted to be in a posn. to meet any further possible contingencies wh. might entail the election of other directors. The board had decided to pay an interim div. on the ord. shs. at the rate of 10% on May 19.

LONDON ELECTRIC WIRE CO. AND SMITHS, LTD.—Sir George H. Fisher-Smith, presidg. at the mtg. on April 11, said the profit and loss acct. showed an increase of £4 662 compared with 1927, which, with the additional £10 000 added to the general reserve acct., made the total increase £14 662. A considerable amt. of business had to be taken at very cut prices, and this increase in profit did not altogether express the improvemt. in the business of the company over that of the previous year. In recent years competition in their business had been exceptionally keen, but their compy. had bn. able to maintain its position in the trade, and he believed the full effects of the special efforts they had made wd. become apparent within the next few years. They had pleasure in recommending that the same final ordinary dividend as last year be paid, making 7½% for the year, leaving to be carried forwd. £22 760.

CHELSEA ELECTRICITY SUPPLY CO., LTD.—Mr. W. R. Davies, presiding at the meeting on April 11th, said the net profit for 1928 was £82 226, including £27 317 brought in from 1927. The balance to be carried forward, after paying the statutory dividend and providing the statutory sinking fund was £24 038. That was about £3 000 less than the amount brought in, but that was due to the proposal to transfer to the employees' pension fund the sum of £16 220, and if that were taken into account it would be seen that they had earned a surplus on the year of about £13 000, after paying the statutory dividends. He hoped that, unless something unexpected should happen, they would, by the end of this year, be able to announce a reduction of their prices for lighting from 5½d. to 4½d., and for power from 1½d. to 1d. The report was adopted and divs. of 6% on the pref. shs. and 8⅞% on the ord. shs. for the year 1928 were approved.

COUNTY OF LONDON ELECTRIC SUPPLY CO., LTD.—Sir Bernard E. Greenwell, presiding at the meeting on Tuesday in the unavoidable absence of Sir Harry Renwick, read a speech prepared by the latter, in which he said he was in a position to record another year of continued prosperity. There was an increase of 75 151 048 kW sold, making a total of 323 462 367 for the year, and an increase of 40 449 kW in the new business secured, making a total of 287 390 kW connected. Gross revenue was £1 859 159, increase £144 810, and net revenue showed an increase of £193 103. The sum placed to reserve accounts out of revenue was £346 000, and it was proposed to pay 10% for the year on the ordinary shares, an increase of 2½%. For the three months of this year ended March 31st, there was an increase of 15% in their sales of electricity. The report and accounts were adopted, and a resolution to increase the capital was passed.

BROMPTON AND KENSINGTON ELECTRICITY SUPPLY CO., LTD.—At the meeting on April 11th, Mr. H. R. Beeton, chairman, said the past year, although the third since their company came under the operation of the Act of 1925, was the first in which they were able to derive any advantage from it. It was not until October 15th that they took the whole of their supply from the London Power Co. and closed down their own generating station. They sold 14% more current and earned upwards of 33% more profit, which enabled consumers to enjoy 80% more benefit than in the previous year, and, after providing for sinking funds and contingencies, they had been able to carry more than £3 500 to a reserve account by way of additional dividend for the year, and to add considerably to the amount they were allowed to carry forward. The saving last year on the aggregate supply to the constituent companies, and through them to the public, amounted to £450,000, and he was confident that the benefits attending this great measure of consolidation would grow steadily in the future.

New Companies.

NIGERIAN ELECTRICITY SUPPLY CORPORATION, LTD.—Cap., £200 000. To produce, generate and distribute electrical energy, to carry on business of electricians, electrical or general engineers and contractors, manufacturers of and dealers in electrical apparatus, etc. Reg. Office: Finsbury Pavement House, London, E.C.2 (Public co.)

RURAL-VOLTS, LTD.—Cap., £10 000. To instal apparatus for distribution of energy across country or in any town, village, residence or place within the U.K., to deal in wireless apparatus, to carry out research connected with the adaptation of electricity to agriculture, horticulture, farming, etc. Solicitors: W. H. Smith and Son, Gresham House, Old Broad Street, London, E.C.

KOLSTER-BRANDES, LTD. Cap., £1 300 000. Manufacturers of or dealers in any equipment, apparatus or device used in connection with any process of transmitting, receiving, producing, recording or reproducing by electrical or any other means any matter, whether consisting of sounds, images, signals, impulses or otherwise, etc. Reg. office: Cray Works, Sidcup, Kent. (Public Co.)

BERRY'S INSULATING AND BUILDING PRODUCTS, LTD.—Cap., £175 000. To acquire from A. F. Berry all share capital of Berrite, Ltd. To carry on business of electrical engineers, manufacturers of and dealers in cables, insulators, wires, lines, lamps, refrigerators, ovens, and all apparatus used in connection with electricity, etc. Solicitors: Clifford-Turner, Hopton and Lawrence, 81-7, Gresham Street, London, E.C.2. (Public co.)

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COMMERCIAL INFORMATION.

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debt. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

BENN, Mr. L., 72, St. Anne's Road, Southend, wireless merchant. £27 13s. 8d. February 25th.

BIBBY, Hugh, Holly Cottage, Liverpool Road, Longton, electrical dealer. £61 11s. 6d. February 27th.

HAMBLING CLAPP AND CO., 21, Garrick Street, W.C., wireless merchants. £19 8s. 6d. February 15th.

POWELL, Mr. H. B., 10, Union Street, Hereford, wireless dealer. £14 10s. 4d. February 6th.

PRIME, Mr. F. W., 110B, Wandsworth Road, S.W., radio engineer. £23 1s. 11d. February 15th.

ROCHDALE MAGNETO SERVICE, 20, Oldham Street, Rochdale, magneto manufacturers. £16 2s. 9d. February 27th.

SHILVOCK, G., AND SON, 197, Station Road, Rugby, electricians. £18 19s. 11d. February 28th.

SPOONER, Thomas, 72, Adelaide Street, Shildon, wireless dealer. £28 6s. 8d. February 26th.

Bill of Sale.

SHEPHARD, Charles, 69 and 83, Sydenham Road, Sydenham, electrical engineer. Dated March 28th, filed April 3rd. £50.

Deeds of Arrangement.

COCHRAN, Samuel King Young, trading as POPULAR WIRELESS STORES, 26, Moorfields, and 3, Byrom Street, Liverpool, wireless dealer. Dated April 8th, filed April 13th. Trustee, P. S. Booth, 2, Bixteth Street, Liverpool, accountant. Liabilities unsecured £1 267; assets, less secured claims, £530.

GILL, Harry John, 33 and 10, Carne Street, Pentre, electrical and wireless contractor. Dated April 6th, filed April 12th. Trustee, S. E. Clutterbuck, 31, Queen Street, Cardiff, I.A. Secured creditors, £54; liabilities unsecured, £291; assets, less secured claims, £78.

Receiverships.

BOWER ELECTRIC (1926), LTD.—P. J. Chaplin, C.A., of 8, Staple Inn, W.C., was appointed receiver and manager on March 27th, 1929, under powers contained in debentures dated September 15th, 1926.

HODGETTS (S. and F.), LTD. E. A. Clive, of 156, Edmund Street, Birmingham, was appointed receiver and manager on March 19th, 1929, under powers contained in first debenture dated June 27th, 1927.

MICO, LTD.—A. F. Hawdon, of 25, Sanderson Road, Newcastle-upon-Tyne, was appointed receiver and manager on March 28th, 1929, under powers contained in debenture dated March 28th, 1924.

NORFOLK ENGINEERING CO., LTD. F. Heywood, of 16, Cambridge Street, Sheffield, was appointed receiver and manager on March 30th, 1929, under powers contained in mortgage debentures dated July 12th, 1919, and October 25th, 1920.

Mortgages.

[NOTE.—*The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—allowed by the date of the Summary, but such total may have been reduced.*]

BARNETT (C.), LTD., London, W.C., wireless accessory dealers.—Registered March 18th, £250 2nd debenture, to F. T. Smith, 52, Bedford Square, W.C., C.A.; general charge (subject to prior charge).

CLEARTRON (1927), LTD., Birmingham, wireless manufacturers.—Registered April 3rd, series of £10 000 debentures, present issue £2 500; general charge. *Nil. July 24th, 1928.

MARSH (BASIL), LTD., Brighton, manufacturers of wireless apparatus.—Registered April 6th, £700 debentures; general charge.

NELSON BROTHERS, LTD., Blackpool, electricians.—Registered April 3rd, charge, to Bank; charged on 2, Regent Road, Blackpool.

STRATFORD AUTO AND WIRELESS CO., LTD.—Registered March 27th, £315 debenture, to Bank; general charge. *Nil October 3rd, 1928.

WEST SUSSEX ELECTRICAL CO., LTD.—Registered April 6th, £200 debentures, part of £1 000; general charge. *£600. December 31st, 1928.

Satisfactions.

ACME ELECTRIC LAMP CO., LTD., London, S.W.—Satisfaction registered April 2nd, £2 551, registered June 9th, 1925.

BRIDGWATER AND DISTRICT ELECTRIC SUPPLY AND TRACTION CO., LTD.—Satisfaction registered March 25th, £13 050, total issued of amounts registered February 6th, 1905, and April 29th, 1914.

EDMUNDSONS' ELECTRICITY CORPORATION, LTD., London, S.W.—Satisfaction registered March 28th, £480 000, registered November 21st, 1902, to January 22nd, 1906.

RADIO SERVICE (LONDON), LTD.—Satisfaction registered April 5th, £125, part of amount registered July 26th, 1927.

Private Meetings, etc.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

HODGETTS (S. AND F.), LTD., brass founders and wood turners, Argonaut Works, Bishop Street, Birmingham. (P.M., 19/4/29.) This company was formed in the middle of 1927, with a share capital of £3 000 in £1 shares, all of which were issued as purchase consideration for the business taken over from the trustees appointed under a deed of assignment executed by Samuel Hodgetts, its proprietor, for the benefit of his creditors. The directors of the company, according to the latest official information, are Samuel Hodgetts, with 1 800 shares, Norman S. Crowley 1 000 shares, and Robert H. Warren 200 shares. A first mortgage debenture for £2 500 was given to Crowley, who has recently appointed a receiver.

WILCOX, A. H., and SPARROW, H. D., trading as WILCOX, SPARROW AND CO., Chapel Ash, and Merridale Lane, Wolverhampton, wireless dealers. Creditors were called together on April 11th at Wolverhampton, when it was reported that the liabilities amounted to £1 290, of which £960 was due to trade creditors, against total net assets estimated to produce £602, or a deficiency of £688. It was stated that the company's bankers were creditors for £139, but were collaterally secured by Mr. Sparrow, sen., to the extent of £100, while they also held two life policies on the lives of the debtors. There was a fully secured creditor for £254, this being the Wolverhampton Freehold Building Society, and they held a first mortgage on the property. Mr. Sparrow, sen., held a second mortgage, the amount of which at present, including interest, was £511. It appeared that the debtors had a lease of the Chapel Ash premises for five years from September 29th, 1928, and this shop was opened on October 26th, 1928, but the turnover had been very small. It was also stated that in the middle of March last, the debtors assigned book debts to the extent of about £150 to Mr. Sparrow, sen. Dissatisfaction was expressed at the position, and it was ultimately decided that the debtors be given 14 days in which to find a cash composition of 10s. in the £, security to be found to the satisfaction of a committee of inspection. Failing this arrangement being made, steps were to be taken for administering the case in bankruptcy.

London Gazette, etc.

Companies Winding-up Voluntarily.

ALLAN (WILLIAM) AND CO. (LIVERPOOL), LTD.—By reason of its liabilities, April 8th.

GIBBS AND WHITE, LTD. By reason of its liabilities, April 8th, H. J. E. Batchelor, 44, Above Bar, Southampton, Incorporated Accountant, appointed as liquidator.

WESTERN ELECTRIC CO., LTD. By special resolution March 25th, confirmed April 9th, C. A. Fryer, Chartered Accountant, 38, Gresham Street, E.C.2, appointed as liquidator for the purpose of reconstruction.

Notice of Dividend.

SHARPE, Henry Clifford, 4, Gordon Terrace, Dorchester, wireless engineer. First and final dividend, $3\frac{5}{16}$d. per £, payable April 17th, Official Receiver's Office, City Chambers, Catherine Street, Salisbury.

Notices of Intended Dividends.

POWELL, Hector Baden, 10, Union Street, Hereford, wireless dealer.—Last day for receiving proofs, April 26th. Trustee, O. B. Wallis, 133, Saint Owen Street, Hereford, Official Receiver.

TEMPLE, Edward, and BURKETT, Jane Eva (Mrs.), 105, Canterbury Street, South Shields, Durham, wireless dealers and electrical contractors, trading as THE WESTOE ELECTRICAL CO. Last day for receiving proofs, April 22nd. Trustee, A. J. Gray, 48, Pilgrim Street, Newcastle-upon-Tyne.

YEEND, Reginald, electrician, trading as the CENTRAL ELECTRICAL WORKS, lately 57, West Street, Wisbech, and Red Lion Street, Spalding. Last day for receiving proofs, April 26th. Trustee, F. H. Langmaid, 41, Sidney Street, Cambridge, Official Receiver.

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PATENT RECORD.

The following information is prepared from the Illustrated Official Journal (Patents) by permission of the Controller of H.M. Stationery Office. Printed copies of full Patent Specifications, when accepted, may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at 1s. each.

Specifications Accepted.

281 344 Dr. B. Schwarz. Induction motors. (29/11/26.)
306 990 Automatic Telephone Manufacturing Co., Ltd. and T. P. Preist. Testing-devices for impulse senders. (30/11/27.)
306 991 Automatic Telephone Manufacturing Co., Ltd. and W. Saville. Telephone systems. (30/11/27.)
281 674 G. F. Jaubert. Colloidal diaphragms for electrolytic cells. (1/12/26.)
306 995 A. Reyrolle and Co., Ltd. and G. E. Grace. Load-sharing arrangements for dynamo-electric machines. (1/12/27.)
306 996 General Electric Co., Ltd. and N. R. Campbell. Manufacture of photo-electric cells. (1/12/27.)
307 099 E. Y. Robinson and Metropolitan-Vickers Electrical Co., Ltd. Manufacture of electron-emitting bodies. (1/12/27.)
306 999 R. H. Smith. Cycles and similar light vehicles adapted for laying telegraph wires and the like. (1/12/27.)
281 692 Siemens-Schuckertwerke Akt.-Ges. High-tension electric cables. (2/12/26.)
281 698 Dr. A. Schmid. Galvanic cells. (2/12/26.)
307 106 British Thomson-Houston Co., Ltd. and A. P. Young. Electro-magnetic acoustic devices, such as loud speakers. (2/12/27.)
307 121 English Electric Co., Ltd. and G. Schroeder. Regulation of asynchronous alternating-current machines. (9/12/27.)
282 386 Siemens-Schuckertwerke Akt.-Ges. Method of and means for preventing faulty action due to the effect of the magnetic field of the current circuit in cable protective devices. (14/12/26.)
307 127 F. J. Wineberg. Electric fires or radiators. (13/12/27.)
307 131 W. V. Butterfield, A. W. Butterfield and S. Butterfield, (trading as Mycromet Manufacturing Co.). Cord-grips for electric fittings and appliances. (15/12/27.)
307 138 Siemens Bros. and Co., Ltd., T. S. Robertson and W. E. Goodwin. Electromagnets and electro-magnetically-operated devices. (22/12/27.)
307 158 P. Ratzsch and E. Stracke. Protective device for plugs for electric plug contacts. (16/1/28.)
284 623 Westinghouse Lamp Co. Evacuation of closed vessels. (1/2/27.)
307 173 C. L. Arnold and M. K. Electric, Ltd. Methods of insulating the exposed parts of the metal bridges of the tumbler type of electric switch. (31/1/28.)
307 177 A. R. Jones. Wireless receiving systems. (7/2/28.)
307 181 Pictorial Machinery, Ltd. and B. Cook. Apparatus for controlling the exposure of a unit to a source of electric light. (8/2/28.)
307 192 H. T. Stott. Combined clock and wireless loud speaker. (11/2/28.)
285 497 International General Electric Co., Inc. Manufacture of insulating-tapes or the like. (18/2/27.)
286 308 Siemens and Halske Akt.-Ges. Electrodynamometers. (3/3/27.)
307 210 Callenders' Cable and Construction Co., Ltd. and F. H. Simkin. Cleats for supporting electric conductors. (3/3/28.)
307 211 A. Chalmers. Junction boxes for electrical cables. (3/3/28.)
286 732 Schieferwerke Ausdauer Akt.-Ges. Method of producing moulded articles, such as sheets and the like, suitable as insulating-material for electro-technical purposes, from filling materials and artificial resin. (10/3/27.)
287 074 G. Mombur. Electric speed-indicating apparatus. (12/3/27.)
307 217 Smith, Major, and Stevens, Ltd. and P. H. Stevens. Automatic stopping devices for electric lifts. (13/3/28.)
307 221 A. J. Howard and L. V. Turner. Boiling-plates for electric cookers. (28/4/28.)
288 285 G. Mombur. Electric speed-indicating apparatus. (8/4/27.)
307 231 Naamlooze Vennootschap Hengelosche Electrische en Mechanische Apparatenfabriek and A. Booden. Star-delta method of starting alternating current motors. (31/3/28.)
307 237 L. Mellersh-Jackson (Federal Telegraph Co.). Radio receiving systems. (11/4/28.)
289 431 Etablissements E. Belin. Picture-telegraph and the like apparatus (27/4/27.)
289 059 British Thomson-Houston Co., Ltd. Apparatus for measuring a low gaseous pressure such as that of a vapour-electric discharge device. (21/4/27.)
307 249 P. A. Klinge and O. E. Borgstrom. Electric heating-devices. (16/5/28.)
307 252 P. A. Klinge and O. E. Borgstrom. Thermal regulator for electrically-heating devices. (24/5/28.)
291 735 W. Kunze and Radiofrequenz Ges. Multiple thermionic valve for a frequency-changing receiver. (18/12/26.)
301 831 Nederlandsche Telegraaf Maatschappij Radio-Holland. Coupling-devices for use in wireless telegraphy and telephony. (6/12/27.)
307 311 S. Ruppel. Quenching of sparks in spark-gaps of electrical switches and the like. (30/8/27.)
307 405 A. H. Marks and P. Russell (legal representatives of E. C. R. Marks, deceased). (Western Union Telegraph Co.). Telegraph systems. (5/9/27.)
307 365 O. Fulton. Electromagnetic couplings. (6/9/27.)
278 751 Manhattan Electrical Supply Co., Inc. Electronic-discharge devices. (8/10/26.)
307 519 British Thomson-Houston Co., Ltd., and T. H. Kinman. Thermionic valve-amplifying systems. (10/10/27.)
307 368 Standard Telephones and Cables, Ltd. (G. Deakin and L. Polinkowsky). Automatic or semi-automatic telephone systems. (2/11/27.)
307 369 Standard Telephones and Cables, Ltd. (G. Deakin, L. Polinkowsky, G. E. Stevens, C. de Vriendt, and G. Liebkind). Automatic or semi-automatic telephone systems. (2/11/27.)

Applications for Patents.

February 14th.

4 991 Acieries de Gennevilliers and P. E. Bunet. Magnetic core induction furnaces. (17/2/28, France.)
4 976 C. L. Arnold, and M.K. Electric, Ltd. Electrical connectors.
5 007 Automatic Telephone Manufacturing Co., Ltd. Mounting electric contacts.
4 958 E. Baguley and Standard Telephones and Cables, Ltd. Terminals for telephone cables, etc.
4 934 J. H. E. Baker and Standard Telephones and Cables, etc. Telephone systems.
4 999 British Thomson-Houston Co., Ltd. Electric distribution systems.
4 923 H. M. Dudgeon and T. C. E. Rowlands. Current collectors for electrical vehicles, etc.
5 018 T. Farrell. Electric identification lamp.
4 968 General Electric Co., Ltd. Luminous electric discharge tubes. (13/7/28, Germany.)
5 009 Hart Accumulator Co., Ltd., and F. H. Pearce. Electric inspection lamps.
5 044 L. Mellersh-Jackson (Siemens and Halske A.G.). Apparatus for supervision of electric power distributing systems.
4 961 E. R. Jones and H. Kirschfeldt. Electric batteries.
4 994 K.N. Electrical Products, Ltd. Vibrating sound-producing apparatus.
5 054 H. T. Logan. Holders for thermionic valves.
5 060 M. Schlotter. Electrolytic deposition of heavy metals. (9/11/28, Germany.)
5 061 M. Schlotter. Electrolytic processes and baths therefor.
4 982 H. E. and R. E. Smith. Replacement fuse for electric circuits.
5 007 S. R. Smith. Replacement fuses for electric circuits.
4 933 Standard Telephones and Cables, Ltd. Switch mechanisms.
4 935 Standard Telephones and Cables, Ltd. Protective circuit for vacuum tubes. (26/5/28, U.S.)
4 959 Standard Telephones and Cables, Ltd. Transmission systems.
4 960 Standard Telephones and Cables, Ltd. (Polinsky and From). Semi-automatic telephone systems.
4 041 Telefunken Ges fur Drahtlose Telegraphie. Discharge devices (14/3/28, Germany.)
5 023 W. S. Thimblethorpe. Wiring circuits for vehicles.
4 965 G. W. Walton. Light sensitive cells.

February 15th.

5 148 Allgemeine Elettricitats Ges. Transmission of signals to moving trains. (15/2/28, Germany.)
5 149 Allgemeine Elettricitats Ges. Magnetic rail contact. (15/2/28, Germany.)
5 158 Automatic Coil Winder and Electrical Equipment Co., Ltd., and C. J. Owen. Coil winding machines, etc.
5 152 Automatic Telephone Manufacturing Co., Ltd., F. Kessler, and S. A. Wickerson. Supporting arrangements for conductors.
5 173, 5 174, 5 175 J. L. Baird, and Television, Ltd. Television apparatus. (16/4/28.)
5 075 Brandes, Ltd. Antenna systems, etc. (21/2/28, U.S.).
5 076 Brandes, Ltd. Radio receiving system. (23/2/28, U.S.)
5 108 British Thomson-Houston Co., Ltd. Dynamo-electric machines. (15/2/28 U.S.)
5 110 British Thomson-Houston Co., Ltd. Heat dissipating devices for immersed electrical apparatus. (17/2/28, U.S.)
5 168 Johnson and Phillips, Ltd., and C. F. Street. Telephone cables.
5 077 W. F. A. Jordan. Electric vacuum cleaners, etc.
5 145 E. Kelsen. Electrolytic manufacture of iron. (16/2/28, Austria.)
5 169 Lignes Télégraphiqués et Téléphoniqués. Apparatus for measurement of transmission levels, etc. (18/2/28, France.)
5 183 Standard Telephones and Cables, Ltd., S. V. C. Scruby, A. Montel, and J. Vial). Fuses for telephone systems.
5 101 R. N. Wellington. Supplying l.t. current to wireless receivers.

February 16th.

5 216 O. Adamson (B. D. Dykes). Electrical terminals.
5 275 Associated Electrical Industries, Ltd., E. M. Johnson, and G. Young. Power systems.
5 276 Associated Electrical Industries, Ltd., and T. E. Greene. Dynamo-electrical machines.
5 140 Callender's Cable and Construction Co., Ltd., F. S. Smith, and J. Urmston. Telephone circuits.
5 157 V. G. O. Colle. Apparatus for supplying current to thermionic valves.
5 109 Elektrizitats and A.G. Hydrawerk. Electric condensers. (15/2/28, Germany.)
5 165 G. H. S. and L. S. E. Ellis. Obtaining electrical measurements.
5 138 O. Fulton. Picture transmission. (22/8/28, Austria.)
5 181 O. Fulton. Picture transmission, etc.
5 123 J. Hand. Tuning device for wireless apparatus.
5 098 W. M. Harrison. Electrical relays.
5 154 W. M. Holbeach. Portable wireless apparatus.
5 103 A. C. Johnson. Remote control of electric lamps, etc.
5 292 Ateliers J. Carpentier. Telegraphic systems. (14/3/28, France.)
5 266 J. L. Baird, and Television, Ltd. Television apparatus. (25/4/28.)
5 284 Belling and Lee, Ltd., and E. M. Lee. Electric couplings, etc.
5 293 Compagnie des Lampes. Generation of oscillations. (8/6/28, France.)
5 232 C. W. Cox, C. E. C. Shawfield, and J. A. Welch. Electricity supply fuse, etc.
5 249 F. Fay, and Reliance Manufacturing Co., (Broughton) Ltd. Electric heating elements.
5 277 P. Freedman. Metallic vapour lamps, etc.
5 282 A. F. M. Hicks. Means for indicating telephone numbers.
5 187 V. Hope. Contacts for electric fuses, etc.

COMING EVENTS.

Friday, April 19th.

Physical Society.—Imperial College of Science, Imperial Institute Road, South Kensington. Fourteenth Guthrie Lecture by Prof. P. W. Bridgman on "The Properties of the Elements under High Pressure." 5 *p.m.*

Institution of Electrical Engineers (London Students' Section).—Institution, Savoy Place, Victoria Embankment, London. Address by Dr. A. H. Railing. 6.15 *p.m.*

Saturday, April 20th.

Association of Mining Electrical Engineers (South Wales Branch).—South Wales Institute of Engineers, Park Place, Cardiff. Paper by Mr. H. T. Gregory on "Three-phase Induction Motors and their Control Systems." 6 *p.m.*

Monday, April 22nd.

Institution of Mechanical Engineers (Graduates' Section).—Storey's Gate, St. James's Park, London. Informal discussion on "The Engineer as a Salesman." 6.30 *p.m.*

Electrical Contractors' Association (Ealing Sub-Branch).—Ordinary meeting

Tuesday, April 23rd.

Electrical Contractors' Association (Chesterfield Sub-Branch).—Falcon Café. Ordinary meeting.

Institution of Electrical Engineers (South Midland Students' Section).—Joint visit with Rugby Engineering Society. Visit to the City of Birmingham Electric Supply Department's "Princess" Power Station, Nechells. 3 *p.m.*

Wednesday, April 24th.

Electrical Contractors' Association (Croydon Sub-Branch).—Ordinary meeting.

Electrical Contractors' Association (Belfast Branch).—5, Bedford Street. Ordinary meeting. 3.30 *p.m.*

Overhead Lines Association.—Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London. "Review of Ferro-concrete Poles in other Countries." 5.30 *p.m.*

Royal Society of Arts.—John Street, Adelphi, London. Paper by Mr. H. L. Fletcher on "The Educational Value of Broadcasting." 8 *p.m.*

Thursday, April 25th.

Institution of Electrical Engineers.—Institution, Savoy Place, Victoria Embankment, London. Twentieth Kelvin Lecture by Dr. G. C. Simpson, F.R.S., on "Lighting." 6 *p.m.*

Friday, April 26th.

Birmingham Electric Club.—Grand Hotel, Colmore Row. Paper by Mr. H. Blades on "Electric Cables—Installation and Maintenance." 7 *p.m.*

Institution of Electrical Engineers (London Students' Section).—Institution, Savoy Place, Victoria Embankment, London. Annual general meeting, followed by a paper on "The Manufacturing and Testing of Submarine Cables," by Mr. V. E. Connor. 7 *p.m.*

Institution of Electrical Engineers (Scottish Centre).—University College, Dundee. Paper by Mr. W. Holmes on "Load-levelling Relays and their Application in connection with Future Metering Problems." 7.30

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THE ELECTRICIAN

Established 1861. The Oldest Weekly Illustrated Journal of

Electrical Engineering, Industry, Science and Finance.

Bouverie House, 154, Fleet Street, London, E.C.4. Telegrams: "Benbrotric, Fleet, London." Telephone: City 0244 (Ten lines).

[Closed on Saturdays in accordance with the "Five-Day Week" plan adopted by Benn Brothers, Ltd., and its associated organisations.]

No. 2656. [No. 17. Vol. CII.] Friday, April 26, 1929. Annual Subscription, 25s. Overseas, 30s.

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Current Topics.

A Serious Problem.

PUBLIC agitation against the erection of the new power station at Battersea continues to gain in force, and has now reached a point at which it may cause grave embarrassment to the electricity supply industry. While we must confess we see little if any reason why the new station should be erected at Battersea, we are, for the moment, not concerned with this part of the question. The really serious aspect, as we have pointed out more than once of late, is that a public utility service proposes to give offence to a large number of consumers and potential consumers of its product, a policy which is obviously not in the best interests of electrical development. The unwisdom of affecting to be unaware of the public's feelings in a matter like this is surely obvious, and we would say in all seriousness that the time has come when not merely the London Power Co., but the whole of the electricity supply industry should get to grips with the problem of mitigating the nuisance and damage due to flue gas emissions. The problem is undoubtedly a difficult one, and although some people are inclined to regard it as impossible of solution, we venture to remain optimistic, basing our hopes on the oft-proved fact that once there is a sufficiently pressing demand for cure, the remedy is nearly always forthcoming. The Battersea outcry, has, it is true, led to the announcement that the Government chemist is to watch the results of certain laboratory experiments for the elimination of sulphur fumes, but we must not delude ourselves into thinking that there is now nothing to be done but wait the results of these experiments. By a curious coincidence, the smoke nuisance is the subject of simultaneous discussion in the American electrical industry. There, as here, the cost of developing and installing protective equipment is advanced as a bar to its use, but as our contemporary, "The Electrical World," points out, the cost of preventing air pollution must be considered as one of the social costs of modern life, a desirable condition of which is that no user of fuel should discharge gases into the atmosphere that are less clean than the air he takes from the atmosphere and delivers under his grate.

The E.H.T. Conference.

THE International High-Tension Conference which was founded in 1921, under the auspices of the International Electrotechnical Commission, and which is, apart from the latter, one of the oldest and most important international bodies dealing with electrotechnical matters, has arranged to hold its fifth session in Paris from June 6th to 15th. Already 380 members from twenty-one countries have signified their intention of being present, and it is anticipated that the 1927 attendance of 544 delegates will be exceeded. Altogether 98 papers have been sent in from eighteen different countries; of these, thirty-three deal with construction and materials, a feature being those papers connected with generators, transformers and transformer coils, thirty-three are concerned with the construction and insulation of lines, including electrical and mechanical features relating to switchgear, cables, bare conductors, insulators, overhead line supports of steel, concrete and wood, and problems relating to their maintenance; and thirty-two papers deal with the lay-out, calculation, operation and protection of lines and networks, including problems connected with lighting effects, surges, protective relays, grounding of neutrals, snow loading, load despatching, measurement, and inter-station communication. Information about the conference can be obtained from M. TRIBOT LASPIÈRE, at 25, Boulevard Malesherbes, Paris, but engineers in this country who wish to take part should communicate with Mr. P. F. ROWELL, at the Institution of Electrical Engineers, London.

The Incandescent Lamp Jubilee.

WHEN last we referred to the arrangements which are being made in America for the "celebration of the fiftieth anniversary of the invention of the incandescent electric lamp," we charitably inferred that the claim that Mr. EDISON was its inventor was due more to oversight than a deliberate desire to belittle the prior achievement of the late Sir JOSEPH SWAN. Later information, however, makes it clear that the claim is being deliberately pressed, so that arrangements for a world-wide celebration on an unprecedented scale are now being put in hand. The celebrations, we learn, will start on June 1st and will continue until October 21st, which, we are told, "is the actual birthday of electric light." This date will be celebrated as the "Night of Light." "A radio programme, the first to be broadcast internationally, is being planned, that will outshine anything ever put on the air before," and we are assured that

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" President Hoover, Lindbergh, Ford, and the greatest men of foreign lands will pay their respects to THOMAS EDISON while the world listens in." The fact that we in this country last year very quietly and soberly celebrated the invention of SWAN'S incandescent lamp does not seem as yet to have penetrated to the United States, and we therefore suggest that official steps should be taken to put the National Electric Light Association of America in possession of the true facts.

An Advertising Scandal.

ELECTRICAL manufacturing firms have for some time been worried by the growing practice on the part of certain of their customers of asking them to pay for advertising space in house organs and other ephemeral publications as a condition of a continuation of the existing business relationship. The purchase of orders with advertising space is a thoroughly bad procedure, and, apart from the ethical standpoint, represents not only a waste of money, but also reduces the average return per pound spent over an advertising appropriation. Some idea of the extent to which these blackmailing tactics are practised on electrical firms was disclosed by Mr. C. PINKHAM in a lecture to the Glasgow Publicity Club last week, and we hope that his exposure of a serious advertising scandal will lead to a discontinuance of an unmitigated abuse of reciprocal business methods.

Practical Rural Electrification.

THE Special Order which the Electricity Commission has just granted to Mr. R. BORLASE MATTHEWS, for the supply of electricity to an area of 1 281 square miles in Lincolnshire, is of particular interest, as the scheme will be the first serious attempt in this country to supply an entire region (including towns, villages, hamlets and farms). Naturally its development will be watched with the greatest interest, for the " back to the land " cry can be of little avail unless some of the amenities of the town are present and the means—afforded by electricity—of earning as good a livelihood there as in the city, are available. For the county of Lincolnshire itself the scheme should usher in an era of farming prosperity and promote rural industrial life. From the point of view of the rest of the country it will provide a demonstration of what can be done elsewhere.

Welded Products Again.

THE welded steel fabrication alternative to castings is well known and widely used by the manufacturer of modern electrical machinery. For many stationary parts, and of late increasingly for many rotating elements, the service has much to recommend it. Cost, as such, is often the least important factor in the reckoning. Indeed, founders might here take heart of grace, and make a determined bid for custom in cases where ingenuity and initiative on their part would raise the service they can offer into a favourable competitive position. The art of the welder has so developed of late that welded products are now very reliable, repairs are often greatly simplified, and damaged work formerly taken down and possibly replaced at great expense of time, labour and cost, is now repaired on the site by this means. Welding is rapidly coming into its own in constructional work generally, and it is being used more and more extensively in bridge building and for building up columns, roof trusses, plate girders, and the like. A further application referred to in the discussion which followed the two recent papers dealing with water-tube boilers before the Institution of Naval Architects is the growing Continental practice of using welded boiler drums. The case of one firm was instanced which alone had manufactured 800 such drums. These, in service in different countries, were giving every satisfaction, the range of pressures for the series varying between 200 and 850 lb. per sq. in. It is also noteworthy that both the Board of Trade and Lloyd's Registry have recently approved, in the case of the new P. and O. turbo-electric liner, that all the main steam pipes should have arc-welded flanges. Welded products should of course, be considered strictly on their merits, but where conditions are such as to warrant a departure in manufacture, the welding proposition has much to recommend it.

Copper and Fittings Prices.

IT is only natural that the recent increases in copper prices should exert some influence on the prices of manufactured goods, but it is arguable that the firms who have announced increased prices for lighting fittings are by this action making still easier the way of those fittings makers who combine a maximum of glass with a minimum of metal in their productions. At a time when conventional designs—of which there seem to be heavy showroom stocks—are meeting with increasing competition from the newer forms, price increases in the former may quite conceivably benefit the latter.

The Wave-length Problem.

THE decision of the European broadcasting authorities, at the conference at Prague last week, to agree to a further allocation of wave-lengths throughout the British and Continental stations, is more or less the result of the failure of the Brussels plan which came into force last January. Though in theory the latter arrangement gave every station an uninterrupted wave-length, in practice it was found that many of the continental stations failed to hold their transmission to the scheduled number of kilocycles, with the inevitable result that side-bands clashed. To-day it is often impossible to separate one station from another for no reason other than that one of them is off its correct wave-length, and while such wandering is free from penalty, there seems little chance of there ever being a complete absence of heterodyning. From the point of view of trade we hope that the Prague plan will be adhered to, for nothing is more disheartening to the listening public than to be unable to separate a desired programme from an interfering whistle. While there appears to be no restriction as to the number of broadcasting stations which may be erected in Europe, the same troubles of wave-length allocation are bound to occur, for though it may be arranged that a ten kilocycle gap be allowed between each station, it takes only one new-comer to upset the scheme. The present recognised broadcast band of from 200 to 600 metres, approximately, should, we think, be occupied by the present transmitters, any new station being compelled to work on a long wave-length. Existing stations defaulting as to wave-length should be penalised and transferred to the long waves as " punishment," thus relieving the shorter band to some extent. When it is remembered that the 200–600 metre band is crowded with stations, while the higher wave-lengths are, so far as broadcasting is concerned, practically unused, it seems strange that new stations do not prefer to work on wave-lengths which they know to be wide of those used by other stations, thus more or less guaranteeing an uninterrupted reception for their listeners. The popularity of the shorter waves is very definitely pronounced, but why this is so we are unable to say.

The May Selling Campaign.

THE selling campaign of the Electrical Development Association for next month is devoted to electric cooking. As in previous months special literature and posters have been prepared, while a special series of advertisements is included in the month's activities. The May window display fitting is something in the nature of a departure from those of earlier months, and introduces a cut-out figure of a woman attending to her duties in the kitchen. The arrangement is still possessed of the simple style which has characterised the E.D.A. windows so far, and no doubt considerable additional interest will be created wherever the window is shown. Some idea of the scheme may be gathered from the illustration of a suggested arrangement reproduced elsewhere in the issue.

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HIGH-VOLTAGE BUSHINGS.

The Condenser Type Bushing—Principles of Nagel and Fortescue Designs—The All-bakelised Process—An Impartial Comparison of Types.

By W. H. THOMPSON, A.M.I.E.E.

(*Concluded from page* 466.)

AN attempt is made in the condenser type of bushing to exert a certain control on the distribution of the electrostatic field. But this control can be exercised within only very narrow limits. The greater accomplishment of this class of bushing is its ability to accommodate its dielectric to the flux distribution.

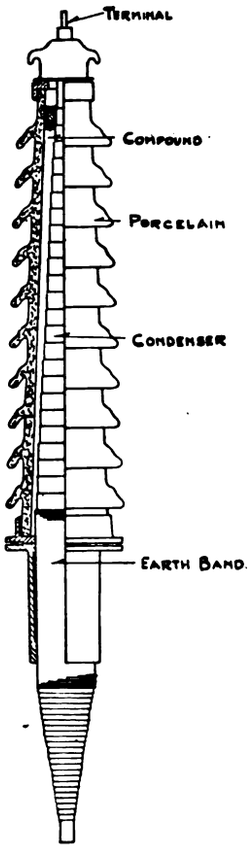

Fig. 5.—Condenser terminal.

It is made up of a central conductor surrounded by a solid dielectric, embedded in which there are a number of metal cylinders, all concentric with the conductor. This, it will be observed, forms a set of condensers in series.

At a given potential, the conductor will carry a definite charge per unit length. This will induce, on the inner surface of the first metal cylinder—or layer—an equal and opposite charge; from which will result, on the outer surface of this layer, another charge, that will be equal in magnitude and sign to the charge on the conductor. But these equal charges are spread out over different areas, since the superficial area per unit length of the outer surface of the first metal layer, is greater than that of the conductor. Therefore, the surface density will be less at the surface of the first metal layer than it is at the surface of the conductor.

By Coulomb's law, intensity equals 4π times the surface density; from which it follows that the intensity, or potential gradient, is less across the dielectric thickness between the first and second metal layers than it is across that between the conductor and the first metal layer.

The same reasoning follows for each metal layer, and, therefore, in order to maintain a constant radial stress, the dielectric thickness between the metal layers will need to diminish from the conductor outwards. Even this does not obtain constant radial stress in the strict sense of the words, since there will be a small variation through each thickness of layer. Here, then, the field flux has not been controlled, but the dielectric has been accommodated to it, by varying the thicknesses of the layers.

The condenser design assumes that the same total flux passes through each layer, or that the displacement is constant for all layers.

In practice, this is not strictly true, since there is an admittance to ground from each layer. Also, on account of the shortening of the metal layers, as they near the earth band, the flux from the exposed ends of each layer will pass into the rims of the next layer and cause a flux concentration there. This is contrary to the theory of flux control, as there will be a comparatively higher stress in the dielectric adjacent to the metal layer edges. Sometimes, the dielectric medium is "radiused" between layers, instead of being left "square," in order to reduce to a minimum the corona formation that tends to occur as a result of the above flux concentration.

But to resume, if R is the intensity, then, by Maxwell, the displacement will be $\frac{RK}{4\pi}$, and this is equal to the surface density. Again if Q is the total charge on the metal layer of radius r and length l, then $Q = KCV$; where K is the dielectric constant; C the capacity, and V, the voltage. And, from this, the surface density will be $\frac{KCV}{2\pi rl}$. Therefore, the theory of constant displacement for all layers is mathematically expressed as:

$$\frac{RK}{4\pi} = \frac{KCV}{2\pi rl}$$

From which,

$$2CV = Rrl$$

or,

$$R = \frac{\text{Constant}}{rl}$$

That is, the intensity times the radius times the length of the metal layer is constant. If then, the intensity R is to be constant, i.e., constant radial stress, rl will be constant. This, however, is the condition for a hyperbola with the conductor

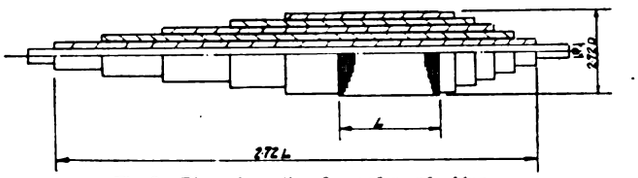

Fig. 6.—Dimension ratios of a condenser bushing.

as one of the asymtodes; which means that the ends of the metal layers will be on a curve of that order. There will then result a condition of unequal axial stress, since the difference in length of these layers is unequal, while the voltage between them is constant.

The above is the principle of the Nagel design. The Fortescue design aims at equal axial stress, and allows unequal radial stress. In this case the metal layers are arranged so that the capacity between any two layers is equal. Therefore, with C constant in the equation, $Q = CV$; V becomes the same for each step; the charge being considered constant. It will thus be seen that, if the lengths of the metal layers are arranged to be in arithmetical progression, the axial stress will be constant. And this is the condition which obtains in this design. Again, it will be noted that, on account of the admittance to ground from each of the layer ends, the theoretical conditions are not strictly borne out in practice.

The capacity of each step will be given by the equation

$$C = \frac{lK}{2 \log \varepsilon r_0/r_1};$$

which is obtained from the geometric capacity of coaxial cylinders, where l is the length of the step, r_0 and r_1 the radius of the outer and inner metal layers forming the step. From the conditions of the case, the values of l will form a series in arithmetical progression; therefore the corresponding values of $2 \log \varepsilon \frac{r_0}{r_1}$ will necessarily form a similar series in order to keep the value of the capacity equation constant.

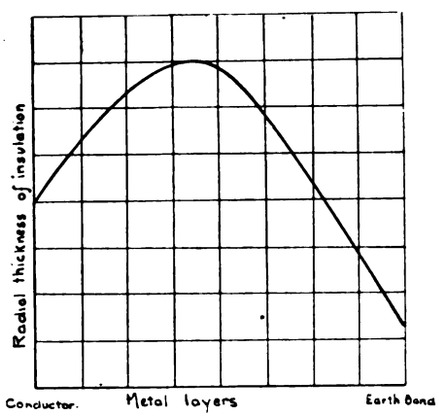

Fig. 7.

It will be found that if the log of the ratios of the radii of metal bands are to form an arithmetical progression, the difference between the radii of successive metal layers will not be constant. That is, the thickness of step is not constant. And it can be proved that these step thicknesses form another series which can be expressed by an equation to a parabola. Or, if the number of the step be plotted against the thickness, the resulting curve is a parabola. See Fig. 7.

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There can be considerable diversity in the design of bushings based on the Fortescue principle. For instance, in most American and British makes, the metal cylinders are made of tin foil sheet; whereas there is a German make in which these cylinders are composed of a fine copper wire net of large mesh. From Maxwell's " Theory of a Grating " it would appear that, when the mesh is small, the approximation to a plane surface is sufficiently accurate for practical purposes. Experience bears this out, and proves that a large mesh metal layer is inferior to a sheet metal layer for bushing work.

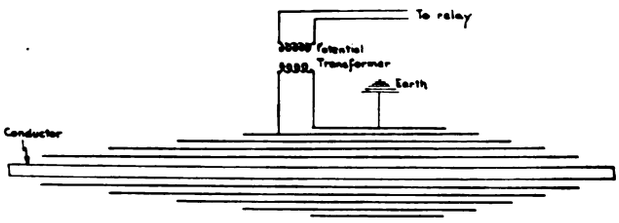

Fig. 8.—Method of obtaining potential supply.

In another make, insulated metal clad cylinders are used; these being pushed one within the other. But this method is much inferior to the all-bakelised process as practised by M.V. Co. for instance.

The diameter of the bushing is important in so far as the greater this is the more inaccurate will be the ring type current transformer, when mounted. Both the oil-filled type, and condenser bushings have a definite earth band diameter for a given conductor diameter, which will give the minimum voltage gradient on the surface of the conductor.

This is when the ratio of earth band diameter to conductor diameter is equal to ε, the base of Naperian logs. It can easily be proved as follows:—Let r equal conductor radius and b equal earth band radius, then G the voltage gradient, will equal

$$\frac{dv}{dr} = \frac{v}{r \log \varepsilon b/r}$$

This will be a minimum when $r \log \varepsilon b/r$ is a maximum, or, when $d[r \log \varepsilon b/r]/dr = O$; which occurs when $b/r = \varepsilon$. See Fig. 6. It will be appreciated that the above does not apply to the oil-filled type to the same extent, even when insulating cylinders are fitted, since the presence of these cylinders does not constrain the flux to the true radial direction, as is the case with metal cylinders. Except for the flux immediately under the earth band, the field will comprise curved lines from the conductor to band edges; which lines will suffer refraction in their passage through each insulating cylinder.

Actually, in neither type of bushing is the above proportion obtainable, although in the condenser type it is nearly so.

It is sometimes claimed that the greater the number of steps of a bushing the more accurate will be the stressing of the dielectric. While to an extent this is true, practice proves that a certain latitude is available, and that a rather coarser stepping gives the better result. The capacity of the bushing, as a whole, is independent of the number of steps.

Comparison of Types.

Having dealt in certain detail with the two most important type of bushings, it will now be interesting to compare them. The object of this comparison is not to favour one or the other design; but to state their cases, and leave the selection to the choice of those engineers whose business it is to use them.

On the question of size, it will be noted that, as regards length, the two types are much the same; but as regards diameter, the oil-filled bushing is larger. This is an advantage to the condenser type, since its smaller diameter permits the use of more accurate ring type current transformers. Also, the current transformers are much more accessible in the condenser type than in the other. Reference to Fig. 4 (THE ELECTRICIAN, April 19, page 466) will show how difficult it is to remove a current transformer from an oil-filled bushing. On the other hand, there should be little reason to interfere with these transformers once they are installed.

It will be understood that, in the case of the condenser type, porcelain shields, both above and below the earth band, can be dispensed with when these bushings are required for indoor transformer use only. In the oil-filled type they are obviously always an essential.

For oil circuit breaker use, the lower porcelain becomes a necessity in the condenser type also. It is then known as the " arc shield," since its function is to protect the lower steps of the bushing against the arc which results upon the opening of the circuit breaker under load. The space between this arc shield and the bushing is filled with pure oil, and it is a sealed chamber with respect to the circuit-breaker tank. By this means the dielectric strength of the oil is maintained across the lower end steps, irrespective of the condition of the oil in the tank.

In the event of the circuit breaker opening under a heavy load, it is possible that the arc of rupture may crack the arc shield of the bushing. If the bushing be of the condenser type, its condition, although impaired, will still be serviceable; but if it be an oil-filled bushing, it will be rendered quite unserviceable, on account of the oil running out into the tank and leaving the top portion of the bushing empty. This, of course, is because the oil in the top part of the bushing, being above the tank oil level, provides the necessary hydrostatic " head."

In the oil-filled bushing, flashover will occur at either the air or the oil end, dependent upon the design. This, and the condenser type, are generally designed for flashover at the air end, and arcing horns are preferably fitted to give this flashover a definite value.

There is the additional possibility in the condenser bushing of a flashover across the bushing steps. It is to prevent this that the precaution is taken of maintaining pure oil under the arc shield, as mentioned above. At the " air " end, the steps are longer and the space between bushing and porcelain rainshed is filled with compound. On indoor type bushings, when rainsheds are not fitted, the " air " end steps are formed only with the tin foil layer; the bakelite being of uniform outside diameter throughout its whole length.

Flashover should Precede Puncture.

The design of both types should also be that flashover shall precede puncture. This is more important in the case of the condenser bushing, since it is an advantage of the oil-filled type that a puncture will be immediately resealed by the liquid dielectric; and, it is claimed, will be good for 95% of the voltage at which it punctured. A puncture in the condenser type will destroy the bushing.

It is generally accepted that a part of the energy of an electric field is absorbed in heating up the dielectric, and

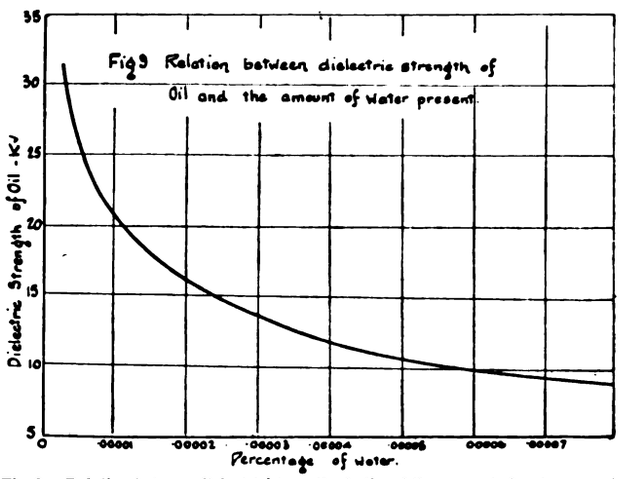

Fig. 9.—Relation between dielectric strength of oil and the amount of water present.

consequently temperature variation results within the dielectric from the uneven flux distribution. The higher the temperature, the greater the heat generation, and, if the rate of energy absorption with temperature is greater than the rate of cooling with temperature, breakdown of the dielectric is inevitable. On this point the oil-filled bushing has the advantage; as the creation of hot spots in the dielectric is prevented by the cooling action set up by the convection currents which result in the liquid.

If the air and the oil are each stressed simultaneously to their respective maxima, flashover at the air end will result, rather than at the oil end. This is because the oil has a greater time lag than the air.

A definite time is required to effect the rupture of any dielectric, since the rupture represents the expenditure of energy, and time is a factor in the fundamental dimensions of energy. That being so, it is obvious that with the same given potential across different dielectrics, the time factors will vary

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in accordance with the energy required to break down the different dielectrics, or, what is the same thing, upon the strengths of the dielectrics. Therefore, as the dielectric strength of oil is greater than that of air, so also is its time lag longer.

When either type of bushing is used outdoors, it is subject to a fairly wide range of temperature variation, and allowance must be made for expansion and contraction. A flexible lead between the top end of the conductor and the terminal provides the necessary allowance for thermal movement in the condenser bushing of the Metro-Vick design, but in the oil-filled type, it is a difficult proposition to make allowance for this movement, and the writer knows of no make of oil bushing which incorporates such a feature.

In the case of the compound or oil, sufficient space is left to accommodate something above the maximum expansion expected. The coefficient of volumetric expansion of oil is 0·001 per deg. C., and that for compound is approximately 0·0006 per deg. C. As, however, the volume of oil required for an oil-filled bushing is much more than the volume of compound required for a condenser bushing, there is a much greater total expansion of oil than of compound than that indicated by the ratio 0·001/0·0006. Oil-filled bushings in Russia, subject to the temperature variations there, have shown oil level differences of as much as 6 in.

This feature of the oil-filled bushing has necessitated fitting to it an air vent, which allows easy access and egress of the air in the top space, and the function is known as the "breathing" of the bushing. It is undoubtedly a disadvantage, since a damp atmosphere can be breathed in, and the moisture condensed in the air space above the oil level. The water so formed will run down into the oil, and being heavier than the latter, will sink to the bottom. In this way water can collect in the bottom of the arc shield, and also cling to the sides of the baffle tubes, when fitted. See Fig. 9.

Nowadays, porcelain rainsheds are made in one piece for bushings up to 132 000 V; above this pressure, two-piece rainsheds are used. The one-piece porcelain is a great advantage to the oil-filled bushing, as it reduces the number of oil-tight joints required. It is believed that some of the biggest manufacturers can to-day justify the hitherto doubtful claim of producing a really "oil-tight" joint. If this is so, then one of the biggest disadvantages to the oil-filled bushing has been removed.

There is, however, the fact that the rainshed of a condenser terminal may be broken to quite an extent and the bushing remain serviceable, but a crack in the porcelain of an oil-filled bushing will enable the oil to escape and render the bushing useless.

As regards the relative watt loss of the two types of bushings, it must be allowed that here the oil-filled bushing has the advantage. So much depends upon the amount of moisture absorbed in the solid dielectric that the power factor may vary to any extent between 0·01 and 0·2. This is not the case with the oil dielectric, which also has the advantage that the anomalous charging current is not reversible, as it is with a solid dielectric.

This subject of absorption and power loss in dielectrics is of considerable complexity, and the writer would refer those interested to the "Critical Resumé," which appeared in an issue of the Institution Journal.*

It is possible to continue to a considerable length the comparison of the two types of bushings. No mention has yet been made of the advantage of an oil dielectric in preventing the formation of internal air pockets and the consequent corona; nor yet of the advantage of the metal layers in stopping a progressing corona. The condenser type also provides the convenience of taking a potential tap for the operation of relays, etc. See Fig. 8. But, as an article must end somewhere, it is hoped that the above will be sufficient to stimulate the interest of engineers to a deeper study of the subject.

BOOK REVIEWS.

The Theory of the Gyroscopic Compass and its Deviations. By A. L. RAWLINGS. (London: Macmillan and Co.) Pp. x+191. 10s. 6d. net.

Although the first three chapters are largely restatements of existing knowledge, the major portion of this book is made up of original matter which has not yet been confirmed by other workers. The mathematics of the early chapters do not prove easy reading, but, as the whole book is designed largely as a work of reference, the skipping of these portions is not a serious matter. While elementary knowledge of the Differential Calculus is considered necessary to a full understanding of the subject, the non-mathematical reader need not be discouraged, as alternative explanations are given in plain language wherever possible.

In tracing the development of the various forms of the gyro-compass, and the inventors responsible for them, the author treads controversial ground, but, though his own views are easy to see, he also presents data from which the reader may draw his own conclusions.

L. A. C.

A Bibliography of Metallic Corrosion. By W. H. J. VERNON, D.Sc., with an introduction by PROF. H. C. H. CARPENTER, F.R.S. (London: Edward Arnold and Co.) Pp. xii+341. 21s. net.

There is hardly a subject upon which during the last twenty years or so, more attention has been focussed than that of corrosion, a broad and comprehensive term covering a wide range of phenomena. To engineers and others concerned with the durability of the metals and alloys they use, it is practically impossible to keep abreast of the enormous and scattered literature which has sprung up relative to the causes of corrosion, its modes and the methods of preventing it, or at least, of mitigating its effects. Dr. Vernon has done well, therefore, in compiling a bibliography of the subject, and has discharged his task in a very able manner. Not only is the arrangement of the various headings such as very greatly to facilitate reference to the available literature on any particular subject, but some guidance as to the nature of the various books, papers and articles referred to is afforded in the shape of occasional critical notes. It may well be wished that when other branches of science reach the stage of having a bibliography devoted to them, their compilers may perform the task as well as Dr. Vernon has done his. The book is divided into four main sections: (I) General, in which the various factors influencing the corrosion process are classified; (II) a bibliography arranged under the main groups of corroding media; (III) a grouping under the headings of the specific metals and alloys themselves, and (IV) an exhaustive bibliography of the various methods employed for the prevention of corrosion, and for the protection of metals and alloys prone to corroding influences. The book is clearly and well printed, and its contents appear to have been carefully checked, for it is free from the mistakes and omissions which so often detract from the value of a work of this kind.

L. P. S.

Die Technik Elektrischer Messgeräte. Third Edition. By G. KEINATH. Vol. I.: Messgeräte u. Zubehör. Pp. viii+612. Vol. II: Messverfahren. Pp. viii+416. (Munich and Berlin: R. Oldenbourg.) Price, bound: Vol. I, 35 Rm.; Vol. II, 24·5 Rm.

This work has reached its third edition, having been published first in 1921. Its wide scope is best indicated by the chapter headings:—Vol. I: General Features, Materials, Description of Instrument Movements, Recording Apparatus, Auxiliary Apparatus. Vol. II: Measurement of Voltage, Current, Power, Power Factor, Frequency, Synchronizing Gear, Remote Measurement, Measurement of Resistance, Capacity, Inductance, Speed, Time, Distance, Acceleration, Pressure, and Magnetic Quantities. The field of test and measurement in which electrical methods are applicable is seen to be well covered. It is difficult to give the author adequate praise, for within the limits of treatment assumed, the subject could scarcely have been better dealt with. It should be noted that the author does not set out to teach principles, but to record practice in its latest and most modern form. The general treatment is to present the elements of the essential theory, followed by a critical examination and concise technical description of the instrument, material or process under discussion, and illustrated by line drawing curves, and half-tone blocks.

In the introduction a useful section on errors, sensitivity, etc., and their dependence upon mechanical considerations, is given, together with details of spring control, instrument torque measurement, suspension, mechanical testing, forms of construction, scales, damping, insulation, overloading, and

* I.E.E. Journal, No. 359, Vol. 64.

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sensitivity to external variations of frequency, temperature, etc. A great range of detail, clearly sectionalised and subdivided, is given in each subject, and cannot fail to be of considerable use to all concerned with or interested in instruments. A lengthy appendix presents an interesting analysis of a number of national standardising rules and specifications for instruments, which should be informative for the purposes of comparison and for the preparation of instruments for the foreign market. The 900 illustrations are clear and carefully arranged, the line blocks illustrating parts, principles and connections being especially good, while the half-tones are adequate. Naturally, many of the typical instruments illustrated are of German origin, but the author has included also British and American examples, particularly of the more delicate and precise types. The format, binding and typographical work are a good example of a high-class technical publication. This work became a standard in its earlier editions, and the new edition places it in the forefront of treatises on measuring instruments and measurements.

S. PARKER SMITH.

Electricity Applied to Mining. By H. COTTON. (London: Sir Isaac Pitman and Sons). Pp. xi+625. 35s. net.

This book comes very opportunely at a time of growing realisation that the mining industry in this country must employ electric power on a far larger scale than hitherto if it is to continue to exist. It is almost encyclopædic in character, dealing with every application of electricity in coal mining in a thorough and competent manner. The early chapters deal with generation, transmission, and distribution, but, as the actual technique of power production is adequately dealt with elsewhere, the author has wisely concentrated, in the section on generation, on the economics of the problem.

The method of treatment of the sections dealing with the application of electricity to mining problems is noteworthy. Feeling that the customary method of describing the electrical gear required for a particular drive, without any reference to the peculiar characteristics of the drive, is inadequate, the author has investigated the nature of the load, particularly in the case of fan, compressor, and pump drives, with sufficient thoroughness to give serviceable data to the mining electrical engineer. The most recent methods and apparatus are described, but the author's statement on page 592 that no electric safety lamp can be used as a gas detector, is incorrect, as there is certainly one electric lamp specially designed for this purpose.

The book is well printed and produced, and is very fully illustrated. It should form an indispensable work of reference for every mining electrical engineer.

H. C. B.

Draughting for Engineers. By C. L. SVENSEN. (London: Blackie and Son.) Pp. xi+363. 12s. net.

Draughting is a subject of vital importance to the engineer, no matter in which branch of the profession his work may lie. Not only must he be able to read a drawing or diagram correctly, but he should also possess the ability to visualise shape and size, or in other words, think "graphically." The author has endeavoured in as simple a manner as possible, to show how to acquire this knowledge. The first chapter contains a fairly comprehensive survey of the instruments and materials necessary, for what one might call the "draughtman's outfit."

Lettering and figuring to which scant attention have been paid will very easily spoil the appearance of a drawing, and the "junior" will obtain information of a very useful character regarding the making of the various types of letters and figures, by a careful study of the text, and a working knowledge of some of the principles and constructions of geometry, which are essential in order that clear mechanical drawings may be made, will also be obtained by reference to the third chapter. Orthographic projection is dealt with very clearly, and includes a series of practical rules and also principles of projection, which form the base of both the making and reading of drawings. The theory of dimensioning, including the system developed by the author, is also discussed.

Bolts and screws are so often used in engineering, and, as some branches of the profession have their own standards, it is necessary to know the proportions or sizes of the more common types of screws at least, and at the same time be thoroughly conversant with the various forms of designation on drawings. These will be found in Chapter VI, which is followed by a study of working drawings. Generally speaking, working drawings should be in orthographic projection, but there are, obviously, occasions such as the slots in the heads of screws, when this practice is not followed. Some of these exceptions, and also the methods adopted are given, and further the cross-section symbols adopted for indicating various materials are detailed.

Not the least important branch of engineering draughting is that of freehand sketching, and the section dealing with this subject shows very clearly how to produce a sketch that will be of a useful character. The intersecting of surfaces, development of surfaces, detail draughting, computation of weights from drawings and piping drawings have each received careful attention. Detail draughting concerns, chiefly, the main details of the horizontal steam engine, but also makes a short reference to rivets and riveting, whilst in the case of piping drawings, the data given with respect to pipe conventions and tables of pipe fittings and standard pipes will certainly serve a useful purpose.

The reason for the chapters dealing with architectural, structural, and electrical draughting is self-evident. From these the "junior" may commence his training in the branch of engineering in which he proposes to specialise. Chapter XVIII, dealing with technical illustrations and data, will, to a certain degree, be found useful, and the final chapter will materially aid the instructor, because of the variety of problems which it contains. The American projection system has been used throughout the book, so that by reference to the appendix, the difference between this and the British system will be noted.

The book is free from material errors; both the text and figures are exceptionally clear, and the book certainly does provide a systematic course of study in engineering and architectural drawing. The author is to be congratulated upon the clear and concise manner in which he has presented the subject.

S. W.

Railway Electrification and Traffic Problems. By PHILIP BURTT. (London: Sir Isaac Pitman and Sons.) Pp. xvi+197. 10s. 6d. net.

The author of this stimulating book deserves congratulation for his courage in writing a book of this character. Formerly deputy-general manager of the North Eastern Railway, and viewing railway electrification solely from a traffic officer's point of view, he is inclined to be apologetic for having produced this book without the collaboration of an electrical engineer. In the reviewer's opinion, this is one of the strong points of the book. Written wholly or in part by an electrical engineer, its views would have been suspect by railwaymen, but as its author is himself a railway man and one whose experience may not be expected to be unduly biassed on the side of any particular system of operation, it forms a welcome addition to the literature of railway electrification. While most electrical men have long believed that a properly designed policy of main line electrification affords the only real chance of re-establishing British railways on a proper financial basis, it is a hopeful augury to find that similar views are shared by Mr. Burtt. The book is well calculated to show that a considerable extension of electric working, put in hand at an early date, will not only be a national advantage, but will also be in the best interests of the railway companies. It is a book that all railway executives should read and profit by.

L. W. C.

A School Electricity. By C. J. F. WAGSTAFF. (Cambridge University Press.) Pp. xii + 250. 5s. net.

This book is intended for elementary students attending technical schools, and is based upon the author's teaching experience, which has led him to leave out many important parts of the subject which he does not think necessary to the student so early in his "electrical course." The principles of force and work, electricity and electrical measurements are very thoroughly dealt with. Much of the text is devoted to instructions for carrying out experiments, and to examples of an illustrative character; also at the end of each chapter a list of problems is given. Generally speaking, the book appears to be well adapted for its purpose, although it is a pity that the author, when revising the book for its second edition, did not bring it thoroughly up to date with regard to the various symbols (e.g., current is now denoted by *I* and not by *C*), for no doubt the student will experience a certain amount of difficulty, due to this, later on in his studies.

W. S.

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PROPOSALS FOR LONDON SUBURBAN RAILWAY ELECTRIFICATION.

Suggested Terminal Developments—Advice of the old G.E. Electrification Committee—Financial and Traffic Considerations.

By J. G. B. SAMS, A.M.Inst.Mech.E., M.Inst.Loco.E.

THE completion of the electrification of all London suburban railway passenger services can reasonably be considered as extremely overdue, both from the shareholders' and from the travelling public's point of view. Full credit must be given to the Southern Railway for their practically complete suburban electrification, and partial credit is due to the L.M. and S. Railway, who have gone some of the way, but the L. and N.E. Railway must be taken to task, as no effort seems to have been made at a commencement. The L.M.S. have an excellent service between Euston and Watford, and also between Broad Street and West London suburbs; they also have an interest in the "Underground" services to East Ham and Barking, which, one notices with pleasure, are to be extended in the near future to Dagenham, in order to serve the L.C.C. Housing Estate at Becontree.

Whether these new services will be run in and out of Broad Street station or whether they will form a mere extension of the existing Underground services has not yet been made public; but it is to be hoped that the idea is to run an entirely new and separate service, distinct from the Underground, which is already uncomfortably crowded at peak periods; and this will argue Broad Street as the City terminal.

Another advantage might lie in the utilisation of the suggested service to ease the present overcrowding on the Underground. And while Broad Street is under discussion, the suggestion is made that a connecting spur between the Midland main line and the ex-North London Railway should be installed, the main line electrified as far as St. Albans, and a service instituted between Broad Street and that town, paralleling the example of the Watford service of the L.N.W. section. There seems room for additional services at Broad Street, which, considering its commanding position in the City, does not handle the traffic that one would expect, seeing that it has now become the only City terminus belonging to the L.M.S. group instead of, as formerly, to a small suburban railway. Another reasonable development of the L.M.S. Barking to Dagenham scheme would be an extension to Tilbury Docks from Barking, but this would be more of a business than a residential proposition.

An Urgent Matter.

So much for the L.M. and S. Railway, and now for the L. and N.E., the electrification of the greater part of whose suburban services is a matter of first-class importance and urgency. These services can be roughly divided into the Great Central section, which, on account of the comparative remoteness of Marylebone terminus, should be placed last in electrification order; the G.N. section, and the western and eastern sections of the G.E. Railway, these last being of equal importance. There is of course no doubt that electrification *will* come eventually, but the attitude taken by the railway management gives the impression that they are trying to fight it off rather than to welcome it as it deserves. A start might be made by following the advice of an electrification committee of the ex-G.E. Railway, which in 1913 recommended the electrification of the western section (Enfield Town, Chingford, etc.) which, barring a short mile where it runs over the Cambridge main line, is a self-contained entity. In any case the widening of this short length of railway would be an advantage, as with the present steam services delay is often occasioned to main line trains by congestion at peak periods, and the starting and stopping of these heavy trains costs an appreciable sum in extra fuel and brake blocks. With the small exception noted, the electrification of this particular section offers no difficulty whatever, hence its suitability as a beginning effort. Taking the L.N.E. suburban services as a whole, and examining the peak period of traffic, with a single exception the headway between trains is never better than three minutes. The exception is the western section of the G.E., where the headway has been cleverly reduced to two minutes with six misses to the hour for recovery, giving a maximum of twenty-four trains to the hour on one set of rails. This may be taken as the irreducible minimum of headway and the last word in steam train operation where a purely suburban service is concerned. If long-distance main line services are interposed, or the possible frequency vitiated by crossings or junctions on the level, the number of trains in a complete steam service can hardly reach the suggested maximum of twenty-four to the hour, although the latest signalling, such as four indication three-colour signals, be installed.

Southern Results.

Under the same conditions of signalling, the running of forty electrically-propelled trains to the hour on purely suburban services is a proved possibility, and this is a material advance on the steam train; where steam main line services have to be interposed this figure will be vitiated, but will still give a greater possible frequency than steam. Why then has electrification been shelved? There can be but two main reasons, finance and the question of the increase of traffic necessary to warrant the outlay. The first answer that may meet these questions is to examine the Southern Railway's electrification results. In this case the traffic has increased from 50 per cent. in definitely urban areas to 100 per cent. in suburban, and the financial results are so good that the railway has been enabled to alter the whole of the existing overhead system of the central section to the standard third rail; this and other similar work being partially paid for out of revenue, a very encouraging sign indeed. The second answer is that seeing this question appears to have got as far as becoming a "plank" in the programme of one of the political chiefs, Government assistance with finance ought to be possible, it being more desirable to finance productive work than unemployment.

Coming to the traffic side of the question, there are always plenty of people who are willing, given the fast and frequent service possible with electric trains, to live up to 45 minutes (say twenty to twenty-five miles) out of town; but the service must be there to attract them. What advantages would electrification provide in this respect for the G.N. and G.E. sections? The most valuable possibility is a faster and more frequent service, which would tempt people to live farther out, to the advantage of themselves and the railway. This tendency might make the extension of dead-end branches like the Palace Gates branch an economic possibility, and would enable the reopening of the Edmonton and Cheshunt branch. Another valuable possibility would be the restoring of the old north and south services via Snow Hill and the widened lines. Years ago the Midland and the G.N. Railways ran through services via this route to Victoria, and the S.E. and L.C. and D. Railways ran return services on to the G.N. line. One of the advantages said to be possessed by the omnibuses and denied to the L.C.C. trams is that of through running across London; here then, given electrification, is the same posssibility for the railways. The same idea is applicable to Liverpool Street stations, Metropolitan and L.N.E. Railways; there is a connecting tunnel between the two systems, and it would be an easy matter for both companies' trains, now terminating each on their own side of the tunnel, to run through on to the other system. That these through runnings would be of advantage to both railway and public cannot be doubted; think, for example, of the number of terminals that would be eliminated.

Ample Scope.

The facts are that neither saturation-point nor maximum railway service has been reached in these parts; there is still ample room for a vast suburban population, given the necessary transport in the shape of electric trains. It will be argued that in several cases expensive flyover junctions and crossings will have to be installed, but these are economic necessities in any case, steam or otherwise. Consider Stratford L.N.E. as an example. Here every train of the Loughton and Fenchurch Street service (and there are a great many during the day) crosses on the level and entirely shuts up the two up and down main lines for anything from two to three minutes; and these main lines are as crowded as any in London. The economic necessity for a flyover crossing is here, previous to any consideration of electrification, and the expense of installation cannot fairly be used as an argument against its most necessary achievement.

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MECHANICAL CONSTRUCTION OF LINES.

Some Tendencies in Design and Erection—Comparison of Practices in Other Countries—Relative Positions of Conductors.

By THEODORE RICH, A.M.I.E.E.

FOR a number of years there was a tendency to design the support of an overhead line under the idea that it must, as far as possible, be a rigid structure, forgetting that the primary object of the post cross-arms or brackets and insulators is to keep the conductors off the ground and out of reach.

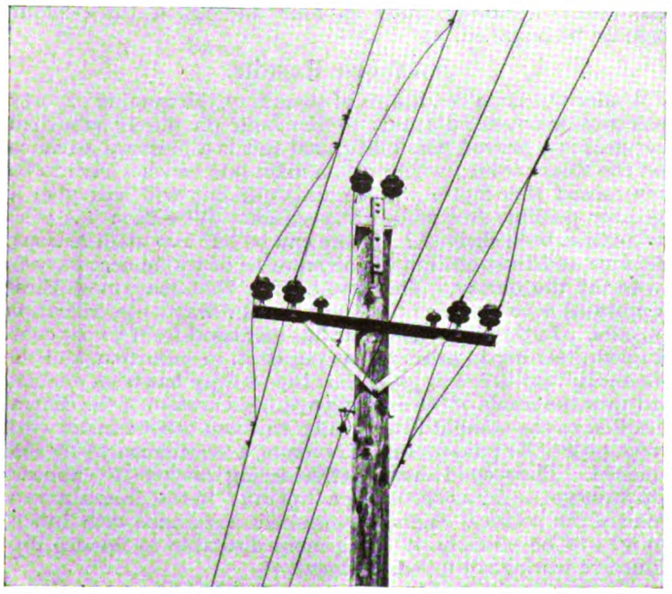

Fig. 1.—Type of construction used in North Wales. This is a 11 000 V steel line and the cross-arm is of angle iron.

In some cases engineers have asked for massive cross-arms and heavy pins, on the assumption that they must stand up to the full strain should a conductor break at the other end of the cross-arms.

In France before the war an engineer of the name of Cornez developed a system for h.t. pin insulators by which the arm was built up of two flat steel strips gripping round the post, fixed with side bolts and not through bolts, the idea being that the comparatively flexible arms will adjust themselves to the balance of the longitudinal strains, and if a line breaks on one side the arm will bend round towards the unbroken side, thereby greatly reducing the strain.

Relieving Cross-arm Loading.

In England Mr. Twiss developed a system of screwed up grip fastenings for insulator caps so that under excessive strain the conductor would slip somewhat and thereby relieve it. One of the advantages of the multiple suspension insulator system is that the strains in the different spans take up automatically, and in case of a break the cross-arm loading is greatly relieved.

If we could only get out of the habit of insisting on strength where it is not wanted there would be an opening for the use of bakelised wood instead of steel pins, with corresponding reduction in electrical stresses.

With suspension insulators, owing to the possibilities of side swing the clearances between the conductors and the support have to be made materially greater than that required for electrical purposes, the arms or brackets have to be longer, and as the conductor is below and not above the arm the posts have to be higher; which in wood means a greater proportional increase in cost than with steel or armoured concrete.

The chain of suspension insulators is more expensive than insulators of the pin type, although the former give greater electrical and mechanical security.

To some extent the development of glass insulators has tended towards a revival of pin insulators for voltages within the range of that usable for bulk transmission, and therefore we find glass pin insulators being erected in France for 60 and 80 kV, glass insulators not having taken on so well for suspension as for the pin types.

The Electricity Commissioners' regulations were modified in 1928, to the extent of reducing the arc loading to be allowed for, and therefore the stress per span, and also the minimum height of low tension conductors. This modification has given some relief regarding first cost, although the extra facilities given on the low tension side, which encourage an increased radius of supply from a step-down transformer station, may lead to difficulties regarding voltage drop as loads fill out.

Across the Atlantic in the early days wood cross-arms and wood pins were very usual for overhead line work. The galvanised steel pin is replacing that of wood, although the wood cross-arm, with brace of flat strip, still has considerable vogue. The absence of compulsory earthing and bonding of metal insulator pins, which earthing tends to lower the insulation of the whole line, makes the insulators much more susceptible to arcing over than otherwise, and the fact that oak is comparatively cheap has its influence. A wood cross-arm with a rounded top has become a favourite. In a fitting of the Ohio Brass Co. (see THE ELECTRICIAN, January 25, 1929, page 108), the pin has a cone resting in a saddle which fits the top of the arm, the insulator being an O.B. 45 000 V type. To strengthen the cross-arm a small bolt and washers can be passed through the arm, back to front, clear of the hole made for the pin. The pin top is a conical screw covered with lead. A good wood cross-arm will last many years where climate is not adverse, and it does not require painting.

Suspension Insulators for Terminals.

At home, steel cross-arms of angle or channel section are frequently used, the channel with the pin going through both flanges standing strain better than an angle. It is getting usual in England to use suspension type insulators for terminals. They make a sound job and give a better insulation than shackles.

A pole top of a line in North Wales is seen in Fig. 1. The line itself is of galvanised steel and is arranged with doubled insulators for a road crossing, for 11 000 V. The cross-arm is of angle iron, mushroom-shaped bird guards are fitted, and the earth wire is suspended below. The line was executed by Crompton-Parkinson, Ltd.

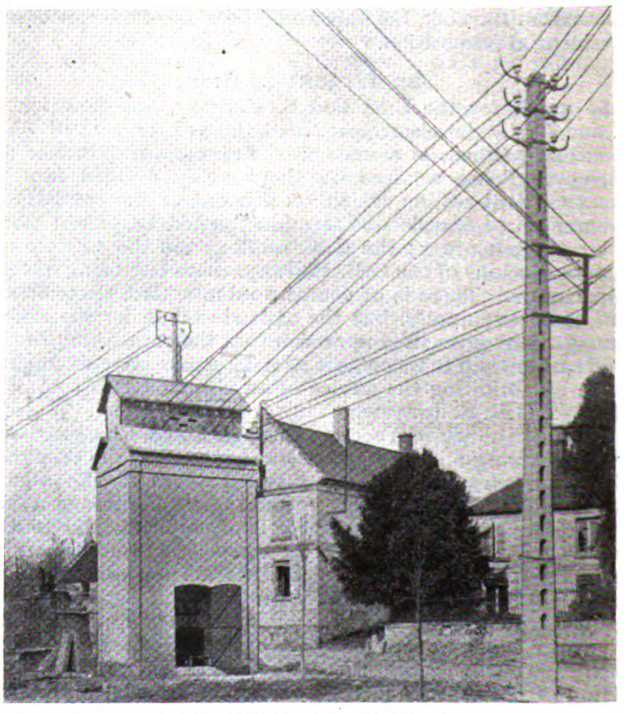

Fig. 2.—A brick sub-station in Northern France with two h.t. lines entering. The post on the right is of armoured concrete, the cross-arms being of the Jacquemard type.

When considering the arrangements of the supports for a three-phase overhead line, one of the first questions to consider is the placing of the conductors relative to one another. From the electrical point of view the equilateral triangle is

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the best, as it gives a mutual balance without transposition. The conductors can easily be rotated when desirable to minimise interference with postal lines.

The arrangement of two insulators on a level below, and the third at the top of the pole, is convenient from the point of view of minimum pole length, although a horizontal cross-arm is attractive for birds.

The herring-bone arrangement is economical for pole height and is not attractive to birds; it has been used to a material extent in America, and recently in England and France. The staggered swan-neck arrangement was for many years a favourite in France, Germany and Italy; the triangle is retained, and sometimes short bracket arms are used.

Where roadside lines are the rule and spans are kept short, the "flag" arrangement is sometimes used. It is not good from the point of view of balancing, but when the insulators face the road it is easy for a linesman on a motor cycle to see whether any of them have been broken. In New Zealand the cross-arm is placed close to the top of the pole, and the three conductors arranged horizontally, an arrangement which is perhaps more economical than pleasing.

On the Continent, swan-neck stalks are very largely used for pressures up to about 25 000 V. The position of the conductor is about on the level with the hole through the pole. Originally the dip in the neck was in the form of a **U**, but recently the German form, with a down slope, has had some vogue. It gives somewhat more clearance in proportion to its strength and provides no place for birds to sit on. It is made either with bolted ends or with coach screw ends, and is often made out of $\frac{7}{8}$ in. or 1 in. bar. For comparatively light lines the swan-neck system is cheap and apparently satisfactory.

A strain in the direction of the line has not the same tendency to turn the insulator over as with a pin on an arm, an unbalanced stress being taken up by a combination of the outward bending and torsion on the bar forming the swan-neck.

In England, with wood posts, pole-roofs are the rule. In Belgium and Denmark conical metal caps are often used. In America, France and Italy the wood poles are usually pointed; in France the tops are often tarred or painted.

Regarding the fixing of pin insulators, cement or sulphur were at one time largely used; nowadays a screw section is popular abroad. A lead cap to the pin gives a certain amount of plasticity, enabling a better bearing to be taken. As with many other things, even in the cementing of insulators, care must be taken, and troubles are not always due to the cement maker.

For insulators, porcelain was first in the field, and in this connection Messrs. Bullers, Ltd., of Hanley, claim to have been the pioneers in the making of telegraph insulators. Cornish china clay has remarkable properties for such purposes, and some of the transatlantic insulator makers, such as the Ohio Brass Co., buy Cornish china clay by the shipload.

Glass is used very largely in France and Italy, especially for h.t. distribution voltages. In the past there have been troubles owing to the difference in expansion between the steel stalk and the glass, but this has been overcome. In Germany, steatite is being tried. So far, for high voltages, moulded organic insulators have not been successful out of doors.

TIMBER PRESERVATION.*

Why Creosoting is Favoured—Impregnating Processes Compared—Savings on Maintenance Costs—Main Points of Decay.

By CHRISTOPHER WADE, A.M.I.E.E.

CREOSOTING under pressure has been used and found satisfactory in this country since 1838, when Mr. John Bethell obtained his original patent for the injection of hot creosote oil or dead oil of tar into the wood to be preserved in a closed cylinder under pressure. Timber so treated is still in use after thirty years. Examples are in existence after fifty years and more, in a perfect state of preservation.

Inquiries have shown that the General Post Office have had as many as fifty-seven years of useful life out of creosoted wooden telegraph poles, and the London, Midland and Scottish Railway about fifty-eight years, or perhaps longer.

A year or two ago a big power company had every pole of some thousands examined and bored into, after being up about twenty-five years; only about ten were found to be doubtful. I believe that creosoted poles last indefinitely in hot and dry climates—when not attacked by white ants, after the first virulence of the disinfectant has worn off.

In the north of America they use large quantities of creosoted cedar for telegraph and power poles. Also in Australia they use blue gum, creosoted under pressure. And in Southern and Central Europe, also in Spain, they use an inferior redwood.

Many other countries possess creosoting plants. Amongst these are Germany and America, with perhaps the largest output, also Denmark, Norway, France, Finland, Sweden, Portugal, Italy, Austria, Russia, Switzerland, and Holland. We export large quantities of creosoted telegraph poles to South America, Egypt, South Africa, the Sudan, etc.

In Norway, Sweden, and Finland, where our supplies of red fir are obtained, it was unusual until recent years to see creosoted poles; if a pole rotted, it was merely a question of cutting down a neighbouring tree to replace it. But even Sweden, where timber is so cheap, has at last discovered the value of creosoting, and has a travelling plant mounted on railway bogies; in this way creosoting the timber where felled, which is, as a rule, the place where it is required, and so saving the haulage of the timber down to the plant and back again to the forests for erection.

As to creosoting processes, the old full cell, or Bethell, process is practically never used now. The German Ruping process has taken its place. By this the surplus oil is drawn off and the timber is left practically dry to handle.

In this process poles are placed in a cylinder. A vacuum is put on in the first place to extract any moisture, and then compressed air pumped in at a pressure of 60 or 80 lb. per sq. in., which opens up the pores of the wood, and the creosote oil is pumped in on the top of this pressure, up to, say, 150 lb. When this pressure is taken off the compressed air in the cells of the timber expels any surplus oil, leaving in about 5 or 6 lb. per cu. ft.

Whitewoods—such as spruce or larch, etc.—will not absorb creosote, owing to the pores or grains of the wood being closed up, and are otherwise unsuitable; larch, moreover, has a tendency to split and twist.

Penetration cannot be obtained in the heartwood of any wood—even redwood—owing to the cells of the heartwood being sealed up. This fact does not seem to be generally appreciated or understood. But as most decay commences from the outside, this is of little account.

Any preparing, such as arm slots, etc., should be done before creosoting, as otherwise untreated timber may be exposed, so letting in rotting agents, or fungi, which are carried by the wind.

The main point of decay is undoubtedly between wind and water at ground line, where all the three necessary factors of decay are present—namely, moisture, air, and warmth. Some poles have been found hollow owing to the moisture entering at the top and percolating down the poles.

We have indisputable facts as to the length of life of good quality redwood, creosoted under pressure. This has been generally used since its adoption by the English G.P.O., the leading railway and power companies. There may be good points in other processes, but they have not been proved. The properly creosoted wood pole requires no attention or maintenance, as against steel towers and poles, which require constant painting.

Some people suggest using or impregnating inferior woods, or whitewood. I do not think this is at all suitable or feasible, as the cost is practically no less, and the nature and texture of the wood is unsuitable. Also I am told the authorities have no intention of allowing the use of whitewood. By this I do not mean larch in Scotland.

During the recent gales I heard of lines of steel poles uprooted at the foundation, and also doubled over at a point high up below the wires, where painting had apparently stopped on account of danger, and so let corrosion in. On the other hand, I heard of no cases of wood pole lines failing.

* Extracts from a paper read before the Overhead Lines Association.

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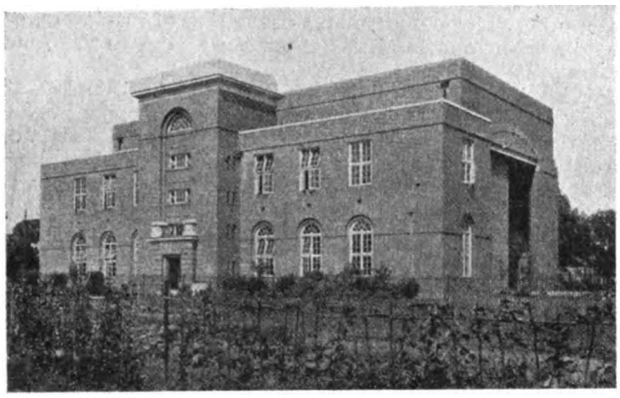
THE NATIONAL PHYSICAL LABORATORY.

Report on Work during 1928—Development of Measuring Apparatus for High-Voltage Work—Re-determination of the Absolute Ohm—Progress in Photometric Problems—Wireless Research Programme.

THE annual report on the work of the National Physical Laboratory for 1928, which has just been published (H.M. Stationery Office: 9s. net), contains, as in previous years, the reports of each of the departments. For the benefit of those who are only interested in the work of particular departments, however, arrangements are being made for the publication of separate sections dealing with physics, electricity, meteorology, engineering, aerodynamics, metallurgy, and units and standards of measurement. Dealing with the work of the Electricity Department, the Executive Committee reports that among the many matters of interest deserving mention in connection with the work of this department, the most conspicuous are the completion of the high-voltage plant, the progress made with the re-determination of the electrical units, and the international agreement and adjustment reached, as a provisional measure, in the photometry of high-efficiency lamps. The staff in the Electrotechnics Division have devoted much time to the development of measuring apparatus for use in the high-voltage work and to the provision of the many items of equipment needed to complete the high-voltage installation. It has been possible to make for firms, as well as for investigatory purposes, breakdown tests on strings of insulators up to the full capacity of the plant, and experimental work has been in progress with a view to improvement in methods of measurement of peak voltage in alternating current circuits, by using, after rectification, the current induced in a conductor by the voltage to be measured. A resistor for measurements up to 150 000 V has been designed and is under construction, as well as a shielded resistor for 40 000 V for use as a potential divider.



Exterior view of the High Voltage Building at the National Physical Laboratory.

Improved Test Methods.

In addition to the high-voltage work, the Electrotechnics Division has effected a number of improvements in the methods ordinarily employed in tests and investigations for industrial firms. A low-range electrostatic voltmeter has been constructed on the same principle as those in use for the range 50 to 150 V. The new instrument gives a scale deflection of 5·5 metres at 50 V, and can be read to one part in a thousand at 10 V.

A set of shielded resistances has been constructed for use in audio-frequency bridge work, ranging from 1 to 50 000 Ω. Air-cooled standard wire resistances for alternating current measurements have been prepared, to replace the water-cooled manganin tubes formerly employed. The resistance for large direct currents has been completed and will probably serve for measurements up to 15 000 A. Some special uses of transformers for measuring purposes have been explored, and the potentiometer electrostatic method for testing voltage transformers has been further tried and found to yield very satisfactory results.

The value of "ohmal" for the construction of standard resistances has been confirmed, and twenty-four such resistances have been under observation. Other resistance materials have been studied.

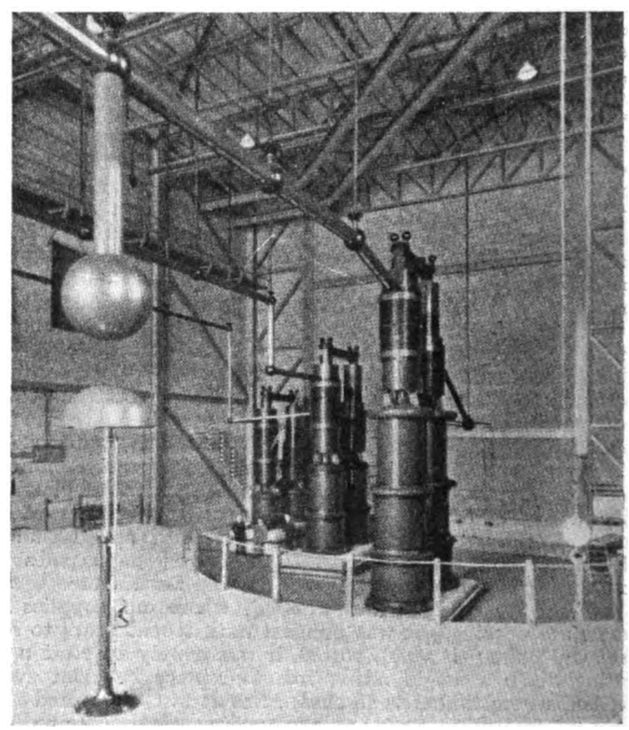
The work on the earthing of electric circuits was brought to an end during the year, and a report has been presented to the Wiring Rules Committee of the Institution of Electrical Engineers. A comprehensive investigation has been made into the effective resistance of lead-covered cables when carrying alternating currents, and will be published by the Institution. Researches on the effects of heating, and on the dielectric losses in cables at high voltages have been in progress for the British Electrical and Allied Industries Research Association.

Electrical Units and Standards.

In the Electrical Measurements Division very satisfactory progress has been made with the work on the electrical units and standards. The Lorenz machine has been put in order for a re-determination of the ohm in absolute measure, and the experiments will shortly be begun. Much has been done also towards the provision of the necessary equipment for the determination of the ohm by the alternating current method devised by A. Campbell. If good agreement is secured between these two methods, knowledge of the value of the absolute ohm will be established on a very satisfactory basis. An inter-comparison of all the standard resistance coils of the laboratory has also been completed, and a study is in progress of the change in resistance with time of newly constructed standards.

The current balance is undergoing reconstruction in an improved form, and it is hoped to reassemble it in the coming year. Measurements showing good agreement with those previously obtained were made with the balance before dismantling it. The results of the work on standard cells, including inter-comparisons with other national laboratories, are regarded as satisfactory.

The account given of an international comparison, between the Bureau of Standards and the National Physical Laboratory,



View inside the High Voltage Laboratory at the N.P.L.

of measurements on a sub-divided mica condenser sent to Teddington from the Bureau, will be found of interest. The results show good agreement in power factor, but a definite difference in the capacity measurements; experiments are proceeding with a view to the explanation of the latter.

A number of additions to the equipment for magnetic measurements have been provided to extend the range within which measurements of hysteresis loops and of total loss can be made.

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Under the heading of research are included some nine investigations of varied interest. The vertical force magnetometer described in previous Reports has been set up at the Abinger magnetic observatory. The measurements have shown variations, due, it is believed, to changes in the temperature of the hut in which the magnetometer is housed, which have amounted to several parts in 10 000 in six months. This matter is receiving attention. The work on the dielectric constant of benzene, mentioned last year, has been completed. The method devised for the comparative measurement of input and output voltages on an amplifying system has been brought into operation, and found to give satisfactory results.

A considerable amount of work relating to radio standards has been accomplished for the Radio Research Board. A critical résumé of the literature on piezo-electric crystals has been prepared, as well as an account of a mathematical examination into the relationship between the piezo-electric and the dynamical properties of resonators.* The interferometer method of examination of vibrating crystal plates has been developed with much skill, and has led to results of great interest.

Some modifications have been introduced into the programme of standard wave transmissions by the Laboratory, and arrangements are being made for the transmission of waves suitable for giving a means of short wave standardisation. An interesting series of frequency measurements on short wave stations in all parts of the world was made for the Radio Research Board, at the request of the Post Office and of Marconi's Wireless Telegraph Co., Ltd., the expense of the work being met by a contribution made to the Board by the company. The results of measurements made on Rocky Point, Long Island, N.Y., by the National Physical Laboratory and a number of other laboratories, showed agreement to about one part in 100 000.

The account of the analysis of losses in an air condenser will be found of much interest. Progress has been made with the work for the Physics Co-ordinating Research Board on alloys for compass correctors. Work on dielectrics has been continued for the British Electrical and Allied Industries Research Association, and a programme of work on a considerably increased scale has been prepared at the request of the Association, with a view to placing the work on a suitable footing to secure material progress, provided the Association is able to furnish the necessary funds.

Illumination Research.

The Photometry Division has a considerable programme of work in hand for the Illumination Research Committee of the Department, and the Report contains this year an account of a number of important investigations which have reached a definite stage of progress. The main research into the effect of glare on the brightness difference threshold, referred to in previous Reports, has been completed, and a paper on the results has been presented to the Royal Society.† An account of some of the work was communicated this year to the International Commission on Illumination. A series of tests for estimating glare and visibility in lighted streets was organised in July, in connection with the Sheffield meeting of the Association of Public Lighting Engineers, and has yielded interesting information. The delegates willingly gave their services as observers, and ten street-lighting installations were examined. A full report on the work has been submitted to the Committee.

The observations on skylight illumination have been continued, and the Usher Institute of Public Health in Edinburgh is co-operating by making measurements in that city. The investigation into various problems of room lighting has made good progress; this includes the study of illumination from light wells, measurements of daylight factor in deep rooms, transmission of window glasses when clean and after exposure, and other work. A description is given of a new design of illumination photometer.

The study of methods of photo-electric photometry has been continued, and a considerable advance has been made in establishing the use of the photo-electric cell on a reliable basis. For work of the highest precision the original photometer, described to the Optical Society last year,* consisting of a bridge arrangement of two photo-electric cells used with a Compton electrometer, continues to give the best results. Modifications have been made to overcome fatigue effects in the cells. The photo-electric cells is also employed for obtaining continuous daylight records.

Photometric Problems.

Work on heterochromatic photometry has been actively continued, in relation to the problems raised by the use of lamps of different colour temperatures. In particular, the use of a method of flicker photometry has been explored, which depends on the determination of what is called the Y/B (yellow/blue) ratio for different observers. Once this ratio has been obtained for any observer, it would appear from the experiments of Ives and others that the results obtained by the observer in the presence of a given colour difference can be reduced to those for the normal eye. Experiments are also in progress to determine the validity of the flicker photometer for use with large colour differences.

Papers have been published on the inter-reflection of radiation, where reflection and emission obey the cosine law;† the results are of much interest in relation to black-body radiators.

Work on the programme arranged at Bellagio in 1827 for securing international agreement on a method of heterochromatic photometry has been continued. Four blue glasses have been received from the Reichsanstalt, and their transmissions have been determined for light of colour temperatures 2 080 deg. K. and 2 360 deg. K. Calculations based on spectrophotometric measurements have also been made, and measurements with a flicker photometer are proceeding.

Intercomparison with the Reichsanstalt of measurements on six gasfilled lamps operated at 13 lumens per watt gave a value of 0.847 for the mean horizontal Hefner candle in terms of the mean horizontal International candle, as compared with the value 0·900 defined in 1909, from measurements with carbon lamps. The value of the mean spherical Hefner candle was found to be 0·850 in terms of the mean spherical International candle. Measurements on tungsten vacuum lamps gave the mean horizontal Hefner candle-power as 0·871 of the mean horizontal International candle-power, in close agreement with the result obtained in 1926, the value found for the ratio of the mean spherical Hefner candle to the mean spherical International candle was 0·878, indicating a difference of about 0·8% between the determinations of mean spherical candle-power at the two laboratories.

Intercomparisons of candle-power measurements have also been made with the Laboratoire Central d'Électricité, and have revealed matters requiring further investigation. A considerable amount of work has been done on a set of gas-filled lamps for use as standards of directional candle-power. The work on problems arising in the use of photometric integrators has also been continued.

In the Wireless Division, good progress has been made with the programme approved by the Radio Research Board. A number of papers have been published during the year, giving the results of researches completed. An interesting series of experiments has been carried out on antenna systems for beam transmission. In addition to study of the conditions affecting the "sharpness of directivity" of the system, experiments have been made in an aeroplane to check the calculations of the polar radiation diagrams of antenna systems in a vertical plane. Help has been given by the Air Ministry by the loan of an aeroplane for this work. Differences have been found from the theoretical energy distribution, and the work is being continued with a view to obtaining an explanation of these.

For research on wave-lengths below 25 m., a special oscillator, in which two 250 W valves are used, has been installed at Slough, and a portable loop receiver has been constructed for use at Teddington. It is possible to hold the note in this constant to about 100 cycles per sec., corresponding, for 7 m. wave-length, to a constancy of 1 in 100 000. A portable direction-finder for use on wave-lengths between 5 and 10 m. has also been provided.

In the continuation of the research on directional wireless, attention has been directed mainly to elucidation of the causes of error in the performance of a rotating loop beacon, and the development of a rotating transmitter free from night errors.

* J. E. P. L. Vigoureux. "Development of Formulæ for the Constants of the Equivalent Electrical Circuit of a Quartz Resonator in Terms of the Elastic and Piezo-electric Constants." Phil. Mag., Vol. 6, p. 1 140, 1928.

† W. S. Stiles. "The Effect of Glare on the Brightness Difference Threshold." Presented to the Royal Society, 1929.

* T. H. Harrison. Trans. Opt. Soc., Vol. 28, p. 195, 1926-27.

† H. Buckley. "On the Radiation from the Inside of a Circular Cylinder." Phil. Mag., Vol. 6, p. 447, 1928.

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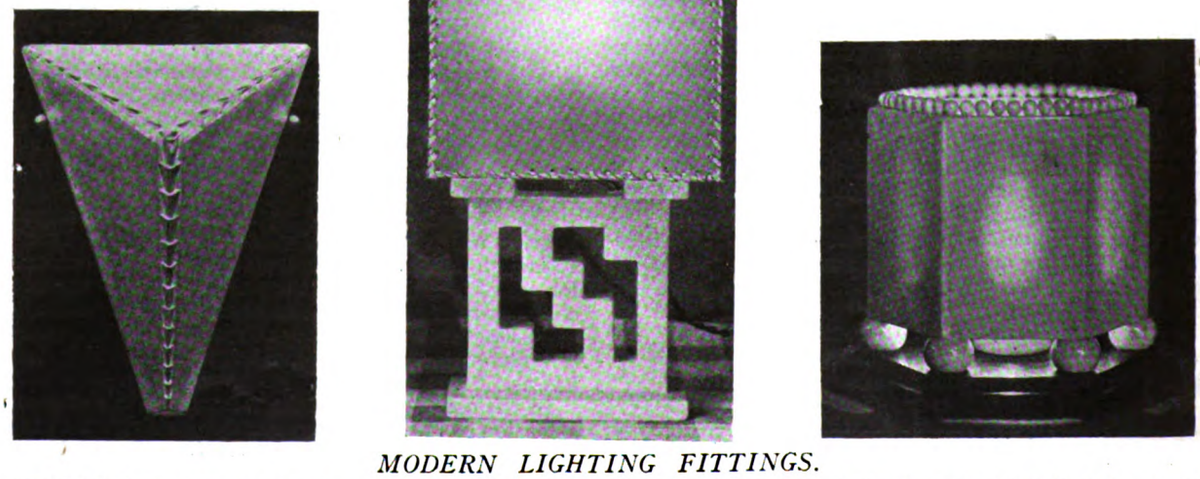

MODERN LIGHTING FITTINGS.

THESE three examples of modern design in lighting fittings are reproduced by permission from the "'Studio' Year Book of Decorative Art, 1929." To the left is seen a wall lamp in moulded unpolished glass, by Genet et Michon, Paris. The central picture is of a table lamp in fretted faience, by Robert Lallemant, Paris. The third picture shows a bedside lamp in carved ivory, designed by Eve le Bourgeois, Paris.

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CORRESPONDENCE.

The Editor welcomes the free expression in these columns of genuine opinion on matters of public interest, although he disclaims responsibility alike for the opinions themselves and the manner of their expression.

"The Factor of Safety of Overhead Lines."

(To The Editor.)

Sir,—In Mr. Taylor's letter of March 27th, on the above subject, he refers at length to reinforced concrete poles. To this part of his letter I do not feel called upon to reply, since the question was not raised in my article.

So far as the remainder is concerned, we do not appear to be in agreement; or, rather, Mr. Taylor has mistaken my meaning. I believe it to be an established fact that pole foundations are usually weaker than the poles themselves. This is obviously absurd—as Mr. Taylor agrees—and since no trouble has ensued, the inference I draw is that generally the poles were too strong.

The last two paragraphs of Mr. Taylor's letter I cannot properly understand, but I gather that he complains of two somewhat facetious paragraphs in my conclusions. But these two imply a moral, though they do not explicitly state it, namely—since I personally should err heavily on the side of safety were I drafting regulations for the protection of the public, and would require much more than I could justify on purely technical grounds, I presume the Electricity Commissioners have shown the same human weakness—but yet I hope they will be courageous, and make future regulations no more severe than investigation shows to be absolutely necessary.—I am, etc.,

W. Fordham Cooper.

London, N.8,
April 18th.

Battersea: A Suggestion.

[to the Editor.]

Sir,—With regard to the Battersea power station, I would be glad if you would allow me to make a suggestion, which, I think, is of the greatest interest and importance to the whole of the electrical industries.

It is, of course, familiar knowledge that the chief point in connection with all the uproar against Battersea is the emission of sulphur in the chimney gases and the consequent corrosive effect on the surrounding buildings, especially when it is remembered that this station is in the heart of one of the most populous centres of London, and is to burn, I understand, about 2 000 tons of coal per 24 hours.

On the very moderate figure of 1½% sulphur, this will correspond to 30 tons of sulphur per 24 hours, which is equivalent to 90 tons of sulphuric acid. Incidentally, of course, the sulphur is more or less completely burned, partly to sulphur dioxide (SO_2), but probably, also, to a considerable extent, sulphuric acid, that is, SO_3, (which unites with the moisture in the air) is formed as well; and, in any case, sulphur dioxide alone, especially in conjunction with moisture, is strongly corrosive.

In spite of the enormous advances that have been made in the technique of steam generation during the past dozen years or so, no one in the world has yet attempted to tackle the question of the elimination of sulphur in flue gases, and I want to make the suggestion that the whole of the electricity authorities in London should unite together, appoint a thoroughly representative committee of experts, and then carry out, at joint expense, research and large-scale investigations on the whole subject, using, for example, one of the London power stations for the purpose. Sooner or later this problem will have to be tackled, and, in my opinion, it is the electrical industries who should do it, especially as they lead the way in the supply of such an efficient, clean, and healthy method of heating and lighting as electricity.

I want to make it quite clear that, of course, I am a militant pro-electricity man, and to emphasise that certainly over 80% of the 1 400 000 000 tons of coal produced in the world per annum is burnt in the raw state with the discharge of sulphur to the atmosphere, so that, collectively, the power station is a minor offender.

The subject is, naturally, extremely complicated, and it is for this reason that detailed research work is necessary. For example, it might be possible to wash the chimney gases with forced sprays of water, while, further, the colliery industry and electricity stations might unite together and adopt special methods of cleaning coal so as to reduce the sulphur content in many cases to a considerable extent. Even this matter, however, is difficult, because, of course, many coals have a considerable proportion of organic sulphur, and it is not outside the realms of possibility that highly efficient methods of washing coal might actually increase the percentage of sulphur, although, generally, the reverse would be the case.

Then one could consider the possibility of combined low-temperature carbonisation and total gasification, with consumption of part of the gas under boilers after purification of the much smaller volume involved as compared with the total chimney gases. Again, various catalytic methods might be discovered of treating chimney gases, and, for example, the latest principles adopted at the Trenton Channel station of filtration through bags, to reduce emission of dust and grit, might conceivably be combined with some catalyst which would separate the sulphur in the solid condition, both from SO_2 and SO_3. The main point is, however, that complete scientific investigation on the whole question is urgently required, and, in my opinion, this should be undertaken by the electricity industry itself, and—above all—without the interference of the politician and the Government official.—I am, etc.,

David Brownlie.

Ealing, W.5,
April 20th.

"The Electric Sign Load."

[To the Editor.]

Sir,—Under the above heading your correspondent "Elecsine," in your issue of April 12th, assumes that the total load on Selfridges' gigantic sign was 900 kW. Your correspondent assumes that all the lamps were 30 W, but this is not so, as about 30 000 of the lamps were only 7 W and 14 V, wired in parallel-series for a 240 V circuit. The only lamps of 30 W were those employed in the four letters constituting the dates. The total load for this exterior lighting was, approximately 250 kW, whilst, for the decorative lighting inside, another 84 kW was required.

We would mention that the whole of the plant has been dismantled and is now in our stores awaiting sale or hire.—I am, etc.,

For Implitico, Ltd.,
W. R. Lambert,
Director.

London, S.E.1,
April 19th.

"Educating the Public."

[To the Editor.]

Sir,—Many contractors will, I feel sure, feel grateful to "Regtract" for drawing attention to the seeming lack of co-operation between the E.C.A. and the National Register of Electrical Installation Contractors. If the progress of the Register has been slow I submit that one of the chief causes has been the hyper-critical attitude of the E.C.A., and its unreasonable demand—which I understand is now abandoned—for E.C.A. representation on every Local Advisory Committee, irrespective of whether the E.C.A. nominee was registered or not. The special committee, to which reference is made in the "Electrical Contractor," is in my view a direct reflection on the propaganda work which has been carried out by the National Register within the last few months. If the Association is not satisfied with the extent of this work why does it not subscribe a definite sum for use by the Register in the prosecution of its publicity campaign?

As I see it, the E.C.A. appears to regard the Register as a competitor, instead of a potent force and ally in building up the public prestige of reputable electrical installation contractors. A more helpful attitude towards the Register would do more good than any number of E.C.A. special committees.—I am, etc.,

"Regicon."

Manchester.
April 20th.

BOOKS RECEIVED.

Year Book of the American Institute of Electrical Engineers, 1929. (New York: American Institute of Electrical Engineers.) Pp. 609.

"The Theory of the Gyroscopic Compass and Its Deviations." By A. L. Rawlings. (London: Macmillan and Co.). Pp. x+191. 10s. 6d. net.

"Elektrotechnischer Briefsteller." In German, French, English and Spanish. By Hugo Loewe. (Leipzig: Hachmeister and Thal.) Pp. vii+287. Price 12 marks.

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NEWS IN BRIEF.

May Meeting of Overhead Lines' Association—Electrical Trade Wages—Indian Tariffs and Electrolytic Copper—N.E. Coast Lighting Service Bureau Moves Its Office.

THE electrical installation at the Brighton Corporation mental hospital is to be extended at a cost of £1 100.

The date of the meeting of the Overhead Lines Association for next month has been altered to May 15th, when Lt.-Col. W. A. Vignoles will present "Getting Consumers in Rural Areas" at 5.30 p.m., at the Institution of Electrical Engineers.

All northern parts of Manchester are now equipped with police telephone boxes.

Electrically operated traffic signals wereput into operationin the centre ofLiverpoollastweek.

York Corporation is to establish automatic road signal apparatus at five additional points in the city.

Plymouth Hospital Committee is to complete the electric wiring of the mental hospital, at the estimated cost of £515.

The Metropolitan Asylums Board is to install, at a cost of £1 210, an internal telephone system at the Grove Hospital, Camberwell.

The Indian Tariff Board proposes that the import duty of 15% on electrolytic copper rod be removed, and that a duty of 5% be imposed on rubber insulated electric wires and cables, other than those specified in Tariff No. 90A, which are duty free.

Arrangements have been made by the North Midland area E.D.A., for the second Area Sales Conference to be held at the Royal Victoria Station Hotel, Sheffield, on April 30th, at 7.30 p.m., when Mr. R. A. S. Thwaites, of the Yorkshire Electric Power Co. will speak on "Selling Electricity for Industrial Purposes." The chairman will be Mr. S. E. Fedden.

Sheffield City Council is inviting applications for the position of general manager and engineer of its electricity supply department.

The Manchester Medical Officer of Health refuses to approve of the use of unscreened ultra violet ray lamps in the public baths unless the treatment is under the supervision of qualified medical officers.

A special course of six lectures on thermionic valves will be given at the Polytechnic School of Electrical Engineering, London, by Mr. W. H. Date, on Wednesdays, commencing May 8th, from 6.30 to 8.30 p.m.

The annual report of the Ontario Hydro-Electric Power Commission states, the revenue of the Commission for the twelve months ended October 31st last was $24 287 296. Expenditures were $23 346 633.

Rotherham Corporation has instructed the architects to submit schemes of heating the new technical college and school of art by low pressure hot water heating apparatus, by using (*a*) solid fuel boilers, and (*b*) gas fired boilers, and (*c*) by electricity.

Official statistics show that on December 31st, 1928, the British telephone system comprised 1 759 666 telephones, an increase of 125 864 over the previous year. During five years there has been a net addition of 611 571 telephones, or over 50%.

Emergency calls are to be provided for in all multi-coin telephone call boxes connected with manual exchanges by means of a press button device which operates a flashing priority signal in the exchange. Automatic telephones do not need the device.

The Borough Electrical Engineer of Tynemouth has recommended that an electric oven for instruction purposes be lent to the Municipal High School free of charge. The question has been raised whether cooking instruction is given at other schools in the borough. The Chairman, Deputy Chairman, and the Electrical Engineer are to make inquiries.

St. Helens Corporation requires an electrical engineer and manager of its electricity undertaking.

Wakefield City Electrical Engineer is to proceed with the conversion of further street lamps from gas to electricity in Westgate.

Glasgow Electricity Department is to carry out a modified scheme of electric lighting and heating at the Shieldhall Hospital, at a cost of £1 505.

London County Council has refused an application for a special subscription of £100 to the British Electrical and Allied Industries Research Association towards the cost of investigating the problem of deeply buried high power electric cables.

The North East Coast Lighting Service Bureau premises will be closed on April 30th, after which its activities will be transferred to the stand of the Electrical Lamp Manufacturers' Association, at the North East Coast Exhibition, which will open on May 14th.

The annual report of the West Yorkshire Telegraph and Telephone Advisory Committee shows that the number of stations in the district at December 31st. 1928, was 65 540, an increase of 2 975. The number of trunk calls during 1928 was 5 859 892, and local and trunk calls numbered 39 782 024.

Manchester Electricity Department received orders in February last for 89 hired cookers, and 31 were connected, making a total of 5 112.

At the general meeting of the North-Eastern Centre, Tees Side Sub-Centre of the I.E.E. at Middlesbrough on April 17th, Mr. J. M. Gibson was elected chairman for the next session, and Messrs. S. N. Warren and D. M. Buist will be vice-chairmen. The hon. secretary is Mr. D. B. Hogg. Mr. A. P. Hill, of the British Thomson-Houston Co., read a paper on "Valve Rectifiers."

A dipper dredge, driven by a 1 100 H.P. Diesel electric generator, and intended for use in connection with the straightening of the Chicago river, has been launched by the Monitowoc (Wis.) Shipbuilding Corporation. The main power unit consists of a two-cycle Diesel engine, directly connected to four generators on a single shaft, and supplying current to the main motors, while auxiliary power is supplied by a 120 H.P. two-cycle Diesel engine connected to a 75 kW generator. There are 28 motors in all.

Following the decision of the London branch of the National Federated Electrical Association on March 6th, it has now been agreed that the rate for journeymen in the London area be increased by 5%, such increase to be based on the rate fixed in accordance with the national standardised wages agreement and to remain in operation for six months. The new rate will therefore be 1s. 10¾d. per hour, against the existing rate of 1s. 9¾d., and the increase will take effect on the first pay day in May for the pay period covered by that pay day. The rate for mates will be increased proportionately—*i.e.*, from 1s. 5½d. per hour to 1s. 6¼d. per hour.

LOOKING BACKWARD.

FIFTY years ago, according to THE ELECTRICIAN *of April 26th, 1879 :—*

The insulation-resistance of the cable between India and Ceylon was found, after twelve years' use, to be 2 550 megohms, against an original figure of 7 000 megohms.

The Postal Telegraph Department had in use 1 650 bichromate, 2 450 U.K., 12 750 Myirhead, 500 ordinary Daniell, and 500 Leclanché batteries.

* * *

TWENTY-FIVE years ago THE ELECTRICIAN *for April 29th, 1904, recorded that :—*

Mr. S. E. Britton, burgh electrical engineer at Motherwell, was appointed borough electrical engineer at Chester.

Following the grant of an injunction against St. Pancras Borough Council for vibration nuisance at its power station, a campaign was initiated to secure the repeal of provisions for action against electricity undertakings for nuisance and damage.

* * *

TEN years ago it was reported in THE ELECTRICIAN *dated April 25th, 1919, that :—*

The successful use of electrically-heated quilts in hospitals was reported from Wigan.

The Electric Lamp Manufacturers' Association was formed, with registered offices at 46, Queen Victoria Street, London.

Mr. W. W. Lackie, then chief engineer and manager of Glasgow Corporation Electricity Department, in a lecture, expressed the opinion that it would be impracticable and uneconomical to have generation and main transmission under one authority, while the distribution was left to be carried on by existing local authorities.

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PERSONAL.

MR. E. Kilburn Scott is prospective Liberal candidate for South Leeds.

Swindon Town Council has appointed Mr. P. M. Chivers as chemist to the electricity department.

Sir James Devonshire has been appointed chairman of Edmundson's Electricity Corporation, Ltd.

Newry U.D.C. has appointed Mr. W. J. Ellison, as senior charge engineer; and Messrs. E. Hillen and R. Porter, Newry, as second engineers.

Mr. C. D. Cuppleditch, who, for some time, has been designer to Messrs. Joseph Booth Bros., Leeds, has accepted the position of manager with Electromobile, Ltd.

Estate of the gross value of £1 487 was left by the late Mr. William Richard Spaven, for 24 years manager of Portsmouth tramways and formerly Leeds traffic manager.

Sir Oliver Lodge has written a foreword for a forthcoming London exhibition of water colours of Italian harbours and hill towns. He confesses, however, that he would never make an artist.

Mr. W. Bolton Shaw, who has carried on his consulting practice at 25, Market Street, Manchester, for the last eighteen years, has removed to 1, New Brown Street, where he will continue in practice.

Mr. William Thom, late general manager of the Potteries Electric Traction Co., has been presented by the staff and employees with a compactum wardrobe. Mr. Thom has become a director of the company.

We are pleased to learn that Mr. A. Brammer, general secretary of the Association of Supervising Electrical Engineers, is recovering from his recent illness and hopes to resume his duties almost immediately.

Mr. J. H. Thomas has relinquished his position as assistant manager of the Manchester Branch of the General Electric Co., Ltd., and has taken up a position as general sales manager to A. C. Cossor, Ltd.

The marriage of Mr. W. T. Gibson, who is engaged with the International Standard Electric Corporation of Paris, and Miss Kathleen Mary Griffin, was solemnised at St. James's Church, Northampton, on April 18th.

Mr. R. Birkett, borough electrical engineer at Southend-on-Sea, has been given two months' leave of absence in consequence of ill-health, and Mr. A. C. Johnson has been appointed acting borough electrical engineer during his absence.

Mr. F. Rowlinson, at present publicity manager to Mather and Platt, Ltd., Manchester, is shortly to take over the establishment of a publicity department for the United Steel Companies, Ltd., Sheffield, the "vertical" group controlling the merger of steel and allied industrial firms.

The marriage of Mr. H. G. Finchett, assistant engineer and manager of the Oswestry Electric Light and Power Co., Ltd., to Miss D. E. Charles, was solemnised at Oswestry Parish Church on April 16th. Mr. Finchett was presented by the staff and employees of the company with a canteen of cutlery and a case of fish knives and forks.

The short leet for the post of manager of the Aberdeen Corporation Tramways has been reduced to the following three names, which will be submitted to the Town Council:—Mr. William W. Clark, engineer and manager, Nottingham and Derby Traction Co. and Midland General Omnibus Co.; Mr. James L. Gunn, manager, Greenock and Port Glasgow Tramways; Mr. H. H. Lancaster, traffic manager, Blackpool Corporation Tramways.

Replying to the Blackpool Tramways and Electricity Committee, by whom they had been invited to hold their next annual conference at Blackpool, the Municipal Tramways and Transport Association stated that in due course Mr. Charles Furness would be elected president of the Association, and it is the opinion of the Council that the Association ought to meet in Blackpool during the year of Mr. Furness's presidency. The 1929 conference will be held at Yarmouth.

Obituary.

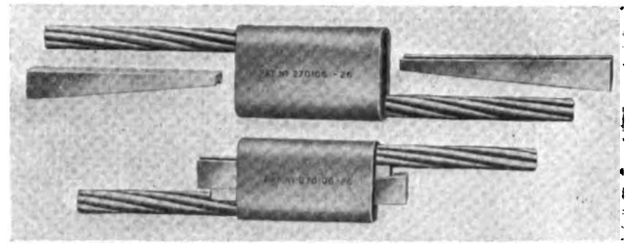
MR. EDWARD GURNEY BUXTON, at Norwich on April 19th, He was a director of the Anchor Cable Co., and of Callender's Cable and Construction Co.

MR. E. HUDSON, on April 16th, secretary of the Oswestry Electric Lighting and Power Co., Ltd. Mr. Hudson had been associated with the company since its inception in 1894 and had been secretary since 1913.

NEW JUMPER CONNECTOR.

Mechanical Connector for Indoor or Outdoor Jointing.

ALTHOUGH designed more particularly for overhead lines, a mechanical jumper connector, introduced by W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Holborn Viaduct, London, E.C.1, is intended for use either indoors or outdoors



Illustrating the new connector of W. T. Henley's Telegraph Works Co.

wherever two free ends of conductors—copper rod, busbars, or the jumper loops of overhead lines at angle and junction poles—have to be jointed. The outstanding advantages claimed for the connector are cheapness, efficiency and lightness in weight. The connector consists of three parts, a seamless, parallel sided copper sleeve containing two gun-metal wedges grooved to accommodate the conductors. The wedges fit tightly inside the sleeve, and during transit or handling will not, it is stated, come out of position. Wires of different diameter can be accommodated together in the same connector. The illustration shows how the connector is used. The free ends of the conductor are inserted into the sleeve over the small ends of the grooved wedges, which are then driven into position. During this operation there is no necessity to take the wedges out of the sleeve. It is recommended that a coat of bitumastic paint should be applied when the joint is made. There are no iron or steel parts to corrode and no bolts or screws of any kind. In a recent test on a connector for a 0·10 sq. in. conductor the increase in resistance of the conductor, directly due to the joint, was, it is claimed, less than 6 microhms. After further being subjected to a tensile test, the pull-out load of which was 670 lb., the connector was said to be in no way damaged and could have been immediately put into service. The types, together with the range of cable diameters, are:—Type 1, 0·16 in. to 0·232 in.; type 2, 0·246 in. to 0·324 in.; type 3, 0·347 in. to 0·415 in.; type 4, 0·448 in. to 0·504 in.

INDIVIDUALIST LUNCHEON.

Views on the Spirit of Adventure and the Modern Youth.

AT the Individualist Luncheon held at the Hotel Cecil, London, on April 17th, an address was given by Mr. H. Gordon Selfridge on "Why not more spirit of adventure?" in which he stated that the spirit of adventure, if properly encouraged in the young men of this country, could and would build into their lives the ability to overcome obstacles. In the newer countries young men rarely remained in the town in which they were born. When they left home they did so almost always with the goal of success steadily in mind. When a young man in America or Canada applied for a post he associated with it the colloquial query, "What is the chance to work up?" and a favourable reply to this was even more considered than the immediate wage. This spirit should become part of the plan of every young man in England. Adventure led to leadership and the real leader must prove himself capable of imagination, energy, strength of purpose, constructive ability, of knowledge of men and of the world. In all matters of adventure, business, official, political or what not, the principles were the same. In all control or governmental management the twentieth century man looked for and hoped for the least possible interference with his natural inclinations. Civilisation necessitated certain restrictions. Wise control enforced these and gave safety to life, health and property. Those elected or appointed to positions of authority too often wanted to do all the thinking, and again too often, the youth let them do that thinking so completely that he, the youth, ceased to think. This did not lead to individuality or personality. Paternalism was bad. Too much protection was not good, and tended to stunt growth of self-dependence.

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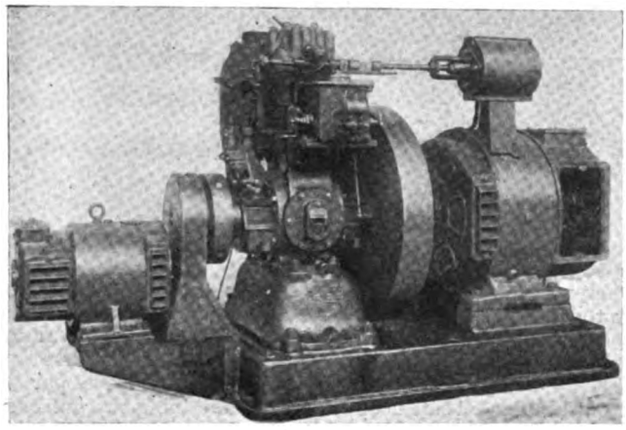
COUNTRY HOUSE LIGHTING.

New 5 kW Plant for Domestic and Other Lighting.

A NEW automatically operated 5 kW electric lighting plant with an 8 H.P. surface ignition oil engine has just been introduced by PETTERS, LTD., of Yeovil. The plant will be exhibited for the first time at the N.E. Coast Exhibition, which opens next



The new 5 kW plant of Petters, Ltd.

month, but, for the benefit of readers interested in equipments suitable for country house lighting, the following are advance particulars.

The plant consists of a type S surface ignition oil engine direct-coupled to a dynamo. A special starting motor is provided, driving the engine crankshaft through reduction gearing, and the whole is carried on a heavy cast iron bedplate. The heat for the ignition of the first charges in the cylinder is provided by means of an electric heating plug, which provides ignition until the vaporiser in the cylinder head has attained a sufficient temperature to carry on ignition automatically. A feature of this starting arrangement is that a rotatable sprayer nozzle is fitted, which injects the fuel in a spray which is directed on the coils of the electric heating plug for starting. When the combustion chamber has become heated after a few moments running, the nozzle is rotated, and the oil spray is directed on to the hot surface of the vaporiser. The rotation of this nozzle is effected automatically by electrical means. A large solenoid is arranged to rotate the sprayer through the medium of a rack and pinion.

LEGAL INTELLIGENCE.

Petition for Liquidation of R.I. and Varley, Ltd., Dismissed by Consent.

IN the Companies Winding-Up Court on Monday, Mr. Justice Maugham heard the petition of Oliver Pell Control, Ltd., electrical engineers, of Commercial Place, Woolwich, and Mr. J. M. Griffiths Rees, for an order for the compulsory liquidation of R.I. and Varley, Ltd., of Kingsway House, London, W.C., a company which acts as selling agents for the wireless and other products of Oliver Pell Control, Ltd., and Radio Instruments, Ltd.

Mr. F. K. Archer, K.C., for the petitioners, said Oliver Pell Control, Ltd., and Radio Instruments, Ltd., had equal holdings in R.I. and Varley, Ltd., and acute differences had arisen between Mr. Joseph and Mr. Rees, representing Radio Instruments, Ltd., and Oliver Pell Control, Ltd., respectively, on the board of the respondent company.

After hearing further evidence, the parties came to an agreement by which it was arranged that there should be a voluntary liquidation, the petition being by consent dismissed.

Power Company Sells Out.

In the Chancery Division on Monday, Mr. Justice Maugham sanctioned an alteration in the objects of the Atlas Light and Power Co., Ltd.

Mr. Cecil Turner, for the company, said it was formed to carry on water works, power stations, tramway and railway undertakings in Argentina. It had recently sold all its investments in that country for £8 500 000, and, owing to the restricted character of its investment powers, the company would have difficulty in using this large sum to advantage. It therefore desired to alter its objects so as to take the general powers of a trust investment company.

IN PARLIAMENT.

London Passenger Traffic Bills Again Before House of Commons Select Committee.

CONSIDERATION of the Bills promoted by the Underground Group and London County Council to authorise a scheme of co-ordination and co-operation of the passenger carrying services in the London area was resumed by a House of Commons Committee last week. Sir Lynden Macassey, K.C., handed in a copy of the companies' Bill amended as directed by the Committee. There was, he said, a clause in the L.C.C. Bill authorising, among other things, local authorities to make representations to the Minister with respect to the need for development or extension of the associated undertaking in their areas.

Lord Ashfield, cross examined, said as a result of the pooling agreement the London General Omnibus Co. paid a substantial sum to the Metropolitan Electric Tramways. The latter was improving its position, and was now very close to meeting its obligations. The Underground Group had a controlling interest in the M.E.T. There was no limit to the amount which could be spent on the traffic undertakings of London. On the proposed Tramway Board, municipal and company undertakings would be represented.

Mr. Arthur Moon, K.C., for East and West Ham, said those boroughs agreed that a scheme should be evolved for the co-ordination of London's traffic, but they did not consider the proposed scheme the best means of dealing with the problem.

Mr. Arthur Collins, financial expert, who gave evidence on behalf of eight Metropolitan boroughs opposing the Bills, said the L.C.C. now controlled 70 per cent. of the tramway traffic in London. A combination between them and the Underground companies would enable them to make it difficult for other traction authorities to survive. The common fund to be established under the Bill would be weaker for the purpose of raising capital for new developments than the present common fund of the Underground Group, as they were taking in concerns which made a loss. A working arrangement without the complication of the common fund was all that was needed. The L.C.C. case would not meet the combine case. He would like to see any such wide development as the Tramway Board brought there for discussion. It ought to be open to a local authority to take any request for extension or development of facilities before a tribunal sitting for that purpose.

Ald. F. C. Ross Douglas (Battersea) said there was no guarantee in the Bills against the present cheap tram fares being increased or the present facilities being changed.

Mr. Rowland Harker, K.C., for Middlesex County Council, (the lessors of the Metropolitan Electric Tramways), asked that the Council should be allowed to take part in the negotiations between the L.C.C. and the Underground Group before the first agreement was made, or to have an opportunity of criticising it.

Sir Lynden Macassey (for the Underground Group) said they had offered that the owners of tramways on the area should be asked to participate in the negotiations.

Mr. R. S. Cripps, K.C. (for certain Metropolitan boroughs) said the Bills did not really deal with the problem of co-ordinating traffic, but only laid down a wide principle of a financial merger, and that the scheme indicated by the Bills was not workable.

Mr. H. Macmillan, K.C., said it had been agreed with the promoters to ask for the insertion of a clause giving the right to local authorities owning tramways in or partly in the London area to be a party to an agreement for common management and a common fund, and that the promoters should supply to such local authorities such information as they may require upon the terms of any such agreement.

Mr. Harker submitted that the Bill should be rejected unless provision was inserted to enable Middlesex County Council to appear before an independent tribunal.

Sir Lynden Macassey, in his final address, said this was the only scheme in the field for the co-ordination of traffic. The promoters were prepared to insert a provision that the application of any surplus of the common fund should be subject to the approval of the Minister of Transport.

Mr. Evan Charteris, K.C., for London County Council, said the Council was going to sacrifice, to a certain extent, a control over the transport of 700 million passengers and obtain control over 2 000 million.

On Monday, the Committee found the preambles of both Bills approved, and, after some adjustments of clauses had been made, the Bills were reported to the House.

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BUSINESS ITEMS.

MR. J. SHIRLEY, wireless engineer, has opened new showrooms at 130, Cowley Road, Oxford.

LEO SUNDERLAND AND CO., LTD., have removed to 58, Buckingham Palace Road, London, S.W.1.

J. O. CALLAGHAN AND CO., have transferred their business from Queen Street to MacCurtain Street, Cork.

The Dublin offices of W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., have been removed to 11, Fownes Street.

A confidential memorandum on the market for wireless apparatus in Genoa has been prepared by the Department of Overseas Trade. Reference, B.X. 5242.

The address of the London office of the MULLARD WIRELESS SERVICE CO., LTD., has been changed to Mullard House, Charing Cross Road, London, W.C.2. The Birmingham offices of the company are now at 36–37, Dale End.

The exhibits of BROOKHIRST SWITCHGEAR, LTD., at the Printing Exhibition, which concluded at Olympia, London, on Thursday, included in addition to the exhibit proper, some 45 panels controlling presses in other parts of the show.

A. P. LUNDBERG AND SONS, LTD., 477/489, Liverpool Road, London, N.7, advise us that Lundberg's dual control switching was used in conjunction with the magnetos fitted on Major Segrave's motor boat, "Miss England," at the time of the speed test in America.

A five-days exhibition was held in the Town Hall, Oldbury, last week, by the SHROPSHIRE, WORCESTERSHIRE AND STAFFORDSHIRE ELECTRIC POWER CO. An electrically operated sewing machine was shown by the Singer Sewing Machine Co. and other exhibitors were the Revo Electric Co., Ltd., and Messrs. W. and T. Avery, Ltd. See page 511.

The METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester, has received a letter from Mr. R. F. Dixon, engineer and manager of Mansfield and District Tramways, Ltd., which points out, that when overhauling one of the tramcars for the undertaking and taking down the field coils for re-insulation, the original shop ticket was discovered, the car having been running continuously for 24 years. The insulation appeared to be in good order, and the coils are being put back for further service.

An order has been placed with the MARCONI'S WIRELESS TELEGRAPH, CO., LTD., by the Société Belge Radioelectrique, on behalf of the Belgian Government, for a short-wave telegraph-telephone transmitter which will be used for communication between Belgium and the Belgian Congo and Belgium and South America. Two short-wave receivers, similar to those used in the Marconi "beam" stations, have also been ordered.

New showrooms and offices have been opened by the SHROPSHIRE, WORCESTERSHIRE AND STAFFORDSHIRE ELECTRIC POWER CO., at 373, High Street, Smethwick. The new premises comprise spacious showrooms, a model demonstration kitchen, store rooms, and offices furnished in an up-to-date manner. The architectural work was done by the company's own building department, the electrical wiring was by WALKER AND CO., Smethwick, and the tubular electric heating system by MESSRS. YOUNG, OSMOND AND YOUNG. See page 511.

Three further high power rectifiers for the New South Wales Government Railways and Tramways, Sydney, have been ordered from BRITISH BROWN BOVERI, LTD., Trafalgar House, Waterloo Place, London, S.W.1. Each of these equipments is for an output of 1 500 kW at 1 500 V d.c., two being for an extension of the Granville sub-station, and the third for the extension of the Cabramatta sub-station (formerly Cabravale). All three equipments will be arranged for completely automatic control, similar to that provided for the ten previous equipments. When the three new sets are at work, this railway company will have a total of fifteen 1 500 kW plants in operation. As a matter of further interest it may be mentioned that the total capacity of Brown-Boveri high power rectifiers installed or on order is now nearing 1 000 000 kW.

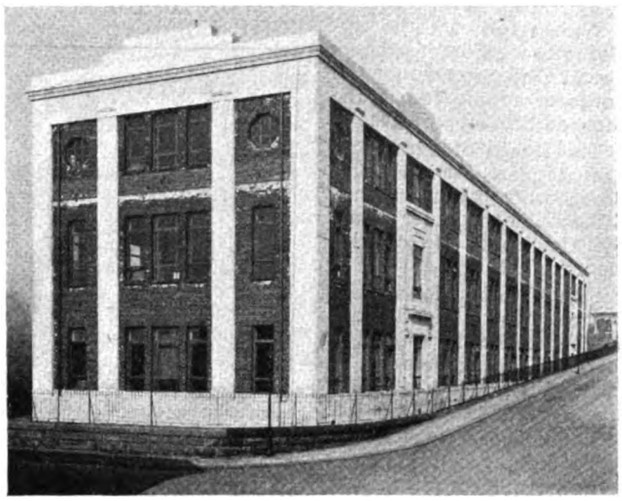
THE JOHN BENN HOSTEL.

Sir Ernest Benn, President, presided over the annual meeting of the East End Hostels Association, at the John Benn Hostel, on April 11th. In submitting the annual report and balance sheet, he said that it cost £6 000 a year to run the Hostel and the Milner Hall, and, after the usual sources of revenue had been exhausted, they required a further sum of £2 000 which he appealed to all present to assist in raising. Mr. R. McKenna seconded, and the Earl of Feversham, Chairman of the Council, supported the motion.

NEW CABLE OFFICES.

Particulars of New Building Erected for B.I. Cables Ltd., at Prescot.

BRITISH INSULATED CABLES LTD., have recently completed, at a cost of £35 000, a block of offices at the corner of the factory property nearest to Prescot station. The new building, designed by Messrs. Bailey and Nisbett, is



The new building of British Insulated Cables Ltd. at Prescot.

256 ft. long by 42 ft. wide, and consists of a steel framed structure encased in sand-faced red brick, with artificial stone plinth, pilasters, and cornice. Ample daylight is provided by 252 steel windows. The main entrance, at the north end, opens into a hall with main staircase and a passenger lift, giving access to all three floors. A second entrance with a smaller hall is provided at the south end of the building.

On the ground and second floors a central corridor runs the entire length of the building, with rooms opening right and left, borrowed lights being fitted in the corridor walls. The first floor arranged so as to provide in the centre of the buildings an office, 5 100 square feet in area, for the general office staff. There are in all 95 radiators connected to a low pressure central heating ring system, with two steam calorifiers. Domestic hot water is also heated by a steam calorifier, through which passes condensate from the central heating calorifiers.

A feature of the new offices is the lighting, medium sized units in enclosed bowls being used throughout. The wiring was carried out by the company's staff with the "Prescot" wiring system. The decoration of the interior has been treated with due regard for lighting, in that a general scheme of light colours has been adopted, various tints being employed, in order to avoid monotony. The Board Room is flush panelled in Ancona walnut. Electric clocks, controlled by the "Pulsynetic" system, are installed throughout.

ELECTRICAL WOMEN.

Visit to "M.K" and Belling and Co. Works—Branch Activities.

SEEING how "outlets" are made was a matter of interest to about 150 members and friends of the Electrical Association for Women, when they visited the works of "M.K." Electric, Ltd., Edmonton, London, N.18, on April 16th. From machine shop to test sections, each department held attention. Special interest was shown by the visitors in the "anti-flash" switch socket, "double purpose" sockets with safety fuses, and a complete range of switchplugs suitable for the home. After inspecting the "MK" works, the party proceeded to Enfield to Messrs. Belling and Co., where they were entertained to tea, and shown round the works.

Dr. A. Bryce gave a lecture on the subject of "Sunlight and Health" to the members of the Birmingham and Midlands Branch of the Association on April 17th.

On April 11th, Mr. J. W. H. Cooper, of the E.L.M.A. Lighting Service Bureau gave a talk to the Rugby Branch on "Colour Lighting in the Home." Mr. Cooper gave various demonstrations of the effects of good and bad lighting, by means of a model room. The ladies were particularly interested in Mr. Cooper's remarks on the effect of dark decorations, Lantern slides were shown illustrating the effects which can be obtained in modern homes by diffused lighting.

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ELECTRICITY SUPPLY.

Bedford and Rural Supply—The Becontree Estate—Lincoln and the Electricity Commissioners—Extensions at Hull.

ROTHERHAM Electricity Committee recommends that the charge per kW to industrial bakeries be fixed at 0·9d.

East Ham Electricity Committee has approved an estimate of £7 290 for laying distributor cables in various streets.

Warrington T.C. is applying to the Commissioners for an Order extending the limits of supply to include three additional parishes.

The Board of Trade has passed plans for the proposed work of laying h.t. cable under the River Colne, by Colchester Electricity Department.

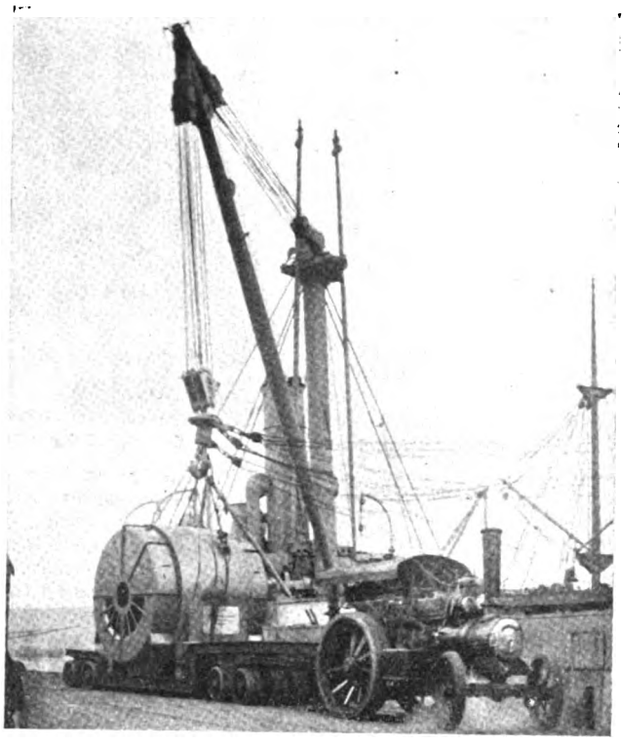
Swansea Electricity Committee has decided that shilling-in-the-slot meters be installed, consumers to be charged 1d. per kW above the prevailing rate.

The Merthyr Electric Traction and Lighting Co.'s new hydro-electric plant at Pont-y-cafnau, on the river Taff, was put into operation on April 6th.

No objection to the proposal of the Paignton Electric Light and Power Co. to spend about £10 000 for extensions in connection with the change over from d.c. to a.c. has been raised by Paignton U.D.C.

Only one application by a tenant of a Colchester Council house for the use of gas for lighting has been received, and, on being informed that an electric slot meter could be installed, the applicant withdrew the request.

Hull Electricity Committee has decided to apply for sanction to loans of £100 000 for maintenance and service, and £50 000 for new sub-stations. — During the last quarter 700 applications have been made to the Electricity Department for wiring.



A PHOTOGRAPH showing the 25-period stator of the 30 000 kW frequency changer which the Metropolitan-Vickers Electrical Co., Ltd., has supplied to the London Power Co. for the Deptford West Station, being loaded at Manchester docks by a steamer fitted with a 100 ton derrick. The stator was lifted by this steamer and swung over to another for conveyance to London. The measurements were 14 ft. 6 in. high by 14 ft. 6 in. wide by 17 ft. 6 in. long. Arrangements were made with regard to discharge whereby the Port of London Authority's 200 ton crane, lifted the stator out of the steamer on to a special trolley, by means of which it was conveyed from the wharf to site.

The Borough Electrical Engineer has reported to Ilford Electricity Committee in reference to the necessary installation of two transformers and switchgear required in connection with the proposed electricity supply to the Claybury Mental Hospital, and has been authorised to obtain quotations for the supply of the necessary electrical equipment and to proceed with the work.

Stirling Electricity Committee has reported to the Town Council that it is estimated that the capital account of the Corporation electricity undertaking will show a debit balance of approximately £1 950 at May 15. The capital expenditure on mains, meters, etc., for the next three years is put at £3 500, making a total of £5 450. The Council has resolved to apply to the Electricity Commissioners for consent to the borrowing of this amount.

At the Town Hall, Bray, Co. Wicklow, recently, Mr. Meghan, the Commissioner who is administering the municipal affairs of the town referred to the taking over of the local electricity supply system by the Shannon Supply Board, said: A charge of £1 192, equivalent to 9d. in the £ on the rates was involved, in addition to the ratepayers losing control of their electricity supply system. The ratepayers could only hope that the Ministry for Local Government would do something for them in the matter.

Barking Electricity Committee has received a letter from the Chief Engineer of London County Council, asking if Barking Council will supply electricity to the houses proposed to be erected on the Becontree Estate if the County Council wires such houses. The Committee recommends the Council to agree to afford the necessary supply, and the engineer is to report fully as to the necessary mains, etc., extensions, including the question of the street lighting of the portion of the Becontree Estate in question.

Leicester Sewage Committee is to adapt the existing store at the pumping station as a transformer house, and to provide a transformer, switchgear and switchboard, electric lighting and heating, and a new store, at an estimated cost of £3 400.

With regard to applications for supply in the villages of Clophill, Maulden and Ridgmont, Bedford Electricity Committee states that though the revenue anticipated during the two or three years following the commencement of supply was not up to the minimum generally regarded by the Committee as necessary, it is believed that when the Ministry of Transport scheme is in operation the requisite revenue will be forthcoming, and it is proposed that extensions to these villages be made at once.

Stoke Newington (London) B.C. has received sanction to borrow £10 000 for electricity mains and services.—The electricity department is to extend mains at a cost of £700 and to instal free wiring at a cost of £422.—The Electricity Committee recommends that the joint committee of representatives of the London and Home Counties Joint Electricity Authority and the Conference of Local Authorities owning electricity undertakings in Greater London be informed that the Council cannot see its way to support the scheme recommended by such joint committee for the co-ordination of local authorities' generating stations and main transmission lines. The Committee remarks that the Central Electricity Board is opposed to the scheme, and the local authorities affected are not agreed as to its desirability.

The Electricity Commissioners have decided to grant the applications of the Yorkshire Electric Power Co. for the Isle of Axholme and District Electricity Special Order, the Yorkshire Electric Power (Eastern Extension) Electricity Special Order, and for a further area for which formal application is yet to be made. This area includes the rural districts of Howden and Riccall, and part of the rural district of Escrick, the unoccupied part of the rural district of Tadcaster and the whole of the unoccupied part of the administrative county of Lindsey (Lincoln) as far south as the existing southern boundaries of Gainsborough and Caistor rural districts. The remainder of the unoccupied area in the administrative county of Lindsey, and the whole of the unoccupied area in the administrative county of Kesteven (Lincoln), is to be granted to Mr. Borlase Matthews.

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BUSINESS OPENINGS.

Latest Particulars of Electrical Engineering and Wiring Installation Contracts for which Tenders are being Invited at Home and Abroad.

WE give below the latest particulars of contracts for which tenders are invited. The closing date is given, when available.

DUNFERMLINE CORPORATION, April 26th.—Electric lighting installation, for housing scheme. Schedules from the Burgh Engineer, City Chambers, Dunfermline; deposit £1 1s.

SALFORD CORPORATION, April 26th.—Supply of e.h.t. and l.t. paper insulated, lead covered cable. Particulars from the City Electrical Engineer.

DUNDEE HARBOUR TRUSTEES, April 27th.—Supply and erection of two 3-ton electric, travelling jib, portal cranes at King George V. Wharf, Dundee Harbour. Specifications, etc., from the General Manager and Engineer, Harbour Chambers, Dundee.

WEST RIDING EDUCATION COMMITTEE, April 27th.—Electric light installation in Thorne Council School. Specifications from Mr. E. L. Harrap, Education Offices, Goole.

Meters for Central Scotland Area.

CENTRAL ELECTRICITY BOARD, April 29th.—Supply and erection of electricity meters, in connection with the Central Scotland Electricity Scheme. Specification (No. C.S.-S.S. 14) and form of tender from Mr. R. H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

MANCHESTER CORPORATION, April 30th.—Supply and erection of one 33 000 V, 11 500 kVA, self-cooled, outdoor auto-transformer (specification No. 250) and one 6 600 V switch, etc., and a neutral earthing resistance (specification No. 251). Specifications from Mr. H. C. Lamb, Electricity Department, Town Hall, Manchester; deposit £1 1s. for each.

SOUTHAMPTON CORPORATION, April 30th.—(1) Steel framed building, platform for fans, overhead bunkers, etc.; (2) two water tube boilers with superheaters, economisers, stokers, fans, soot blowers, etc.; (3) steam, feed water and other piping, etc.; and (4) water softener, at Electricity Works, Western Esplanade, Southampton. Specification, etc., from Mr. W. G. Turner, borough electrical engineer; deposit £2 2s.

STAFFORDSHIRE EDUCATION COMMITTEE, April 30th.—Electric light installation in the Girls' High School, Stafford. Specification, etc., from Messrs. Moffett, Rosher and Mann, Union Chambers, Temple Row, Birmingham; deposit £3 3s.

STAFFORDSHIRE EDUCATION COMMITTEE, April 30th.—Electric light and power installation in new High School for Girls, Wellington Road, Bilston. Specification, etc., from Messrs. Moffet, Rosher and Mann, Union Chambers, Temple Row, Birmingham; deposit £5 5s.

COMMISSIONERS OF HIS MAJESTY'S WORKS, ETC., May 1st.—Supply of electrical accessories. Forms of tender, etc., from the Controller of Supplies, King Charles Street, Westminster, S.W.1.

DEVIZES RURAL DISTRICT COUNCIL, May 1st.—Electric light installation in houses at Market Lavington, Potterne, and Rowde. Particulars from the clerk, Mr. P. R. Trapp, Maryport Chambers, Devizes.

HEYWOOD CHAPEL, NORTHOWRAM, May 1st.—Electrical installation in chapel, school, manse and caretaker's house. Tenders to Mr. F. Rushworth, 24, Back Clough, Northowram.

EPPING GUARDIANS, May 2nd.—Electric light installation at the Institution. Specification, etc., from the Clerk, High Street, Epping.

STEPNEY (LONDON) GUARDIANS, May 2nd.—Installation of X-ray apparatus, refrigerating apparatus and inter-communication telephones. Forms of tender, etc., from the Clerk, Bancroft Road, Mile End, E.1. Stamped, addressed envelope to be sent.

WARRINGTON EDUCATION COMMITTEE, May 2nd.—Specifications, etc., from Mr. J. Moore Murray, Education Office, Sankey Street, Warrington.

GRIMSBY CORPORATION, May 3rd.—Supply and erection of about 10 miles of 33 000 V overhead line. Specification (No. 260) from Mr. S. R. Windle, borough electrical engineer, Grimsby.

MANCHESTER CORPORATION, May 3rd.—Supply, during twelve months, of electric kettles (specification 236), electricity meters(237), air-break circuit breakers (244), star delta switch starters (245), a.c. industrial electric motors (246), potential and current transformers (247), cables (248) and time switches (249). Specifications, etc., from Mr. H. C. Lamb, Electricity Department, Town Hall, Manchester; deposit £1 1s. for each.

SWANAGE URBAN DISTRICT COUNCIL, May 3rd.—Electric light installation in town hall. Specification, etc., from the Surveyor, Town Hall, Swanage.

WALTHAMSTOW EDUCATION COMMITTEE, May 3rd.—Electrical installation in Billet Road School, Walthamstow. Specification, etc., from Mr. G. R. Spurr, Electricity Works, Exeter Road, Walthamstow, London, E.17; deposit £1.

CENTRAL ELECTRICITY BOARD, May 4th.—Supply and erection of 33 000 V and lower voltage cables, under the South-East England electricity scheme. Specification (No. S.E.E.-G.C.1) and form of tender from Mr. Richard H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

SOWERBY EDUCATION AUTHORITY, May 4th.—Electric light installation at Sowerby New Road Council School. Specifications, etc., from Mr. A. Beilby, Education Offices, Sowerby Bridge.

EDINBURGH EDUCATION AUTHORITY, May 6th.—Electric lighting installation in Gorgie New Special School and Annexe to Trinity Academy, Bangholm Recreation ground. Schedules etc., from the Education Offices, Castle Terrace, Edinburgh.

ISLINGTON (LONDON) BOROUGH COUNCIL, May 6th.—Supply and installation of two lead batteries for Edison refuse collecting vehicles, having carrying capacity of 3½ to 4 tons, Further particulars from the Cleansing Superintendent, Liverpool Road, N.1.

WALTHAMSTOW URBAN DISTRICT COUNCIL, May 8th.—Supply of (*a*) l.t. distributor and service cables, and (*b*) e.h.t. and l. t. feeder cables to contract No. 66. Specifications from Mr. G. R. Spurr, Electricity Works, Exeter Road, London, E.17; deposit £1 for each.

WEST MIDLANDS JOINT ELECTRICITY AUTHORITY, May 10th.—(a) Main 33 000 V switchgear, each circuit breaker having rupturing capacity of not less than 1 500 000 kVA; (b) auxiliary 33 000 V switchgear, each circuit breaker having rupturing capacity of not less than 500 000 kVA, with group feeder reactors, for Ironbridge power station. Specification (No. 4) and form of tender from Mr. E. F. Hetherington, chief engineer and manager, Phœnix Buildings, Dudley Road, Wolverhampton; deposit £2 2s.

WEST MIDLANDS JOINT ELECTRICITY AUTHORITY, May 10th.—(1) One 50 000 kW turbo-alternator, with step-up transformers, etc.; (2) condensing plant, boiler-feed pumps, evaporators, etc.; (3) circulating water pumps, etc., for Ironbridge power station. Specifications (No. 2) and form of tender from Mr. E. F. Hetherington, chief engineer and manager, Phœnix Buildings, Dudley Road, Wolverhampton; deposit £2 2s.

HULL CORPORATION, May 16th.—Supply and laying of underground cables. Specifications, etc., from Mr. J. N. Waite, city electrical engineer and manager, Electricity Works, Sculcoates Lane, Hull; deposit £2 2s.

CHERTSEY GUARDIANS, May 18th.—Electric lighting installation at the Institution, Ottershaw, near Chertsey, Specifications from Mr. F. J. Warcham, clerk, Council Offices, West Byfleet, Surrey.

Overseas.

UNLESS otherwise stated, particulars of overseas contracts are to be had from the Department of Overseas Trade (Room 52), 35, Old Queen Street, Westminster, London, S.W.1. *Note.—An asterisk denotes that local representation is, in practice, essential.*

JOHANNESBURG MUNICIPALITY, April 27th.—Supply of steel tramway poles (contract No. 154). (Reference A.X. 7 728.)

IRISH FREE STATE ELECTRICITY SUPPLY BOARD, April 29th.—Supply and laying of 40 000 V cables in the county and city of Dublin. Specification, etc., from Mr. P. J. Dempsey, 60-62, Upper Mount Street, Dublin; deposit £5.

VICTORIAN ELECTRICITY COMMISSION, April 29th.—Supply of two or three steam turbo generator sets, with condensers, etc., for Yallourn power station extension (specification 29/7). (Reference B.X. 5 062.)

VICTORIAN ELECTRICITY COMMISSION, April 29th.—Supply of two swing hammer mills, with electric motors, for brown coal (specification 29/9). (Reference A.X. 7 434.)

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NEW ZEALAND POSTS AND TELEGRAPHS, April 30th.—Supply of telephone cable (No. P. and T. 151/1 412). (Reference B.X. 5 240.)

CAPETOWN MUNICIPALITY, May 1st.—Supply of 30 ft. steel poles, cross arms, insulators, fly fuses, etc. (specification 459/1929). (Reference A.X. 7 697.)

LOURENCO MARQUES PORT AND RAILWAYS BOARD, May 6th.—Supply of electric motors, turntables, drilling machine, etc. (Reference A.X. 7 765.)

STUDENTS of the Mechanical Engineering Department of University College, Dublin, in the library of the G.E.C. research laboratories, on the occasion of their tour of the Wembley works. They also visited the Osram Lamp Works, at Hammersmith.

WINNIPEG MUNICIPALITY, May 6th.—Supply of switching equipment at Slave Falls. (Reference B.X. 5 250.)

PRETORIA MUNICIPALITY, May 20th (extended from May 6th).—Supply of cables, switchgear and transformers. (Reference B.X. 5 245.)

INDIAN STORES DEPARTMENT, May 21st.—Supply of 400 kW 6-phase rotary converter and accessories for His Majesty's Mint at Calcutta (order No. N./9691). (Reference B.X. 5 255.)

MONTEVIDEO PORTS ADMINISTRATION, May 22nd.—Supply of four electric cranes, to lift 3 tons, mounted on trucks. (Reference A.X. 7 814.)

EGYPTIAN PRISONS ADMINISTRATIONS May 25th.*—One year's supply of lamps and electrical articles (section 7). (Reference C. 3 022.)

AUCKLAND ELECTRIC POWER BOARD, June 3rd.—Supply of cables and accessories. (Reference B.X. 5248.)

NEW ZEALAND POSTS AND TELEGRAPHS, June 18th.—Supply of telephone cords (No. P. and T. 151/1425). (Reference B.X. 5 251.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, June 20th.—Supply of one 10-ton and three 4-ton, electric level luffing cranes (tender No. 1 437). (Reference A.X. 7 828.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, August 6th.—Supply of 120-ton, four-motor overhead travelling crane and runway (specification No. S.M. 358). (Reference A.X. 7 810.)

Tenders Accepted.

ADMIRALTY.—Edison Swan Electric Co., Ltd., radiators.

NEWTON ABBOT GUARDIANS.—Coulson, electrical installation at the Institution, £530.

TORQUAY CORPORATION.—British Thomson-Houston Co., Ltd., supply of switchgear, £431.

OLDHAM CORPORATION.—W. F. Spencer, fixing hot water heating system at new power station.

LAMPETER CORPORATION.—Lampeter Electricity Supply Co., Ltd., portion of public lighting.

LONDON COUNTY COUNCIL.—Edison Swan Electric Co., Ltd., control battery for Greenwich power station.

HULL CORPORATION.—Drysdale and Co., Ltd., water pump; Bruce Peebles and Co., Ltd., motor converters, £13 115.

DARTFORD URBAN DISTRICT COUNCIL—Hackbridge Cable Co., Ltd., supply of cable, etc., £1 725. (Recommended.)

HENDON URBAN DISTRICT COUNCIL.—Standard Telephones and Cables, Ltd., installation of fire alarm system, £2 901.

GLASGOW CORPORATION.—Barber and Colman, supply of experimental set of automatic traffic control apparatus, £103.

DUMFRIES JOINT SANATORIUM BOARD.—Gordon and Moodycliffe, electric light installation in two houses, £20 12s.

ST. GILES CHURCH TRUSTEES, WEST BRIDGFORD.—W. J. Furse and Co., electrical work in connection with new parochial hall.

PAISLEY CORPORATION.—J. Bell and Son, electric lighting work, in connection with erection of three-storey tenements at Ferguslie.

HALIFAX CORPORATION.—Headen and Brennand, electrician's work in connection with erection of 12 houses at Stretchgate Lane, Pellon.

BRIGHTON CORPORATION.—Mather and Smith, Ltd., brake blocks, £132; British Insulated Cables, Ltd., trolley wire, £228 13s.; Tungstalite, Ltd., lamps, £100.

BINGLEY URBAN DISTRICT COUNCIL.—R. White, electrician's work, in connection with erection of 13 houses at Crossflats, 10 at Cullingworth, 10 at Wilsden and 12 at Harden.

SOUTHWARK (LONDON) BOROUGH COUNCIL.—Alton Battery Co., Ltd., battery plates, £65 7s. 11d.; General Electric Co., Ltd., automatic switches, £74 1s. 9d. for 3 000 A, and £60 15s. for 2 000 A.

SOCIETE BELGE RADIOELECTRIQUE.—Marconi's Wireless Telegraph Co., Ltd., short wave telegraph-telephone transmitter, for communication between Belgium, the Belgian Congo and South America, and two short wave receivers, for the Belgian Government.

CROYDON CORPORATION.—A. Reyrolle and Co., Ltd., transformer pillar for 500 kVA transformer, £132 1s. 9d.; feeder panels, £700 12s. 6d.; transformer switch for 1 000 kVA transformer, £154 19s. 3d.; transformer switches, £278 2s. 6d.; Film Cooling Towers, Ltd., repairs to cooling towers, £155. (All recommended.)

LONDON COUNTY COUNCIL.—Alpha Manufacturing and Electrical Co., Ltd., electric light wiring and fitting at Bentworth Road new elementary school, £268. (Recommended.) Also tendered: Cox-Walkers, Ltd., £275; Ellis and Ward, Ltd., £291; Malcolm and Allan (London), Ltd., £313; A. Hawkins and Sons, £339.

MANCHESTER CORPORATION.—Tudor Accumulator Co., Ltd., repairs to battery at Dickinson Street station; Metropolitan-Vickers Electrical Co., Ltd., oil purifier for Dickinson Street station; C. A. Parsons and Co., Ltd., and English Electric Co., Ltd., static transformers; Titan Trackwork Co., Ltd., tramway special trackwork; J. Blakeborough and Sons, electrical operating gear for valves at Lostock boosting station (for Waterworks Committee).

BIRKENHEAD CORPORATION.—New Switchgear Construction Co., Ltd., one 2-panel transformer cubicle equipment, £141 10s. and three wing cubicle equipments, £298 10s.; General Electric Co., Ltd., three 200 kVA transformers, £372; and one 100 kVA, £82; Mersey tunnel work: British Thomson-Houston Co., Ltd., truck type cubicle, £98 10s.; W. T. Glover and Co., Ltd., cable. Cables: Hackbridge Cable Co., Ltd., £267 10s.; British Insulated Cables Ltd., £380.

BROMLEY CORPORATION.—A. Sutton, electric wiring of 91 houses to be erected on the Southborough housing site, £531. Also tendered:—E. Dyne, £412; J. Vigor, £471; British Electrical Installations, £648; J. H. Plant, £663; Payne Bros., £685; E. Tye, £690; G. T. Bellamy and Co., £708; Telephone Electrical Maintenance Co., £723; Helps Electric, £750; Higginbotham and Sons, £750; Fordham Electrical Engineering Co., £750; G. E. Wallis and Sons, £750; C. E. Pittman, £757; Cross Bros., £757; C. F. Munn and Co., £772; Darlington and Reid, £792; C. Gosling, £822; W. Davey, £827; R. E. Knight, £842; Gardner, Brown and Co., £890; Henfrey Electrical Installations, £908; C. W. Dempster, £910; Tredegars, Ltd., £951; R. G. Knight, £1,408; S. Boskin, £2,900.

LONDON STUDENTS' SECTION I.E.E.

Report of Committee for the Session 1928-1929.

THE report of the Committee of the London Students' Section of the Institution of Electrical Engineers for the Session 1928-29, to be presented for approval at the annual general meeting to be held to-day, shows that ten meetings were held during the session, with an average attendance of 68·5. The average for the 1927-28 session was 76. The number of visits made was 11, the average attendance being 15. The most popular visits appear to be those on Saturday afternoons. The Committee points out that though the attendance at the majority of visits was satisfactory, it was in certain cases disappointing, making it necessary to cancel two visits on account of poor support.

The attendances at the dinner and dance were 130 and 200, respectively, the former being a record for the past six years. The summer meeting was held from July 28th to August 6th, and consisted of a tour through Holland and West Germany, 32 students from London and the provinces taking part.

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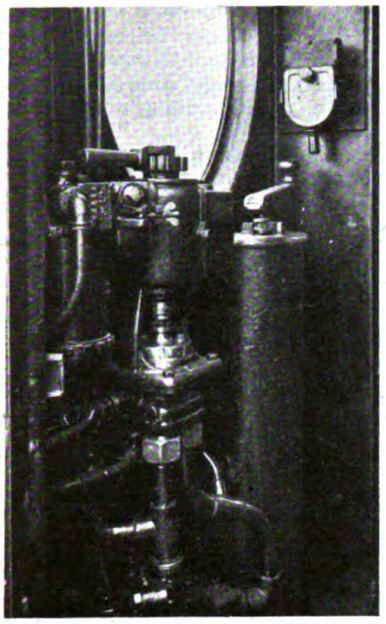
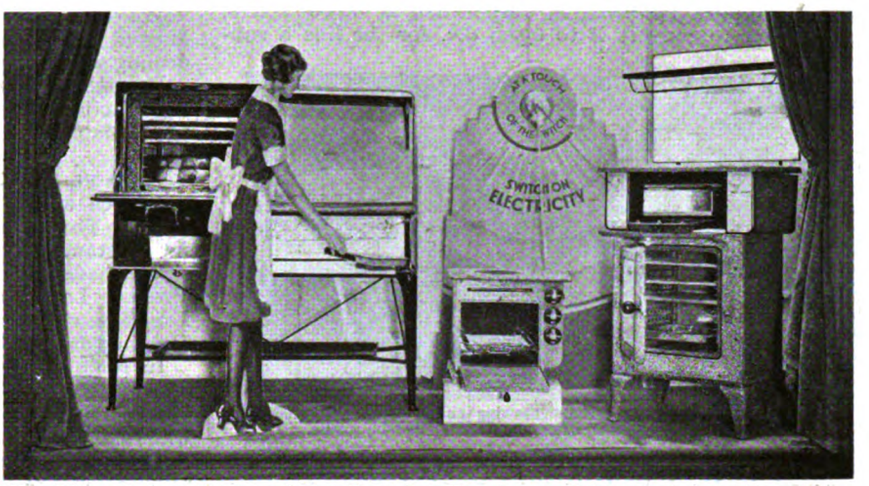
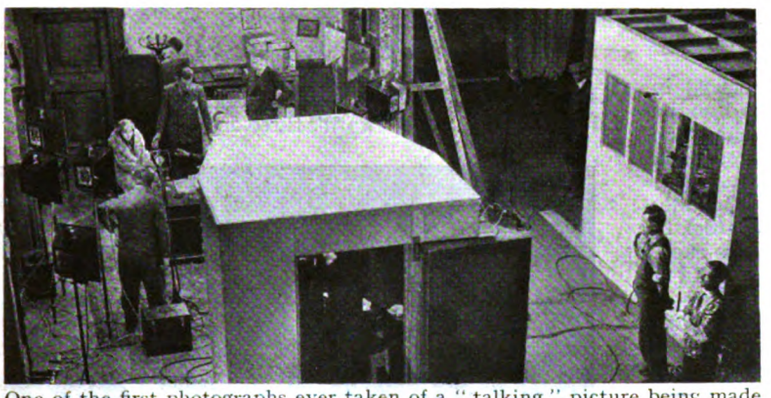
ELECTRICAL NEWS OF THE WEEK IN PICTURES.



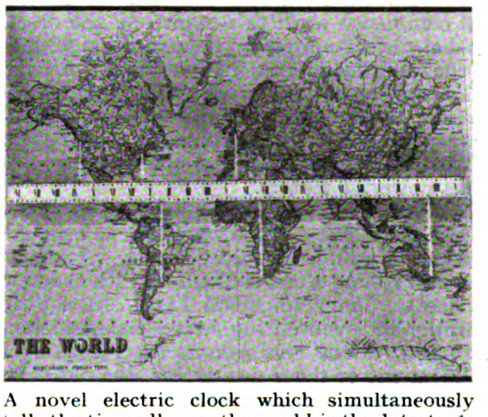
An improved electro-pneumatic brake which has been the subject of experiments by the London "Underground" Railways. It is claimed that with this brake an 8-car electric train can approach a station at 40 m.p.h. and make an accurate stop within two or three inches of a given mark in 20 seconds.



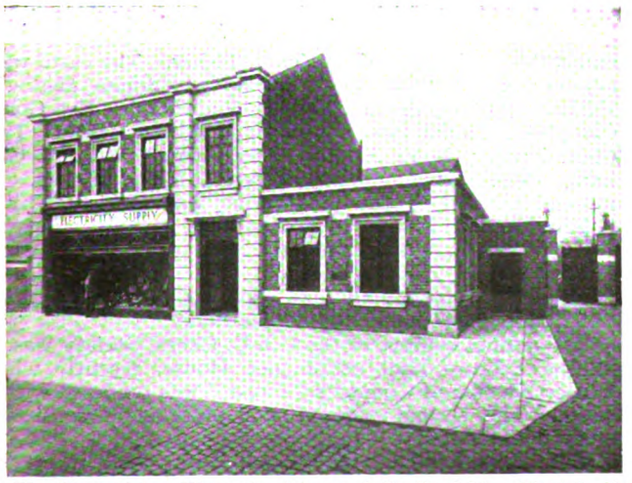
The May window display of the Electrical Development Association, while still preserving the simplicity of previous windows, strikes a new note. It will be remembered that the selling campaign for next month is devoted to electric cooking, and, in order to meet all requirements, the window furniture has been designed so as to allow any make of cooker to be included in the display. The dressing material required, apart from the cooking appliances themselves, is small, and, as may be seen from the picture, is easy to arrange. A background of white paper representing tiles gives to the window the appearance of a modern kitchen, while the figure in the apron adds life to the scene; the "switch," of course, tells its own story.



One of the first photographs ever taken of a "talking" picture being made at the Elstree studios. The camera is housed in the wooden hut seen in the centre foreground, with the sound recording apparatus in the compartment on the right. One of the microphones being used may be seen, close to the director of the operations, to the left of the camera house.



A novel electric clock which simultaneously tells the time all over the world is the latest attraction to be seen at the new Piccadilly Circus station in London. The clock face is a map of the world on Mercator's projection.



The Shropshire, Worcestershire and Staffordshire Electric Power Co. has opened new showrooms and offices at Smethwick. The premises, shown on the left, include a spacious demonstration kitchen, where special lectures on electric cooking will be given. The S.W.S.Co. last week organised a five-day exhibition at Oldbury, the exhibits being displayed in rooms appropriate to the class of goods. A general view is shown on the right, and even at this early date the exhibition is voted a success.

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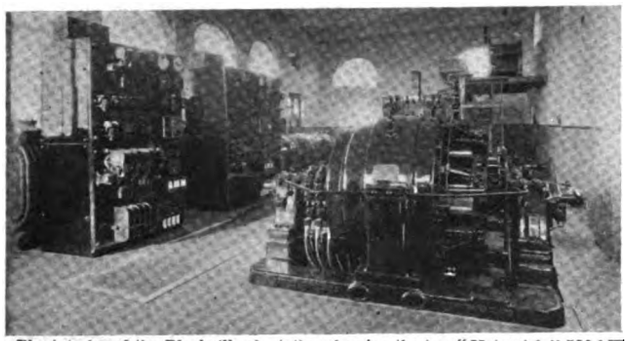
ELECTRIC TRACTION.

Opening of Electrified Mumbles Railway and Automatic Sub-Station.

IN connection with the opening ceremony of the electrified Mumbles railway, on April 18th, it is interesting to note that power is supplied by Swansea Corporation at 6 600 V a.c., and in order to convert it to 6 500 d.c. for the line a sub-



The interior of the Blackpill sub-station showing the two "Metrovick" 500 kW rotary converters with their automatic starting and relay panels.

station has been provided at Blackpill, the arrangement being made by Mr. J. W. Burr, the borough electrical engineer. The sub-station arranged for fully automatic control includes two 500 kW rotary converters, which, together with the a.c. and d.c. switchgear, a negative booster set, and the automatic control gear for the whole of this equipment have been supplied by the Metropolitan-Vickers Electrical Co., Ltd.

The Minister of Transport has approved of the extension of Sunderland tramways on the Durham Road to Humbledon Hill.

The L. and N.E. Railway and the L.M. and S. Railway will commence work this month on the erection of the overhead electrical equipment in connection with the electrification of the Manchester South Junction and Altrincham line.

Twenty more re-equipped cars have now been placed in service in the northern and western section of the London Metropolitan Electric Tramways. The lighting has been considerably increased, and the cars have been fitted with more powerful motors.

Nine new trains have been put into service on the Piccadilly (London) Railway. The whole of the original rolling stock of this line is being replaced by 27 new trains of six cars each. The new rolling stock is identical with the new cars already in service on the Hampstead Line. In addition to improved lighting and ventilating arrangements, the new cars have automatic doors. As soon as the Piccadilly Line has its full complement of these new trains, the old rolling stock on the Bakerloo Line will also be replaced.

The Ministry of Transport inquiry into Bradford Corporation's application for a Provisional Order authorising the running of railless trolley vehicles over 29 routes in the city and 11 outside was held recently by Mr. A. D. Erskine. Mr. J. G. Gunter, deputy town clerk, said Bradford had now 37 trolley vehicles running on 15 miles of route, all in the City except some 1 500 yards. On all the proposed 40 routes, except 8, tramways were in operation. Mr. R. H. Wilkinson, tramways manager, said the granting of the Order would not necessarily mean that all the tram routes would be converted, The cost of reconstructing the tram track would be £916 000. and of preparing for trolley cars, £226 000. Mr. J. E. Lightburn, representing the County Council and several urban district councils, said the proposed trolley vehicle service would add to the cost of upkeep of roads and would add to the number of danger points. The County Council asked for a complete veto on poles on the highways. They had strong objection to some of the proposed turning points, which would annul to a degree the benefit for which they looked from their widening schemes. The inquiry was closed.

AN ELECTRIC POULTRY FARM.

The March issue of "Rural Electrification and Electro-Farming" gives particulars of a farm near Edinburgh, where 100 000 birds produce some 15 000 000 eggs per annum. The mixing of poultry meal, the plucking of killed birds, and heating of water tanks are carried out by electrical means, while each laying house is illuminated by electric light controlled by two switches, and a special dimming device for extending the hours of "daylight" during winter months.

TRADE PUBLICATIONS.

GENT AND CO., LTD., Faraday Works, Leicester, have sent us Book 5/Section 2c relative to electric turret clocks.

PHILIPS' LAMPS, LTD., 145, Charing Cross Road, London, W.C.2, has issued leaflet No. 402, describing and illustrating "Phililite" diffusing units.

We have received from the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, folder O.S.4759, dealing with automobile lamps.

FERRANTI, LTD., Hollinwood, Lancs, has published a new constructional chart of the "H.T. Supply Unit No. 5." This unit complies in every respect with the requirements of the I.E.E.

KLAXON, LTD., 36, Blandford Street, London, W.1, has published a special booklet dealing with industrial Klaxon horns. The instruments are motor driven, and are suitable for all standard voltages.

We have received from BRITISH INSULATED CABLES LTD., Prescot, Lancs, a new bell wire price list which replaces L.24/6, a new list of manufactures which replaces P.220, and P.246 dealing with pole materials, which replaces P.208.

In reply to the leaflet "Atmosphere" which, written by one of the staff of VENNER TIME SWITCHES, LTD., of 45, Horseferry Road, London, S.W.1, was published some little while ago, the company has issued a further leaflet entitled "The Beginning of Our Atmosphere." The authors of the latter publication are Messrs. Robert C. Graseby and Ernest E. Sharp.

The MULLARD WIRELESS SERVICE CO., LTD., Mullard House, Charing Cross Road, London, W.C.2, has issued catalogue leaflets Nos. V.R.85, V.R.81, V.R. 54/1, and V.T.17/1 illustrating valve types, P.M.6, P.M.1 H.F., P.M.256, and DO/40 respectively. These leaflets replace V.R.55, V.R.47, V.R.54, and V.T.17, which should be destroyed. Two new leaflets, Nos. V.R.73 and V.R.77, illustrating valve types D.F.A.9 and DO/20 respectively, are also available.

THE SOCIAL SIDE.

ON April 15th, at the Balfour Institute, Smithdown Road, Liverpool, the A.T.M. Dramatic Society gave a very successful rendering of Noel Coward's three-act comedy, "Hay Fever,"

A scene in the comedy, "Hay Fever," as performed by the A.T.M. Dramatic Society.

under the production of Mr. Thos. Fisher. The caste was as follows:—Sorel Bliss, Gretta Downie; Simon Bliss, Will Faulkner; Clara, Freda Blundell; Judith Bliss, Eva Gordon-Campbell; David Bliss, Leslie F. Whyman; Sandy Tyrell. Chas. Plank; Myra Arundel, Lily Searle; Richard Greatham, Thos. Fisher; Jackie Coryton, Molly Keddie. The musical portion of the programme was furnished by the A.T.M. Orchestra, some 30 strong, who gave selections from Gilbert and Sullivan, under the able direction of Mr. C. Brandreth.

Reading Tramways football club has reached the final of the Reading mid-week cup competition.

The annual concert of the G.E.C. Choral Society was held in the Lecture Hall at Magnet House, recently, when a concert version of Gounod's "Faust" was rendered with fine effect. The second part of the programme consisted of songs and choruses.

The Greenwich Cable Works, Ltd., held a function recently at the Ship Hotel, Greenwich, to celebrate the forthcoming change from the present works to new works at Croydon. Mr. J. H. C. Brooking was in the chair, and during the evening a number of prizes were given for dancing, humorous songs, and a Limerick competition.

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COMPANY NEWS.

Appreciation of General Electric Shares—Great Northern Telegraph's 20% Distribution—Associated Electrical Industries' Dividends—Official Quotations Granted—Marconi £1 Shares—Directors' Reports—New Companies.

THE dropping of the General Electric Co.'s proposal to issue new "British" ordinary shares has been followed by an improvement in the market price of the existing ordinary shares to £3 5s., which is 3s. 9d. higher than the quotation a week ago. County of London Supply shares have been bought, and at £2 15s. 6d. the price is 3s. 6d. up on the week. Brompton and Kensington shares have eased off 6d. Marconi International Marine shares have risen half-a-crown, but Marconi's Wireless are unchanged. English Electric shares are a further 7½d. down at 6s. 3d.; Ever Readies are 6d. to the good. District and Metropolitan Railway ordinaries are down a half, and Underground Electrics have lost the 6d. gained last week.

Last Annl. Divd.	Description.	This Week.	Last Week.	1926 to 1928. Highest	Lowest.
	% Electricity Supply.				
(d)	Brompton & Kensington Ord. ..	26/6	27/-	35/6	23/9
4	Central Elec. Sup. 4% Deb. ..	94	94	95½	88½
(a)	Charing Cross Elec. Ord. (£1) ..	26/-	26/-	51/-	24/3
4½	,, ,, ,, 4½% C.P. (£1)	17/6	17/6	18/3	16/6
(b)	Chelsea Elec. Sup. Ord.	27/-	27/-	45/3	24/-
10	City of Lond. Elec. L'ting Ord. ..	31/10½	31/10½	52/10½	26/-
6	,, ,, ,, ,, 6% C.P.	23/-	23/-	24/3	21/6
7½	County Lon. Elec. Sup. Ord. ..	55/6	52/-	68/6	25/9
6	,, ,, ,, ,, 6% C.P. ..	23/-	23/-	24/-	21/3
(c)	Kensington & K'bridge Ord. (£1)	26/6	26/6	27/6	23/9
1/9½	Lon. Elec. Sup. Ord. (£1).. ..	27/-	27/-	37/6	23/-
1/9½	Metro. Elec. Sup. Ord.	41/3	41/3	53/-	24/9
4½	,, ,, ,, 4½% C.P. ..	17/6	17/6	18/3	16/3
7½	N'castle & Dis. Elec. Ltg. Ord. ..	27/6	27/6	31/9	17/6
1/2½	N'castle-upon-Tyne Elec.Sup.Ord.	25/-	25/-	30/3	19/3
6	N. Metro. Elec. 6% C.P.	23/-	23/-	23/9	20/10
6	Notting Hill 6% C.P. (£10) ..	10½	10½	11½	9½
(e)	St. James & P.M. Ord. (£1) ..	27/6	27/6	28/6	23/6
1/4½	Shrops. Worcs. & Staffs. Power B.Ord.	37/6	37/6	37/6	21/4
1/9½	W'minster Elec. Sup. Ord. (£1) ..	26/-	26/-	52/9	24/-
4½	,, ,, ,, 4½% C.P. (£1)	17/6	17/6	17/10½	16/7½
8	Yorks. Elec. Power Ord.	34/-	34/-	38/9	24/6
6	,, ,, ,, 6% C.P. ..	24/-	24/-	26/9	20/7
	Railways and Tramways.				
8	Brit. Elec. Trac. Pfd. Ord. Stk ..	128	128	152	117
6	,, ,, ,, 6% Pf. Stk.	128½	128½	133	103½
4	Cent. Lon. Ry. Ord. Stk. (asstd.)	72	72	72	54
4	,, ,, ,, 4% Deb.	80	80	83	77½
4	City & S. Lon. 4% Perp. Deb. ..	79½	79½	81	76½
5	Lon. Elec. Rly. Cons. Ord. Stk. ..	73½	73½	75½	42½
4	,, ,, ,, ,, 4% Pf. Stk.	73	73	77	68
4	,, ,, ,, ,, 4% Deb. ..	80	80	83	76½
5	Lon. & Sub. Trac. A. Deb. ..	95½	95½	97½	74
4	Lon. Un. Trams, 1st Deb. ..	61	61	63	39
4½	Met. Elec. Trams, 4½% Deb. ..	72	72	73½	62
5	,, ,, ,, 5% Deb.	67½	67½	70½	65½
3½	Met. Rly. Cons. Ord. Stk. ..	60½	61	81	54½
3½	,, ,, ,, 3½% Pf. Stk. ..	64	64	67	60½
3½	,, ,, ,, 3½% Deb. ..	70	70	73½	67½
5	Met. Dis. Rly. Ord. Stk.	76	76½	77½	52½
4½	,, ,, ,, 4½% 1st Pref. ..	80½	80½	84	74½
6	,, ,, ,, 6% Perp. Deb. ..	116½	116½	118½	110
4	S. Met. Elec. Trams, 4% Deb. ..	70	70	70	64½
7	Uudergrouud Electric Rlys. Ord.	23/6	24/-	28/2	11/-
—	Yorks. (W.R.) Trams, Ord. ..	5/-	5/-	16/-	3/-
4½	,, ,, ,, 1st. Deb. ..	59	59	78	60
	Electrical Manufacturing.				
7	Brit. Elec. Transformer 7% C.P...	15/-	15/-	19/10	4/6
15	Brit. Insulated Cables Ord. ..	92/6	92/6	86/3	56/-
6	,, ,, ,, 6% C.P. ..	22/6	22/6	23/10	21/-
7	British Thomson-Houston Pref. ..	23/9	23/9	24/9	19/7
7	,, ,, ,, 7% Deb.	105½	105½	109½	102½
10	Brush Electrical Ord.	27/6	27/6	30/9	24/-
15	Callender's Cable Ord.	87/6	87/6	91/3	66/-
6½	,, ,, 6½% C.P. ..	25/-	25/-	25/9	22/-
7½	,, ,, 7½% B. Pref. ..	27/6	27/6	28/3	25/-
8	Crompton-Parkinson 8% Cum. Pf.	25/-	25/-	27/-	14/-
6	,, ,, 6% Cum. 2nd Pf.	18/-	18/-	19/6	9/7
7½	Edison Swan Elec. 1st Pref. ..	25/7½	25/7½	13/-	7/4½
5	,, ,, ,, 1st Deb. Stk.	86½	86½	92	81½
7½	Elec. Construction Ord.	20/-	20/-	32/6	23/6
7	,, ,, 7% C.P. ..	22/6	22/6	22/9	21/-
—	English Elec. Ord.	6/3	6/10½	15/9	5/-
—	,, ,, 6% C.P. ..	9/4½	9/4½	18/9	7/-
7	Ericsson Telephones 7% Pref. ..	20/-	20/-	22/7½	17/6
35	Ever Ready (Gt. Britain) Ord. ..	23/6	23/-	92/3	18/1
6	Ferranti 6% Pref.	18/-	18/-	19/4½	16/9
7	,, 7% 2nd Pref.	21/3	21/3	19/3	13/9
10	General Elec. Ord.	65/-	61/3	46/6	26/6
‡25	W. T. Henley's Ord.	120/-	120/-	120/-	69/3
12½	Johnson & Phillips Ord.	36/3	36/3	67/11	34/-
7½	Lon. Elec. Wire. & Smith's Pref ..	23/9	23/9	25/-	22/3
7½	Siemens Bros. & Co. Ord. ..	27/6	27/6	36/6	24/9
10	Telegraph Const. Ord. (£12) ..	24½	24½	30½	20
	Telegraph.				
3½	Anglo-Am. Tele. Ord. Stk. ..	61½	61½	63½	56½
20	Eastern Ord. Stk.	280	282	273	135
3½	,, 3½% Pref. Stk.	67½	67½	70½	59
4	,, 4% Deb.	79½	79½	81½	74
10	Eastern Extension Ord. (£10) ..	28	28	27½	14
22	Gt. Northern Telegraph (£10) ..	33	34	43½	26
10	Indo-European (£25)	35½	35½	48½	30
20	Marconi's Wireless T. Ord.	83/9	83/9	84/4	12/-
25	,, Int. Mar.	65/-	62/6	90/-	16/6
20	Western Tel. Ord. (£1) ..	28	28½	27½	12½

(a) 19 ½d. per share. (b) 1s. 9·3d. per share. (c) 1s. 6·949d. per share.
(d) 1s. 8·706d. per share. (e) 1s. 7·181d. per share. ‡ Including 1s. bonus.

HERBERT MORRIS, LTD.—Div. for half year to Jan. 31, 1929, on ord. shs. at rate of 10% p.a., less tax.

EASTERN TELEGRAPH CO., LTD.—Int. for half-year endg. Apl. 30 on 4% mtge. deb. stk. will be payable on May 1.

BRUSH ELECTRICAL ENGINEERING CO., LTD.—Div. of 10% recommended for past year. Surplus under co-partnership scheme, £11 711.

ANGLO-AMERICAN TELEGRAPH CO., LTD.—Intm. div. for qrtr. ended March of 15s% on ord. stk. and £1 10s.% on pfd. stk., payable May 1.

JARROW AND DISTRICT ELECTRIC TRACTION CO., LTD.—Rev. for 1928, £8 195, plus £1 202 brt. in. After deductg. all exes., blce. was £426.

CONSTANTINOPLE TELEPHONE CO.—It is announced that warrants for paymt. of 3½% (3s. 6d. p. sh.) int. on sh. cap. will be posted about April 30.

OXFORD ELECTRIC CO., LTD.—Net rev. for 1928, £45 382. plus £6 166 brt. in. Div. of 8½% on ord. shs. To res. and renewal of plant acct., £25 000. Fwd. £6 448.

TYNEMOUTH AND DISTRICT ELECTRIC TRACTION CO., LTD.—Rev. for 1928, £62 275, increase £7 577; net pft., £1 421, agst. £6 395. Ord. div., 5%, agst, 7½%. Fwd., £330, agst. £2 754.

GREAT NORTHERN TELEGRAPH CO., LTD.—Total div. and bonus of 20% proposed, includg. 5% already paid, for 1928. To res. and renewal fund, £33 333; to pension fund, £38 889. Fwd., £224 823.

ELECTRICAL FINANCE AND SECURITIES CO., LTD.—Net rev. for 1928, £15 398, agst. £12 877. Intm. div. of 4%, less tax, was paid in Oct. last, and fin. div. of 6%, less tax, now recommended. Fwd. £5 337.

CALCUTTA ELECTRIC SUPPLY CORPORATION, LTD.—Fin. div. on ord. shs. 7%, actual, making 12% actual, for 1928, plus cash bonus of 4d. p. ord. sh., both subject tax at 2s. in £, payable on May 16.

MANSFIELD AND DISTRICT TRAMWAYS, LTD.—After mtg. deb. and loan int., net. rev. for 1928 was £635. After allowing for credit blce. of £4 717 brt. fwd., and transferring £2 305 to deb. stk. redemptn. acct., blce. fwd. is £3 367.

BRIDGWATER AND DISTRICT ELECTRIC SUPPLY AND TRACTION CO.—Pft. for 1928, after providg. £1 000 for depreciatn., £1 134 for deb. int. and £1 484 for pref. div., £1 463, plus £783 brt. in. Div. of 6% on ord. Fwd. £1 047.

YORKSHIRE (WOOLLEN DISTRICT) ELECTRIC TRAMWAYS, LTD.—Traffic and other receipts for 1928, £271 758. After deductg. all exes., etc., and settg. aside £41 000 to renewals fund, blce. was £19 455, plus £21 638 brt. in. To res. £10 000. Div. 6% on ord. shs. for year. Fwd. £17 893.

ASSOCIATED ELECTRICAL INDUSTRIES, LTD.—Divs. of 6% less tax, on ord. and 8% p.a. on pref. shs. for 1928 have been declared. In Dec. last cap. was largely incrd. in connection with acquisition of shs. in British Thomson-Houston Co., Ltd., Edison Swan Electric Co., Ltd., and Ferguson, Pailin, Ltd.

GATESHEAD AND DISTRICT TRAMWAYS CO.—Rev. for 1928, £121 405, decr., £6 681. Exes., includg. mtge. and loan int. and £10 000 placed to renewals fund, amt. to £103 116, decr. £384. Net pft. £18 289, agst. £24 595, plus £21 369 brt. in. To sinkg. fund for mtge. redemptn., £4 800. After provisn. for pref. div. and payg. 6% for year on ord. shs., carry fwd £18 895.

NOTTING HILL ELECTRIC LIGHTING CO., LTD.—Pft. for 1928, £63 990, agst. £78 162, plus £27 744 brt. in. Int., sinkg. and contingency fund and income tax charges total £35 757, and intm. divs. absorbed £10 210. Co-partnership bonus, £1 890; fin. pref. div., £4 800; fin. dfd. sh. div., £10 099. Fwd., £28 978. Total div. on dfd. shs. is 14s. 4·006d. p. sh., agst. 13s. 7·636d. p. sh.

CORK ELECTRIC SUPPLY CO., LTD.—Rev. for past year, £136 327, exes., £87 142, leavg. £49 185. Inc. tax, £3 000, int. on debs., £3 672; to res. for depreciatn. and renewals, £15 000; to gen. res., £7 500. Int. recd., £1 147; brt. in, £13 986. After provisn. for pref. div., fin. div. at rate of 5% on ord. shs. is recmmdd. £15 758 fwd., subject to additl. remuneratn. to directors.

DIRECT SPANISH TELEGRAPH CO., LTD.—Rev. for 1928, £88 570, plus income tax recovered, £648, and £1 083 brt. in. After provisn. for expenditure, includg. £4 320 for int. on

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debs. and exceptnl. expenditure for repairs of cables, maintenance of land lines, instrumts. and batteries, accts. show blce. of £3 638. Div. on pref. shs., 10% p.a., and on ord. shs., 10% p.a., tax free. Fwd. £1 990.

SHANGHAI ELECTRIC CONSTRUCTION CO., LTD.—Directors recommend that cap. be raised from £500 000 to £700 000, and that £100 000 of undivided pfts. be capitalised and issued as free bonus to shhldrs. in fully paid £1 shs., in ratio of one new sh. to every 5 shs. held. Fin. div. of 7½%, tax free, is proposed, makg. 12½% for year, agst. 12%.

CORNWALL POWER CO.—Workg. pft. of Parly Co., after provision for depreciation, £17 607. Div. at rate of 7% for year on ord. shs. Reserves include depreciatn. res., £105 931 and gen. res. £514 513. The limited cos. accts. show total blce. £23 196, includg. blce. brt. fwd., £2 588. Written off prelim. exes., £1 500; div. 4% on ord. shs. Fwd. £2 696.

OFFICIAL QUOTATIONS.—The following securities have been granted quotations in the Stock Exchange Official List: 250 000 £1, fully paid, 6½% C cum. pref. shs. of the Adelaide Electric Supply Co., Ltd., $100 000 series B. 5% gen. and refundg. mtge. sinkg. fund gold bonds, 1955, of the Montreal Tramways Co.; 79 082 £1, fully paid, ord. shs. of the Underground Electric Railways Co. of London, Ltd.

YORKSHIRE TRACTION CO., LTD.—Rev. for 1928, £225 895. After deductg. administratn. and gen. expes. and providg. for exes. chargeable to rev., includg. deb. and other int., and setting aside £29 000 to renewals fund, there remains blce. of £18 070, which, with £17 159 brought fwd., makes available blce. of £35 229 dirs. to res. £8 000, div. on 7% pref., shs £1 551, div. on ord. shs. at rate of 10% p.a., (of which 4% has been paid) £8 576; fwd. £17 102.

ANGLO-PORTUGUESE TELEPHONE CO., LTD.—Gross income for 1928, £170 019; gross pft. £58 618. Addg. £263 for bank int. and transfer fees and deductg. £15 995 for div. stk. and loan int., there is net pft. for year of £42 886, plus £74 299 brt. fwd. Gen. res. transfer, 5% fin. div., less tax, for 1927, and intm. div. of 3%, less tax, for 1928 amtd. to £52 431, leavg. £64 754. Fin. div. 5%, less tax, on ord. shs., makg. 8% for year; div. 8%, less tax, on "A" ord. shs. Fwd. £39 751.

GENERAL ELECTRIC CO. OF NEW YORK.—Net sales billed during 1928, $337 189 422, agst. $312 603 771. After provisin. for cost of sales, maintenance, depreciatn. res. and taxes, net inc. from sales was $39 661 230, agst $36 149 768, plus inc. from other sources, $17 671 201, agst. $15 395 918. After paying int., providg. for contributn. to gen. res. ($2 856 948) and payg. 6% cash divs. on specl. stk. and regular and extra divs. on common stk., surplus for year was $8 313 494, agst. $11 973 267.

INDO-EUROPEAN TELEGRAPH CO., LTD.—Rev. for 1928, £291 833, agst. £318 139. Rev. acct. shows blce. £84 375, which is carried to pft. and loss acct., and, after deduction of income tax, reduced to £67 376, plus £87 367 brt. in. Written off expenditure on reconstructn. of line in Russia and Poland, £12 500, cost of Persian section of line, £1 000, and freehold and leasehold property, £1 500. Div. proposed of £1 2s. 6d. p. sh., makg., with intm. div. already paid, 7% for year, and bonus 5s. p. sh., both tax free. To retiremt. trust fund, £15 000. Fwd., £14 867.

MARCONI £1 SHARES.—Marconi £1 shhldrs. met in London on Apl. 17th, and approved, provisionally, the scheme formulated by the protective committee, wh. provides that the merger terms shall not be accepted, and that the £1 shs. shall be lodged with the Prudential Assurance Co. under a trust agreemt. It was stated that the two committees—representg. the pref. and ord. shhldrs.—were in favour of the scheme. A mtg. of Irish shhldrs., in Dublin, on Apl. 18th, passed a resolutn. to accept the terms of the merger in their entirety, and the commee. was directed to collaborate with the commee. representg. the British 10s. shhldrs., and offer assistance in supportg. the terms of the board. A circular has been sent out to the British 10s. shhldrs., and the replies endorsing the board's action are stated to be numerous.

SHROPSHIRE, WORCESTERSHIRE AND STAFFORDSHIRE ELECTRIC POWER CO.—Net recpts. for 1928 from sales of current and from int. and divs. on investmts., etc., £303 950, plus £45 628 brt. in. Administration exes., £52 282; rates, £24 156; deb. and loan int., £78 519, blce., £188 621. After provision for div. for year on 6% cum. pref. shs. and divs. of 8% for year on "A" ord. shs. (on acct. of wh. 4% has bn. paid) and 7½% for year on "B" ord. shs., blce. £92 621, has been carried to appropriatn. acct., res., wh., with premiums on cap. issues during year and contributions from consumers in respect of new services, amts. to £150 266. Out of this amt. is proposed to write off commissns. and discts. in respect of issues of cap., £18 937; to devote to inauguratn. of endowmnt. fund, £2 392; to place to res. £5 000, and carry fwd. £78 937.

THE new lighting installation at St. Peter's Church, Ealing, London, has been completed by Messrs. Honor Bros., electrical contractors, Ealing, to the designs of the General Electric Co., Ltd. The superiority of electricity over gas as a lighting medium is illustrated by these two pictures, which show on the left the old gas installation, with the new system on the right. The wiring has been carried out by means of 2 500 megohm grade Pirelli-General cable in screwed conduit. Floodlights, installed at clerestory level, are used for nave and chancel lighting, being equipped with 200 W white bowl-sprayed gasfilled lamps. The side aisles are illuminated by silvered glass reflectors fitted with 100 W and 150 W lamps of a similar type. The Lady Chapel is illuminated on the same lines.

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THE CABLES AND WIRELESS MERGER.—The directors of Cables and Wireless, Ltd., have announced that the offer to the sh. and stk. hldrs. of the cable co.'s and Marconi's Co. will be conditional on its being accepted within a prescribed time by the hldrs. of 60% (or such smaller percentage, if any, as may be approved by the Government) of the amt. of stk. or number of shs. in ea. of the followg. four classes: Eastern Telegraph ord. stk., Eastern Extension ord. shs., Western Telegraph ord. shs., Marconi's Wireless Telegraph £1 pref. and £1 and 10s. ord. shs. The transfer books of the Eastern Extension Australasia and China Telegraph Co., the Eastern Telegraph Co. (so far as they relate to the ordinary stk.), the Western Telegraph Co. and Marconi's Wireless Telegraph Co., Ltd., will be closed from Apl. 30 to May 21, inclusive, in connection with the forthcoming offer of exchange by Cables and Wireless, Ltd.

GENERAL ELECTRIC CO.'S ALL-BRITISH SHARES PROPOSAL.—The proposed issue of 1 500 000 £1 new British ord. shs. has bn. abandoned. On Apl. 19 the followg. letter, signed by Sir Hugo Hirst, was issued to the shhldrs.:—"Certain proposals for which I have made myself responsible in connection with the finance of the General Electric Company, Ltd., have become the subject of an acute controversy on a stage much wider than that of the company itself. These proposals were made with the sole object of increasing the prosperity of the company, of which I have been for many years the chairman and managing director, and were prompted by my view that a preponderating interest in our great industry should always be in British hands. I have always held the view that our scheme did not prejudice the property rights of or act unfairly towards any of our shareholders. Nothing was further from my mind or that of my colleagues, and we have no such intention. However, under all the circumstances of the case, with the assistance of the British, Foreign and Colonial Corporation, it has been decided not to proceed with these proposals. We are certain that the general problem which such proposals has raised must receive consideration from eminent financial and economic authorities. This step, therefore, has been taken with a view to enabling that study to take place in a clear and calm atmosphere. I am sure that ultimately a way will be found to reconcile the needs of national industry with the requirements of any international obligations."

Company Meetings.

CLYDE VALLEY ELECTRICAL POWER CO.—A mtg. was held on Apl. 24 to consider a proposal to create and issue 900 000 £1 ord. shs. and to cancel 200 000 unissued cum. 2nd pref. shs., the new shs. to be issued to existg. shhldrs. in the proportn. of three for every four now held.

PARA ELECTRIC RAILWAYS AND LIGHTING CO., LTD.—Sir Francis M. Voules, presiding at the meeting on Monday, said the net result for the past year, after deducting debenture service and London office expenses, amounted to £28 803, to which was added the balance of £5 698 brought forward from last year. After providing £10 000 for depreciation and renewals reserve, they were able to pay an interim dividend of 3%, and a final dividend of the same amount on the preference shares.

LANARKSHIRE TRAMWAYS CO.—Mr. A. R. Monks presiding at the meeting. last week, said the revenue was £133 908, a reduction. of £5 419. Revenue from motor buses showed an increase, but did not fully compensate for the loss in tramway revenue. The company was seeking powers under a Provisional Order to abandon its tramways in sections as and when they satisfied the Minister of Transport that it was just and expedient to do so, to cancel the wayleaves and other obligations in connection with the tramways, to restrict motor 'bus competition, etc.

BIDEFORD AND DISTRICT ELECTRIC SUPPLY CO., LTD.—Sir Hugh Stucley, presiding at the meeting on April 10, said the past year had been one of continued progress. The extension to Appledore had proved a fruitful source of further revenue, and the directors were now considering the extension of the mains to Instow by laying a cable from the Appledore side of the river, should they find the necessary support forthcoming. The dividend on the ordinary shares was increased from 4% to 5%, in addition to the 7% on the preference shares, and it was resolved to reduce the cost of current by 10% from July 1 next. The present charge for lighting was 10d.

BATH ELECTRIC TRAMWAYS, LTD..—Mr. E. H. R. Trenow presiding at the meeting on April 15th, said the traffics and earnings for the past year showed a decrease of £1 505. Working expenses had gone down £2 102, the net result of their operations in Bath being £500 better. They were still working under the Temporary Increase of Charges Act, which enabled them to charge fares approximately 40% above pre-war rates. Wages and materials were roughly 80 to 100% higher. They recommended the payment of a dividend of 3½%, the same as last year. On dividend reserve account they were carrying forward £636, while on revenue account the amount taken to next year was £3 793. A dividend of ½% on the preferred ordinary shares was approved.

New Companies.

BEAM SIGN CO., LTD.—Cap., £2 000. Dealers in electrical or other display pictures or signs, manufacturers of and dealers in wireless sets, etc. Reg. office: 20, Kingsway, London, W.C.2.

HENRY BILLINGS AND SONS, LTD.—Cap., £10 000. Electrical and general engineers, electricians, suppliers of electricity for all purposes, manufacturers of and dealers in electrical apparatus, etc. Solicitors: W. G. Christians and Son, Swansea.

SOUTH-EAST YORKSHIRE LIGHT AND POWER CO., LTD.—Cap., £50 000. Electric light, heat and power supply company, electrical engineers, electricians, manufacturers of electrical apparatus, etc. Reg. Office: 53, Cornhill, London, E.C. (Public Co.)

EDISON STORAGE BATTERIES, LTD.—Cap., £12 000. Electricians, electrical and mechanical engineers, manufacturers of and dealers in electric batteries, dynamos, lamps and all apparatus connected with the generation, distribution, and employment of electricity. Reg. office: Victoria House, Southampton Row, London, W.C.1.

TRANSMUTOGRAPH, LTD.—Cap., £130 000. To acquire from J. P. Naylor exclusive licence for U.K. to manufacture and vend his invention called the "Transmutograph," and to carry on business of suppliers of and dealers in electrical, luminous, and other signs, signalling apparatus, etc. Reg. office: Adelaide House, King William Street, London, E.C. (Public co.)

WELDING EQUIPMENT, LTD.—Cap., £1 000. To acquire business now carried on at Yorkshire Street, Salford, Manchester, as the Welding Equipment Co., and to carry on the business of manufacturers of, dealers in welding and electrical equipment, etc. Reg. office: 20, St. Ann's Square, Manchester.

W. R. BOTTOMLEY AND CO., LTD.—Cap., £3 000. To acquire business of electrical engineer carried on by W. R. Bottomley at Providence Electrical Works, Marsh, Huddersfield, as "W. R. Bottomley Private Telephone Co.," and to carry on same and business of wireless, engineers, and manufacturers of and dealers in radio and telephone apparatus and supplies, etc.

PYE RADIO, LTD.—Cap., £180 000. To acquire radio business of W. G. Pye and Co., to adopt agreements with C. O. Stanley, the Gresham Trust, Ltd., T. A. W. Robinson, and with R. M. Ellis, and to carry on business of manufacturers of and dealers in wireless transmitting and receiving sets, electrical apparatus and apparatus used in connection with television, telegraphy, telephony, etc. Solicitors: Bartlett and Gluckstein, 199, Piccadilly, London, W.1. (Public co.)

METAL AND CHEMICAL PRICES.

TUESDAY, April 23rd.

	Price.	Inc.	Dec.
Copper—			
Best Selected .. .. .. per ton	£81 0 0	—	£2 0 0
Electro Wirebars .. .. „	£84 0 0	—	£5 0 0
H.C. Wires, basis .. .. per lb.	11⅛d.	—	⅛d.
Sheet .. .. „	1s. 0d.	—	¼d.
Phosphor Bronze—			
Wire (Telephone) basis .. per lb.	1s. 2⅛d.	—	⅛d.
Brass 60/40—			
Rod, basis .. .. .. per lb.	9d.	—	—
Sheet „ .. .. .. „	10⅛d.	—	⅛d.
Wire „ .. .. .. „	11⅛d.	—	—
Pig Iron—			
Cleveland Warrants .. .. per ton	£3 11 0	—	—
Galvanised Steel Wire, basis 8 S.W.G. .. .. .. „	£14 15 0	—	—
Lead Pig—			
English .. .. .. per ton	£26 5 0	5s. 0d.	—
Foreign or Colonial .. .. „	£24 17 6	10s. 0d.	—
Tin—			
Ingot .. .. per ton	£198 10 0	—	£5 0 0
Wire, basis .. .. .. per lb.	2s. 7⅛d.	—	1d.
Aluminium Ingots .. .. per ton	£95 0 0	—	—
Spelter .. .. „	£26 15 0	2s. 6d.	—
Mercury .. .. per bottle	£22 5 0	—	—

Sulphur—Flowers, Ton £12 0 0 *Copper Sulphate*—Ton £25 to £25 10 0
„ Roll, „ £10 10 0 *Boric Acid* (Crystals) „ £30
Sulphuric Acid (Pyrites, 168°) Ton £6 15 0 *Sodium Chlorate*—Per lb. 2⅛d.
Sodium Bichromate—Per lb. 3⅛d.

Rubber—Para fine, 11⅛d.; plantation, 1st latex, 9¼d.

∴ The metal prices are supplied by British Insulated Cables Ltd, and the rubber prices by W. Henley's Telegraph Works Co., Ltd.

THE LEAD MARKET.

The lead market had an easier tone at the beginning of last week, prices falling away 6s. 3d. per ton, but, according to James Forster and Co., a firmer tone developed later and the loss was more than recovered. The American price was again lowered on April 15th to 7 cents. per lb.

Closing prices on April 19th were £24 16s. 3d. for April, £24 11s. 3d. for May, £24 7s. 6d. for June, and £24 5s. for July, 6s. 3d. to 2s. 6d. per ton higher on the week.

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COMMERCIAL INFORMATION.

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debt. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

BIRKBECK, Mr. A., 68, Trafalgar Road, Wallasey, electrical contractor. £14 4s. 7d. March 6th.

CHARTERS ELECTRIC SUPPLIES CO., LTD., 25, King Street, Warrington, electrical engineers. £15 10s. 3d. March 14th.

DEAN, Cecil, Mount Calm, Woodlane, Isleworth, electrical engineer. £12 6s. 2d. March 19th.

EMPIRE ELECTRIC SYSTEM, 62, Dale Street, Liverpool, electrical engineers. £11 7s. 3d. March 18th.

GLENMORE MOTOR AND ELECTRICAL ENGINEERING CO., Great Waltham, Chelmsford, motor and electrical engineers. £10 4s. 2d. February 27th.

HOLDERNESS, Mr. D. S., Wallingford Street, Wantage, radio engineer. £15 9s. 3d. February 28th.

REIN AND SON, 3, Queen Street, Bath, electrical engineers. £34 0s. 4d. March 13th.

RICHARDS, Mr. S., 76, High Street, Blackwood, wireless dealer. £10 15s. 11d. March 1st.

ROBINSON, George W., 11, 12, 13, 14, Portsea Mews, Portsea Place, Connaught Street, W.C., electrical and general engineer, £14 9s. 10d. March 14th.

THOMAS, Ernest W., 19, Nelson Road, Ponders End, electrical engineer. £19 6s. 6d. February 26th.

WAKELING, Arthur B., 558, Beverley High Road, Hull, electrical engineer. £27 1s. 8d. March 13th.

WESTBURY, Mr. L. W., Ashfield, Sargeant Hill, Birmingham Road, Walsall, wireless factor. £16 15s. 3d. March 4th.

Private Meetings, etc.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

ASHWORTH AND SMITH (ELECTRICAL SUPPLIES), LTD., wholesale electrical dealers, 27, Blackfriars Street, Manchester. The statutory meeting of creditors was held recently, when Mr. B. H. B. Eldridge, 52, Brown Street, Manchester, the liquidator, submitted a statement of affairs which disclosed liabilities of £3 130, all due to unsecured creditors. The assets were estimated to realise £2 416, from which had to be deducted £17 for preferential claims, leaving net assets of £2 399, or a deficiency, so far as the creditors were concerned, of £731. The assets comprised furniture, £10; motor car, £30; book debts, £2 603, expected to produce £1 708; stock, £700, valued at £466; cash in hand, £9; and cash at bank, £193. The company was registered in January, 1927, when it took over an existing business, the purchase price being £2 325. Shares to the value of £1 500 were issued to the vendors, and the balance of £825 was left on loan by Messrs. Ashworth and Smith, Ltd. With the issued capital of £1 500, there was a deficiency as regarded the shareholders of £2 231, which was accounted for by the following items: trading loss in 1927, £320; trading loss in 1928, £362; loss during 1929, £137; written off book debts, £895; depreciation of stock, £234; written off fixtures, £84; and depreciation of motor car, £62. After a short discussion, a resolution was passed confirming the voluntary liquidation of the company with Mr. Eldridge as liquidator and an advisory committee was appointed of the principal creditors. The following are creditors:—Ashworth and Smith, Ltd., £905; Schlothaver, C. F., £296; Siemens Schuchert, Ltd., £185; Beardsall, W. E., Ltd., £119; Armoduct Cable Co., £102; Credenda Conduits, £101; Nathar, F. J., and Co., £87; General Accessories Co., Ltd., £86; Midland Manufacturing Co., £79; Helzel Bros., £61; Electric Accessories Manufacturing Co., £58; Metro-Vick Supplies, Ltd., £56; Ashley Cables, Ltd., £55; Blackwell, T. and C., Ltd., £53; Stockwell, Williamson and Co., £47; Baxendale and Co., Ltd., £45; L'Appareillage Electric de la Seine, £43; Stella Conduit Co., £42; Scandinavian Cable Co., £40.

MICO, LTD., accumulator manufacturers, etc., Newcastle-on-Tyne. A meeting of the creditors of the above was held recently, when a statement of affairs was submitted which showed gross liabilities of £2 141, made up as follows: Issued capital, £265; first debentures and interest, £361; second debenture, £300; creditors on open accounts, £928; bank overdraft, £201; and preferential claims, £85. The assets comprised book debts, £153; stock, £683; and cash in hand, £40; or a deficiency of £1 265. The total claim of the bank was approximately £500, but they held the second debenture as security. The company was registered in 1904, and for many years was able to carry on successfully. The last accounts were made up to May, 1927, when there was a debit balance on the profit and loss account of £800. For two or three years past the company had carried on business at a loss. Recently a creditor issued a writ, and on March 28th a receiver for the debenture holders was appointed. It was pointed out that the business had been badly affected in the last year or two through the extension of "after sales service" by certain manufacturers. The first debentures were issued in 1924 for cash, and the second debentures in November, 1928. After some discussion it was decided to leave the matter in the hands of a firm of chartered accountants who were acting for the trade creditors.

VALENTINE, Fred, trading as ARTISTIC DECORATIONS, 156, Nethergate, Dundee, electrical dealer, etc. A meeting of the creditors of the above was held recently, when Mr. A. S. Cram, C.A., of 38, Whitehall Street, Dundee, submitted a statement of affairs which showed liabilities of £1 626, and net assets of £442, or a deficiency of £1 184. The estate showed an apparent dividend of about 5s. 5d. in the £, but it was pointed out that there was a contingent liability in respect of claims for damages for breach of contract in the event of certain work not being completed. Mr. Cram reported that a trust deed had been signed in his favour. The debtor had been trading for about 15 months, and, so far as could be ascertained, it had never been a success. The debtor had a free capital of £50 when he commenced, and a friend had since advanced him over £700 at different dates. The debtor had taken contracts in connection with housing schemes, some of which were in course of completion. A resolution was passed confirming the trust deed already signed, and a committee was appointed to act with the trustee. The following are creditors:—Boote, T. and R., Stoke-on-Trent, £82; bankers, £95; Wood and Cairns, Ltd., Edinburgh, £172, Edison Swan Electric Co., Ltd., £23; Cockburn, M., and Co., Dundee, £59; British Thomson-Houston Co., Ltd., £18; Drake, Geo. H., Dundee, £27; General Electric Co., £37.

Receivership.

E. A. MANUFACTURING CO., LTD. Percy H. Stone, F.C.A. of Bank Chambers, 47, Temple Row, Birmingham, was appointed receiver and manager by the debenture holders on April 19th.

London Gazette, etc.

Company Winding-up.

ZONE WIRELESS CO., LTD. Winding-up order, April 15th.

Partnerships Dissolved.

AUTO ELECTRIC SERVICES (Margaret STREETER and George BOYD), electrical engineers, East Street, Petworth, Sussex, by mutual consent as from March 1st, 1929. Debts received and paid by Mrs. Margaret Streeter.

BENTLEY HUNT AND VANSTONE (James Edward BENTLEY-HUNT and Charles Percy VANSTONE), electrical and radio engineers, 4, Wood Street, Bath, as from March 25th, 1929. Debts received and paid by J. E. Bentley-Hunt, who will continue the business, but not under the firm name.

HAVIL MOTOR CO. (William Henry BUTCHER, George Percy HALL and Joseph Albert PHILLIPS), automobile, electrical and radio engineers, battery repairing and recharging depot, dealers in gramophones, gramophone and wireless accessories, and booking agents, 30, High Street, Peckham, S.E.15, and Havil Street, Camberwell, S.E., by mutual consent, as from April 17th, 1929. Debts received and paid by J. A. Phillips, who continues the business.

Notice of Intended Dividend.

NORMAN, George Arthur, 11, Freeman's Yard, Barnsley, electrical engineer. Last day for receiving proofs, May 8th. Trustee, B. S. Briggs, County Chambers, King Street, Wakefield, Official Receiver.

Bankruptcy Proceedings.

COHEN, George, electrical engineer, 49, Newman Street, Oxford Street, London. An adjourned sitting for the public examination of this debtor was held in the London Bankruptcy Court on Wednesday of last week, his statement of affairs showing ranking liabilities £4 445 and net assets £296. Cross-examined by counsel on behalf of the trustee in bankruptcy with reference to cash and goods accounts lodged under an order of the Court the debtor said that the receiving order was made against him in July last. He was then trading in partnership with his son, who was only 17 years of age at the time. He appealed against the receiving order and that appeal came on for hearing in October. The Order was, however, confirmed by the Court and on November 20th he was adjudicated bankrupt. Acting on advice he abandoned the suggestion of a partnership with his son. The goods account showed that he had stock of the value of £1 200 in hand at the beginning of March; between that date and July 15th, 1928, he bought goods for £191 and effected sales amounting to £477, which apparently left stock on hand at the latter date of the value of £913. On July 17th, however, he swore an affidavit to the effect that the stock was worth £1 700. The debtor agreed that £1 700 was a rough valuation, but he would not assent to the suggestion that it was a fictitious figure. It was, in fact given to him by the accountant and he accepted it. Although his wife was, according to his cash account, a creditor for £314 at the date of his failure, she was only returned for an amount of £75 in his amended statement of affairs, and that was explained by the fact that the latter figure was all that she was content to claim. The examination was concluded.

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Infringement of

C.M.A. Trade Mark

(Registered Nos. 422219, 422220, and 422221)

Cable Makers Association v. Edward William Knight sued and trading as City Engineers' Supply Company (a firm)—

On January 18th, 1929, in the High Court of Justice, a perpetual injunction was granted restraining the Defendant, his servants or agents from infringing the said trade mark, and the Defendant was ordered upon oath to deliver up to the Plaintiffs or destroy in their presence all infringing articles in his possession or power and to pay the Plaintiff's costs.

The Cable Makers Association are owners of the following Trade Marks:—

C.M.A.	-	Regd. Nos. 422219-20-21.
NONAZO		Regd. No. 458865.
VICMA	-	Regd. No. 486180.
VINAZO	-	Regd. No. 486179.

Licenses to use these are granted to members of the Cable Makers Association only.

Advt. of The Cable Makers Association, Sardinia House, Sardinia Street, London, W.C.2

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PATENT RECORD.

The following information is prepared from the Illustrated Official Journal (Patents) by permission of the Controller of H.M. Stationery Office. Printed copies of full Patent Specifications, when accepted, may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at 1s. each.

Specifications Accepted.

307 523 F. Newton. Electric motors for rotating cans or boxes for spinning or otherwise treating artificial silk or other fibres. (5/11/27.)
307 317 T. G. Allen.
307 318 G. T. Evans. Transmission of signals in printing telegraphy employing for transmission voice-frequency or high-frequency alternating-currents. (26/11/27.)
307 370 Siemens Bros. and Co., Ltd., and W. G. Patterson. Repeaters for telephone systems. (2/12/27.)
293 414 Ideal Werke Akt.-Ges. fur Drahtlose Telephonie. Loud speakers. (6/7/27.)
307 322 General Electric Co., Ltd., and M. Kahn. Control of electric motors (5/12/27.)
307 323 A. Reyrolle and Co., Ltd., and E. W. M. Scott. Electric protective systems. (5/12/27.)
307 377 S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). X-ray tubes. (5/12/27.)
281 725 F. Merk. Circuit arrangement for automatic telephone exchanges. (4/12/26.)
307 325 Graham Amplion, Ltd., and P. Freedman. Thermionic devices. (5/12/27.)
307 326 Graham Amplion, Ltd., and P. Freedman. Thermionic devices. (5/12/27.)
307 378 Graham Amplion, Ltd., and P. Freedman. Thermionic devices. (5/12/27.)
307 327 Graham Amplion, Ltd., and P. Freedman. Thermionic devices. (5/12/27.)
307 379 A. Reyrolle and Co., Ltd., B. H. Leeson, and O. C. F. King. Electrical remote-control systems. (6/12/27.)
307 383 A. Reyrolle and Co., Ltd., B. H. Leeson, and O. C. F. King. Selective indicating mechanism. (6/12/27.)
307 384 A. Reyrolle and Co., Ltd., B. H. Leeson, and O. C. F. King. Electrical remote-control systems. (6/12/27.)
307 385 A. Reyrolle and Co., Ltd., and O. C. F. King. Electric switches suitable for use in controlling the transmission of signalling or operating currents in an electrical remote-control system. (6/12/27.)
307 443 General Electric Co., Ltd., and H. C. Hannam-Clark. Electrical remote-control systems or the like. (6/12/27.)
307 386 J. Stone and Co., Ltd., and A. H. Darker. Auxiliary lighting of railway and like vehicles. (6/12/27.)
282 064 N.V. Internationaal Octrooibureau. Electric luminous tubes. (10/12/26.)
307 411 J. A. Crabtree and F. Painter. Mounting of switch fuses and similar units or accessories in boxes, cases, or containers. (7/12/27.)
307 446 Standard Telephones and Cables, Ltd. (Western Electric Co., Inc.). Aerial systems. (7/12/27.)
307 452 W. E. Kershaw and J. L. Woodbridge. Electrolytic cells. (8/12/27.)
293 292 Manhattan Electrical Supply Co., Inc. Metal-glass union. (2/7/27.)
307 537 Automatic Telephone Manufacturing Co., Ltd., W. S. Vick, and G. D. Turton. Telephone systems. (9/12/27.)
307 538 Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. Telephone systems. (9/12/27.)
307 539 A. Whitaker, C. O. Browne, and Gramophone Co., Ltd. Means for controlling the intensity of a beam of light in accordance with electrical variations for use, for example, in recording sounds. (9/12/27.)
307 543 Standard Telephones and Cables, Ltd. (Materiel Telephonique). Manufacture of lead antimony alloys for use in sheathing electric cables and the like. (10/12/27.)
307 544 W. S. Smith and N. W. McLachlan. Thermionic amplifiers. (10/12/27.)
307 552 A. Avtsine. Electric trolley-heads. (14/12/27.)
307 554 E. Pye and S. J. Healk. Time switch for incandescent electric lights. (15/12/27.)
307 555 Ashley Wireless Telephone Co. (1925), Ltd., and W. A. Brooke. Thermionic-valve holders. (16/12/27.)
307 556 J. A. Crabtree. Electric switches and other electrical devices. (16/12/27.)
294 562 A. G. Hasler, Vorm. Telegraphenwerkstatte Von G. Hasler. Telephone system. (26/7/27.)
307 558 A. H. Midgley. Thermionic valves. (19/12/27.)
307 562 British Thomson-Houston Co., Ltd., and H. C. Heath. Socket contacts and the mounting of the same for use with switchgear or other electrical apparatus. (22/12/27.)
307 563 S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). Manufacture of glass. (23/12/27.)
307 570 M. Buchholz. Process for preventing explosive gas mixtures from being formed in the casings of electrical apparatus enclosed in an insulating medium. (2/1/28.)
293 293 Elektra-Lack-Werke Ges. System Dr. Kronstein. Insulating material. (2/7/27.)
307 584 A. C. Wynne. Electric switches. (21/1/28.)
284 624 British Thomson-Houston Co., Ltd. Systems of electric distribution. (1/2/27.)
285 455 British Thomson-Houston Co., Ltd. Speed control systems for alternating-current induction motors. (17/2/27.)
307 596 F. E. Bancroft, and Metropolitan-Vickers Electrical Co., Ltd. Means for converting radiant heat energy into mechanical energy. (8/2/28.)
307 611 General Electric Co., Ltd., and P. H. Coales. Electric switchgear). (22/2/28.)
307 617 C. J. Beaver and W. T. Glover and Co., Ltd. Electric cables. (27/2/28.)
307 618 F. B. Dehn (Vesta Battery Corporation). Method and means for pasting battery plates. (27/2/28.)
307 629 Walker, Hunter and Co., Ltd., and J. Walker. Formers for electrical heating-elements. (12/3/28.)
297 312 Siemens and Halske Akt.-Ges. Circuit arrangement for telephone installations with selector working. (17/9/27.)

Applications for Patents.

February 18th.

5 428 Associaifd Telephone and Telegraph Co. Telephone systems. (29/2/28, U.S.)
5 450 Associated Telephone and Telegraph Co. Telephone systems. (29/6/28, U.S.)
5 369 Ateliers J. Carpentier. Radio communication systems. (17/2/28, France.)
5 433 Automatic Telephone Mfg. Co., Ltd. Automatic switches for telephones, etc.
5 306 W. and T. Avery, Ltd. Dashpots.
5 388, 5,389 H. H. Berry. Advertising signs, etc.
5 421, 5 422 British Electric Pari-Mutuel, Ltd. Totalisators.
5 371 C. E. Clemmson. Electric lamp shade.
5 355 H. S. Cowx. Electromagnetic make-and-break movements, etc.
5 363 A. G. Dicker. Electric switch. (25/2/28, U.S.)
5 447 Electrical Research Products, Inc. Treating signalling conductors. (24/2/28, U.S.)
5 448 Electrical Research Products, Inc. Electro-optical image producing systems. (24/2/28, U.S.)
5 449 Electrical Research Products, Inc. Heat treatment of loaded conductors. (24/2/28, U.S.)
5 358 E. Fries. Device for controlling temperature of oil in transformers. (5/12/28, Germany.)
5 340 H. Garde and B. V. Shann. Electric candle fittings.
5 438 General Electric Co., Ltd. Track brakes.
5 403 Imperial Chemical Industries, Ltd., and J. H. Paterson. Electrodes for arc welding.
5 367 International General Electric Co., Inc. Means for taking sound films, etc. (18/2/28, Germany.)
5 394 Kolle and Co., A.G. Production of light-sensitive layers. (16/2/28, Germany.)
5 451 Linke-Hofmann-Busch-Werke A.G. Diesel electric locomotives. (18/2/28, Germany.)
5 391 L. E. Ryall. Thermionic amplifiers.
5 392 L. E. Ryall. Alternating current signal receivers.
5 433 W. Saville. Automatic switches for telephone systems.
5 406 O. Schneider and A. Weiffenbach. Electric switch.
5 379 Siemens-Planiawerke A.G. fur Kohle-Fabrikate. Electric arc lamps. (16/11/28, Germany.)
5 373 Siemens and Halske A.G. Telegraphic installations. (18/2/28, Germany.)
5 378 Siemens and Halske A.G. Signal transmission system. (18/2/28, Germany.)
5 397 A. F. H. S. Simpson. Electrical transmission of pictures, etc.
5 352 W. Stephens. Electric heating and cooking stoves.
5 439 Telefunken Ges. fur Drahtlose Telegraphie. Electric chokes. (16/2/28, Germany.)
5 440, 5 442, 5 443 Telefunken Ges. fur Drahtlose Telegraphie. Wireless signalling systems, etc. (18/2/28, Germany.)
5 414 C. J. R. H. von Wedel. Circuits for discharge tubes. (17/2/28, U.S.)
5 426 Westinghouse Lamp Co. Glow discharge devices. (24/7/28, U.S.)

February 19th.

5 514 A. Allan, and A. Reyrolle and Co., Ltd. Electric couplings.
5 487 P. M. Anderson. Low frequency transformer.
5 500, 5 549 J. L. Baird and Television, Ltd. Television apparatus.
5 527 H. H. Berry. Electric fires, etc.
5 517 British Thomson-Houston Co., Ltd. Motion transmission systems. (/25/2/28, U.S.)
5 538 Ebonestos Insulators, Ltd., J. Holloway, and B. Weaver. Attachments for mouthpieces of telephones.
5 476 F. Foy. Electrical apparatus for heating liquids.
5 464 F. Gray and J. L. Hodgson. Electrical transmission apparatus.
5 541 G. H. Gudgeon. Electric switch.
5 506 A. E. M. van der Meersch and Thermo Path Co., Ltd. Electric soldering irons.
5 492 G. W. Melland and J. H. Runbaken. Electric current indicators.
5 508 Sargent and Lundy, Inc. Electrical switching apparatus. (3/3/28, U.S.)
5 533 Siemens and Halske A.G. Producing insulating masses of high disruptive strength. (27/2/28, Germany.)

February 20th.

5 646 W. E. Beatty (Bell Telephone Laboratories, Inc.). Insulating materials. (15/12/27.)
5 569 F. B. Benson. Signal amplifiers, etc., for wireless apparatus.
5 574 G. B. Burnside. Electric lamps.
5 654 Ceag, Ltd., and R. J. Plummer. Electric fuses.
5 620 J. Christie and A. Reyrolle and Co., Ltd. Oil-jacketed insulators for switchgear, etc.
5 679 R. F. Collinson. Synchronising means for electrical picture receivers, etc.
5 599 E. D. Dobbie. Thermionic valves.
5 579 G. O. and W. Donovan. Cut-outs, etc.
5 685 W. Germershausen. Electric discharge tubes. (12/5/28, Germany.)
5 612 W. G. Hay. Casings for electric cables, etc.
5 587 A. Horstmann and Horstmann Gear Co., Ltd. Electric time switches.
5 640 International General Electric Co., Inc. Operating electric clock installations. (22/2/28, Germany.)
5 567 E. C. Johnson. Trolley pulleys of electrically propelled vehicles.
5 677, 5 678 H. G. A. Kay and Wireless Pictures (1928), Ltd. Apparatus for reception of transmitted pictures, etc.
5 683 B. Lange and A. Schwarz. Electric revolution indicators, etc.
5 660 L. A. Levy and D. W. West. Electrical production of visible images.

COMING EVENTS.

Friday, April 26th.

Birmingham Electric Club.—Grand Hotel, Colmore Row. Paper by Mr. H. Blades on "Electric Cables—Installation and Maintenance." 7 *p.m.*

Institution of Electrical Engineers (London Students' Section).—Institution, Savoy Place, Victoria Embankment, London. Annual general meeting, followed by a paper on "The Manufacturing and Testing of Submarine Cables," by Mr. V. E. Connor. 7 *p.m.*

Institution of Electrical Engineers (Scottish Centre).—University College, Dundee. Paper by Mr. W. Holmes on "Load-levelling Relays and their Application in connection with Future Metering Problems." 7.30 *p.m.*

Monday, April 29th.

Institution of Electrical Engineers (Western Centre).—South Wales Institute of Engineers, Park Place, Cardiff. Kelvin Lecture by Dr. G. C. Simpson on "Lightning."

Architectural Association.—34, Bedford Square, London. Lecture by Mr. G. S. Francis on "Modern Tendencies in Architectural Form." 7 *p.m.*

Tuesday, April 30th.

Illuminating Engineering Society.—Lecture Theatre of Messrs. Holophane, Ltd., Elverton Street, Westminster. Paper by Mr. S. English on "Some Further Properties of Glass and their Application in Illuminating Engineering," followed by a discussion. 7 *p.m.* Demonstration of various novel applications of coloured light, by Mr. R. G. Williams. 8.45 *p.m.*

Wednesday, May 1st.

Electrical Contractors' Association.—(Bath Sub-Branch).—Ordinary meeting.

Electrical Contractors' Association (Cardiff Branch).—Ordinary meeting. 2.30 *p.m.*

Institution of Electrical Engineers (Wireless Section).—Institution, Savoy Place, Victoria Embankment, London. Paper by Dr. J. Hollingworth and Mr. R. Naismith on "A Portable Radio Intensity-Measuring Apparatus for High Frequencies." 6 *p.m.*

Thursday, May 2nd.

Electrical Contractors' Association (Newcastle Branch).—Ordinary meeting 11 *a.m.*

Electrical Contractors' Association (Bristol Branch).—Ordinary meeting. 3.15 *p.m.*

Thursday, May 2nd-Friday, May 3rd.

Iron and Steel Institute.—Institution of Civil Engineers, Great George Street, Westminster. Annual meeting.

Friday, May 3rd.

Institution of Electrical Engineers (Meter and Instrument Section).—Institution, Savoy Place, Victoria Embankment, London. Chairman's address by Mr. G. D. Malcolm. 7 *p.m.*

Saturday, May 4th.

Institution of Electrical Engineers (London Students' Section).—Visit to Mr. R. Borlase Matthews' "all-electric" farm, East Grinstead, Sussex.

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THE ELECTRICIAN

Established 1861. The Oldest Weekly Illustrated Journal of

Electrical Engineering, Industry, Science and Finance.

Bouverie House, 154, Fleet Street, London, E.C.4. Telegrams: "Benbrotric, Fleet, London."
Telephone: City 0244 (Ten lines).

[Closed on Saturdays in accordance with the "Five-Day Week" plan adopted by Benn Brothers, Ltd., and its associated organisations.]

No. 2657. [No. 18. Vol. CII.] **Friday, May 3, 1929.** Annual Subscription, 25s. Overseas, 30s.

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Current Topics.

The Battersea Problem.

THE agitation against the Battersea power station project shows no signs of abating. On the contrary, it daily attracts further criticism from quarters which can hardly be ignored. The grounds of complaint are growing, too; the critics are now worrying about Fulham, and people many miles removed from the storm centre are now discovering—and making known—similar smoke problems in various London districts. While it is not our intention or desire to add in any way to the embarrassment of the affected supply authorities in a difficult position, we do feel that the situation is one that must be faced, and that boldly, in a serious attempt to meet the expressed wishes of the public in the Battersea case. The problem of preventing or decreasing the emission of sulphurous fumes is a complex one, and if the subject is to be considered, as it should be, in its national bearing, the scope for inquiry is further increased. The main stations under the national electricity scheme are not all similarly situated; urban, residential, manufacturing or agricultural areas are all affected, and it does not by any means follow that what may be a nuisance of an intolerable character in one case may be admissible in another, and vice versa. Further, localities will differ very materially in their physical character, and in the meteorological conditions to which they are subject, so that identical arrangements for carrying away waste gases may not be universally applicable. For an inquiry to be complete the problems will have to be considered by power station engineers, physicists, chemists, meteorologists and agricultural experts. In the view of a distinguished authority the problem is probably more a matter of bringing existing knowledge to bear on the question than of initiating experimental work. We think, however, that some experimental work will be necessary, particularly in connection with the design of chimney stacks, to which little attention seems to have been paid.

Alternative Sites and Methods.

IN the meantime there is no shortage of suggestions for alternative sites and methods as a means of solving the Battersea trouble. Sir RICHARD REDMAYNE, recalling that a scheme put forward by the London County Council in 1906 for the erection of a power station considerably smaller than the present one, on the Battersea site, was rejected by a Select Committee of the House of Commons, urges the transfer of the station to a site on the Kentish coast, basing his demand on economic as well as æsthetic and health grounds. Sir BASIL BLACKETT is another advocate of a change on economic grounds, and in a letter to "The Times" on Monday, set out to show that the station could be removed, not only without serious loss, but even with profit. He contends that a site much farther down the river would be at least £250 000 cheaper than Battersea, and that to this could be added the estimated capitalised saving in coal costs at 1s. 3d. per ton on sea-borne coal delivered in the lower reaches of the river instead of at Battersea, amounting to some £350 000, thus producing a minimum saving of at least £600 000, which, he claims, would easily cover the cost of transmitting energy from the distant generating point. Mr. A. H. DYKES also favours a Kent coalfield site, but stipulates that such a station should carry only the base load, and that the peak load should be carried on Diesel engine stations situated in London itself. On the whole, the alternatives at the moment seem preferable to remedial action at Battersea, but the whole question is one that should be re-examined without delay.

The Tariff Question.

OF the consideration of electricity supply tariff problems there seems to be no end. But notwithstanding all that has been said and written about this question in the past, we are still not within reach of the ideal tariff; in fact, some who have studied the matter deeply confess that there is no ideal. So that while the tariff committee recently set up by the Electricity Commissioners is regarded by many as being in quest of the unattainable, it has at least the advantage of a voluminous literature on the subject, representing all or nearly all possible points of view. To this committee, and to all interested in the tariff question, we would suggest consideration of the question, put by Mr. RUTHERFORD BLAIKIE on a later page of this issue, "Are we justified in framing load factor tariffs if the cost is really governed by quantity?" Another point worthy of notice is the suggestion that tariff statistics should be compiled on a "per consumer" rather than a "per head of population" basis. In considering the suggestion that a perfect solution of the tariff problem is impossible, the Commissioners' committee might well give careful attention to the views put forward by Mr. C. F. MOUNSDON in our issue of September 9th, 1927. In the domestic tariff which he advocates the fixed charge is a composite

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one—based on three factors, lighting connections, floor area, and rateable value—so fixed as to give a curve conforming as nearly as possible to actual consumptions for houses of all classes. The adoption of the three factors certainly has the effect of smoothing out most of the existing anomalies, and it may well be that the best approach to the nearly ideal method of charging may eventually be evolved along these lines.

Marine Electricity.

AT one time THE ELECTRICIAN used to publish once a year a special number dealing with the applications of electricity in the marine world, with particular reference to electric propulsion. That we have abandoned the annual event in favour of a regular series of articles, published every month in the year, suggests that we believe there is a sufficiently great future in this field to warrant frequent attention in our pages. We do believe that marine electricity has possibilities, and that they are not generally appreciated in the electrical industry; development is proceeding at such a pace, however, that few electrical men can much longer remain in ignorance. Most of us are aware that electric propulsion is being employed for certain tugs, fruit carrying, and a few other specialist ships, but what is not so well known is that there are now built, or building, no fewer than thirteen electric passenger liners, and that within the next four or five years the total number of large electric passenger ships in service will probably reach at least seventeen. Marine electricity in this country is now definitely on the verge of big developments which will, it is hoped, repay those electrical firms which have for some years past done valuable pioneer work in this direction.

"The Women's Vote."

ALTHOUGH it has no real connection with politics, "The Women's Vote," a new production of the E.D.A., is of real topical interest during the election season. An attractively produced and priced poster, measuring 20 in. by 30 in., it depicts women going to the ballot box to record their vote for "Electricity in Every Home." We hope it will be prominently displayed by supply authorities and electrical installation contractors during the present month. Incidentally, we might point out that the women's interest in the domestic applications of electricity, as exemplified in the remarkable work of the Electrical Association for Women, has already been of practical benefit to the industry, especially in those directions where the potentialities of this consumer-support have been properly appreciated and encouraged. Like the politicians, the electrical industry has much to gain—or lose—from the "women's vote." Let us take steps to ensure that "Electricity in Every Home" shall be a reality and not just a slogan or a politician's electioneering pledge.

"The Incandescent Lamp Jubilee."

OUR disclosure last week of the American scheme for honouring Mr. EDISON for the invention of the incandescent lamp previously discovered by the late Sir JOSEPH SWAN has already provided us with ample evidence that British electrical engineers are particularly alarmed at the possibility that an old misconception may be broadcast to the world and thus deprive the memory of a great British scientist of the honour—which is rightfully his—of an invention which was really the foundation of the modern electrical industry. Already we have received a number of letters of protest, and among the selection which we print on our correspondence page this week is a suggestion which, if adopted, should soon lead to a modification of the N.E.L.A. programme. The suggestion is that as Sir JOSEPH was a president of the Institution of Electrical Engineers it is the plain duty of the Institution to send to the National Electric Light Association of America a formal protest against their proposal. We would suggest that such a protest might well be accompanied by copies of Mr. JAMES SWINBURNE'S address on "Sir Joseph Swan's Electrical Work" delivered before the Institution on December 28th last, and of Dr. J. A. FLEMING'S "Brief Personal Recollections in Connection with the Jubilee of the Invention of the Carbon Incandescent Electric Lamp by Sir Joseph Wilson Swan in 1878," which was published in the I.E.E. Journal of February last. As the great representative body of electrical men, the Institution seems particularly suited to make this protest, and as the celebrations are timed to start on June 1st we hope that no time will be lost in deciding who shall take action and what form it shall take.

The B.I.F. Date.

FOR several years past we have consistently advocated that the date of the British Industries Fair should be changed to one more likely to attract buyers from overseas. We are now glad to hear that the Advisory Committee of the Electrical Section of the Fair, in view of the representations made that the month of May is more suitable than February, have passed a resolution in which they express the opinion that the Department of Overseas Trade and the Birmingham Fair Management Committee should hold an impartial inquiry to consider the question, and that the Birmingham committee should take a referendum of the whole of the exhibitors at the Birmingham section of the 1929 Fair to ascertain their views on this important question. Representations are also to be made regarding facilities for reaching the Fair, parking arrangements, the grouping of trades, etc. So far as it goes this move is distinctly gratifying, but it must be remembered that this is not entirely a matter for exhibitors in the electrical section who form a minority amongst the whole body of exhibitors. Furthermore, we are definitely warned that whatever the result of the recommended action—if taken—no change of date can be made so far as the 1930 Fair is concerned.

A Remarkable Estimate.

USED as we are to the extravagant claims that are so persistently advanced by an industry which claims to be in competition with our own, we can bear with proper fortitude most of the imaginative sallies of the anti-electrical propagandists. In any case the claims are frequently so indefinite as to leave plenty of avenues for retreat in the face of a challenge. In a different category is the statement, made at Tuesday's dinner of the Society of British Gas Industries, that "to-day 90% of the cooking in our homes is done by gas." This is a remarkable estimate and we would like to know how this figure was arrived at. Before this statement was made we thought that quite a fair percentage of houses cooked by the old-fashioned coal-fired range. We were also given to understand that, here and there, one or two adventurous spirits had utilised electricity for cooking. Obviously we were mistaken.

Arterial Road Lighting.

FOLLOWING a fatal accident due to the absence of lighting on an arterial road, part of which is within its area, one of the local authorities in Greater London has accepted responsibility for lighting that portion which goes through its own territory. The urban district council in this case, as in many others, considered that the responsibility for street lighting rested with the county council, and the decision in this case will doubtless lead to an acknowledgment of responsibility by similarly placed urban authorities. The larger question of lighting all the main roadways is one which must sooner or later claim the serious attention of public authorities. The contrasts, even between the well-lighted areas and those contiguous districts where the illumination is not so good, are sufficiently fruitful in the provision of accident risks, but the hazards are tremendously increased on the many miles of important highways which are without lighting of any sort. This is a matter which the electrical industry might well investigate.

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ELECTRICITY SUPPLY AND THE CONSUMER.

Work of the Rural Supplies Committee—Tariff Expediency—Load Factor and Quantity Systems—Further Examination of Weir Report Forecasts—Suggested Basis for Statistics.

By J. RUTHERFORD BLAIKIE.

THE newly-appointed Committee, set up by the Electricity Commissioners, to report on rural supply tariffs, etc., recalls the work of the Conference on Electricity Supply in Rural Areas. The report of this Conference, with its two sub-committees, issued in July, 1928, does not appear to have received the attention and recognition that is its due, having regard to the fund of useful information it contained and the really scientific plan of attack. It is a most agreeable contrast to some of its predecessors, but even if the report is on a scientific plane, that is not to say that it is beyond criticism; indeed, a cynic might observe that it is here that the trouble begins. Be that as it may, there is always a prospect of progress when food for thought is provided in good order.

The first comment might be that some of the conclusions are not sufficiently backed by the evidence, or that it is incomplete, but if that is so, the position of the Conference is made good by its first recommendation, viz. :—

" That the Electricity Commissioners be asked to regard the development of electricity supply in rural areas as a special branch of their work to which continuous attention should be devoted; and to consider the advisability of appointing a special officer for this purpose."

Also No. 6 recommendation referring to a special section in the Annual Report.

On the strength of these recommendations it might have been expected that the 8th Annual Report of the Commissioners would have been of exceptional interest. However, it proves to be disappointing in this respect, and the decision to proceed further by committee will be regretted by all who realise how impossible it is for a committee, whose members have usually quite enough to do in their own occupations, to undertake the labours of research work. Another unfortunate aspect of this procedure is that the Commissioners themselves are unwittingly hardening the present difficulties by the narrow limits of the reference so far as tariffs are concerned, such as domestic supplies, rural supplies, etc. It seems to be taken for granted that these classifications are final, and not temporary expediencies to overcome the gradual breakdown of load factor tariffs. Would it not be better to examine the fundamental differences that underlie load factor and quantity (rateable value) tariffs and decide which of the two is better suited for present-day requirements?

In the present instance, however, the Conference finds sufficient reason for applying information derived from supply statistics as a whole, and sees no reason for supposing that any further variety of tariff is desirable for rural areas. I agree that there is no need to create another of these load factor expediency groups, but where the opportunity occurs, in an unspoilt market, it seems to be opportune to consider the logical expansion of the rateable value tariff to a real quantity tariff.

Choice of Principles.

As there appears to be a general lack of understanding of these fundamental differences, perhaps I may be excused for borrowing something from the style of the Weir Report and attempt a " picture."

We have before us the choice of two important principles. The first, which was so brilliantly demonstrated 25–30 years ago, showed how the cost depended on the number of hours of use or, in other words, load factor.

It appeared when the primary interest of electricity supply was lighting, that is comparatively small consumers. Power was regarded as a by-product and there was practically no heating.

The second was born some 15 or 20 years ago in Norwich, and depends on the principle that the size of the consumption of a consumer, or the degree of utilisation of the capital expended (chiefly in mains) has a greater influence on the cost than load factor, within the limits of general experience. It was received with the most bitter and violent hostility that has ever raged round a tariff controversy. The critics of that day failed to see the connection between the kW demand and the rateable value of a consumer, for the very good reason that there isn't any.

And this rather comic situation prevails to a very wide extent to-day. It may be mentioned, at this point, that rateable value is, of course, only a happy expedient for distributing a heavy standing charge per consumer, which in many cases would make the resultant price too high. But there is nothing in that; the load factor school had to compromise in the case of very low load factors in a similar way, otherwise the rate would exceed the statutory limit.

The Quantity Tariff.

With larger consumers in the one case, or longer hour consumers in the other, both systems got over their difficulties, and could charge the correct amount per consumer, or the correct amount per kW demanded. But the load factor system had a long start and was doing very well, so that with the exception of a few important undertakings who charge graded quantity rates for power, the quantity tariff has remained much the same for many years, that is, applied only to small consumers in the rateable value form.

We will now proceed with the " picture " :—

Load Factor.	Quantity.
1. A charge per kW.	1. A charge per consumer graded for size.
(*a*) Installed.	Plus a low unit charge metered graded for size.
(*b*) As indicated by instrument. Graded for size in two or three steps.	(*a*) Rateable value.
Plus a low charge per unit metered; also graded in steps.	(*b*) Graded rates for quantity, large power.
2. Flat rates based on assumed L.F. for different purposes.	
(*a*) Lighting domestic houses.	
(*b*) ,, hotels, etc.	
(*c*) ,, shops.	
(*d*) ,, churches.	
(*e*) ,, factories.	
(*f*) Power lift hoists.	
(*g*) ,, intermittent.	
(*h*) ,, electric furnaces.	
(*i*) Heating cooking	
(*j*) ,, room warming.	
3. Domestic supplies. A charge based upon the demand for lighting, assumed by	
(*a*) Number of rooms wired.	
(*b*) Wattage of lamps installed.	
(*c*) Floor space, plus unit charge 2 (*i*) and (*j*).	
4. Time control with clock switches.	
5. Change circuit system.	

Application.

Special instruments or inspection. In the case of purpose tariffs, a separate circuit and meter required for each purpose.	A single meter for all purposes.

Effect on Consumers.

Charges.

1*a*. Not satisfactory.	1. No opinion.
1*b*. Fairly satisfactory.	1*a*. Satisfactory.
2. Satisfactory.	1*b*. Satisfactory.
3*a* and *b*. Fairly satisfactory; *c* satisfactory.	
4. Fairly satisfactory.	
5. No opinion.	

Expansion.

Mostly neutral.	1. No opinion.
3 *a* and *b*. Retarding. *c* Encouraging.	1*a*. Encouraging.
	1*b*. Encouraging.

It should be noted that these opinions are merely personal, but are given as a suggestion for a questionnaire or other means of arriving at a conclusion.

With the coming of the Weir Report a curious thing happened. It was publicly announced that the cost per unit would be 1d. when the consumption reached 500 units per head of population, which appears to be correct, as we shall see later. It was not when the load factor reached 40 or 50%, but when the consumption reached a certain quantity per head, or otherwise when the consumption per average consumer reached a certain other quantity. Now if this is

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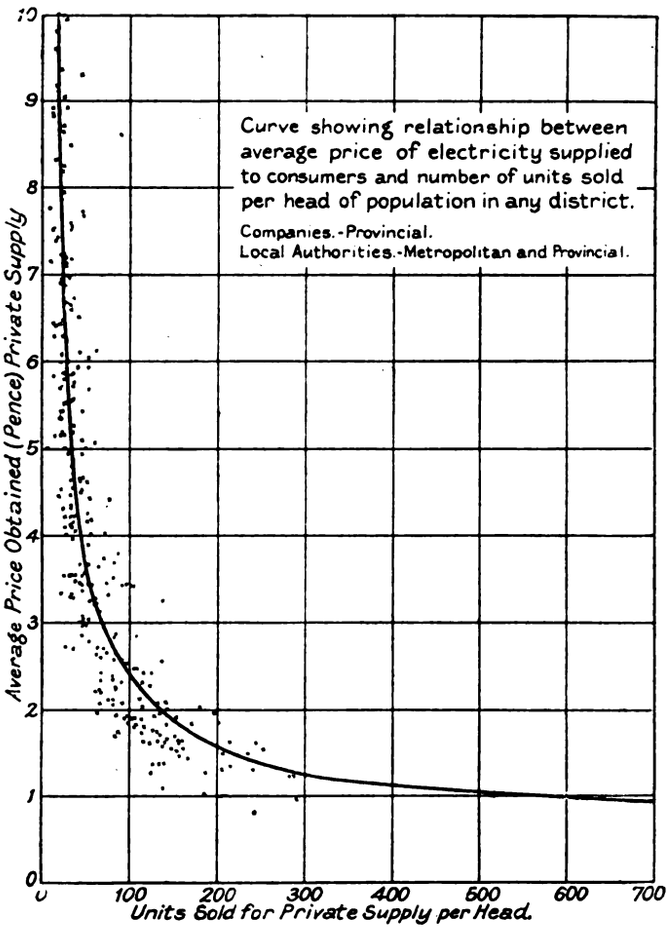
so, what becomes of load factor tariffs; are we justified in framing load factor tariffs if the cost is really governed by quantity?

We will now examine the likelihood of this forecast being correct. In the first place we have the curve in the Weir Report* prepared by Mr. J. M. Kennedy from the practical results of a large number of undertakings. This indicates that the price will be 1·05d. per unit at the 500 mark. Since



then we have had the advantage of the Commissioners' statistics showing the units sold, year by year, and the average price obtained, which tend to confirm the curve. The figures are as follows :—

	Population	Units per head — Commissioners basis	Units per head — Weir basis	Price.
Weir Report	36·5 millions	—	110	2·047d.
Commissioners 1923–24 ..	—	117	—	1·87d.
1924–25 ..	—	125	—	1·76d.
1925–26 ..	44 millions	130	157	1·65d.
1926–27 ..	44·18 ,,	155	188	—

From these data the formula can be obtained :—

$$\text{Average price} = \frac{147\text{d.} + \text{units per head} \times 0{\cdot}723\text{d.}}{\text{units per head}}$$

The price in 1926-27 should be 1·505d., and at 500 units per head it works out at 1·01d. It is unfortunate that the Commissioners' 8th Annual Report, dealing with 1926-27 does not appear to contain the average price obtained, such as appeared in the 7th Annual Report at 1·65d., page 19, paragraph 72. Perhaps the Commissioners will repair the omission by publishing this figure in the technical Press.

As a further check, the actual results of two groups of municipal undertakings have been examined for the year 1928.

	Total output units sold.	Average units per head.	Average price obtained.	Price by formula.
10 Municipal undertakings about 200 units per head ..	1 302 millions	206	1·42d.	1·435d.
5 Municipal undertakings about 500 units per head ..	346 ,,	503	1·03d.	1·015d.

* Also see THE ELECTRICIAN, March 5th, 1926, page 260.

I suggest that these results completely vindicate the quantity principle.

To develop the matter further, I would refer again to the curve in the Weir Report. It will be found that the line does not pass through the thickest cluster of points at about 120 units per head, which cluster, by the way, is confirmed by the Commissioners' figures.

Mr. Kennedy evidently tried to make a single straight line law cover the whole range. He apparently got the extremities of this range fairly well, and had to sacrifice a little at the 120 unit mark. It is very remarkable that these results are so nearly a straight line law, but it would probably be nearer the truth if it was a series of such lines changing slightly at certain points to cover different portions of the range. There are obvious reasons for this, one being that at the higher consumptions there is a larger proportion of h.t. and e.h.t. mains, but we must pass over this at the moment. An interesting anticipation of such a change occurs in the Chester tariff, which is described in the Conference Report, page 49, section 41.

"This consists of a fixed charge based upon rateable value of the consumers' premises together with unit charges not exceeding 2½d. per unit for a certain consumption and not exceeding 1½d. per unit for all further units."

As it stands, this is a three-part tariff, a fixed charge, a block at one rate, and further units at another rate. The same result can be expressed in a quantity tariff, assuming, say, £3 for the fixed rate and, say, 300 units to the point of change. The tariff would read :—

For consumption up to 300 units per annum	£3 plus all units at 2½d.
For consumption from 300 to 600 units per annum	£3 18s. 6d. plus all units at 1½d.
For consumption from 600 to 1 000 units per annum ..	£4 11s. 6d. ,, ,, ,, 1½d.
For consumption from 1 000 to 2 000 units per annum ..	£5 1s. 5d. ,, ,, ,, 1½d.

By carefully selecting the steps in the consumption, and the drop in the unit rate, such a tariff can be made to approximate very closely to the ascertained costs. There is no difficulty in dealing with ½d., as ready reckoners are available. Alternatively, of course, the Chester form could be expanded. A further development would be to construct a suitable scale for quarterly quantities.

Small Consumers.

Having regard to this principle of a series of lines in a quantity tariff the question of the unit rate to small consumers becomes of great importance, as if it starts too low the capacity for reducing in progressive sections becomes exhausted. On page 54, section 72, No. 2 Sub-committee says :—

"From the standpoint of the consumer, the great inducement to an extended use of electricity under a two-part tariff is a low rate per unit. On the other hand a high fixed or service charge acts to discourage the voluntary adoption of such a tariff. While a due balance must therefore be observed by a supply authority, the Sub-committee are of the opinion that to secure the general use of electricity in rural areas the aim in view should be a limit of 1½d. or 1d. per unit charge of two-part tariffs."

This low rate was a very favourite argument with load factor tariffs, in the hope of increasing the load factor, but I very much doubt if it had any effect. Consumers would not use electricity for longer hours than they required, no matter how low the rate might be. It is a difficult thing to prove, but so far as consumption per consumer is concerned I give the results in Nottingham and Brighton in 1900 for what they are worth.

	Tariff.	Units per consumer.	Price.
Brighton ..	365 hours at 7d., remainder 1d.	1 230	2·98d.
Nottingham	400 ,, ,, 4d., ,, 2d.	1 310	2·87d.

So far, in reviewing the possibilities of ascertaining the costs on the quantity basis we have had to be content with an imperfect reflection of units per consumer, in units per head of population, as there are no statistics available per consumer. If the Electricity Commissioners could have given us the average units per consumer in addition to the units per head of population, they would have been of very great service.

It has been shown, that taken over very large averages the units per head appear to be very reliable, but in individual cases there are far too many freaks, for example :—

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1928.	Units sold millions.	Units per head.	Price obtained.	L.F. per cent.
Manchester	353·5	273	1·06d.	33·21
Gravesend	19·7	254	1·17d.	38·27
Darlington	13·8	276	·9	28·11
Luton..	31·4	216	·98	30·55
Maidstone	17·6	374	1·17	34·24
Preston	38	147	1·16	28·78
Wallasey	31	166	1·05	30·53

Early in 1926 (February 26th) a curve similar to that in the Weir Report, but on the basis of units per consumer was published in THE ELECTRICIAN, and used to demonstrate how it happens that some small undertakings are able to sell as cheaply as others of far greater size, load factors being similar. (Such cases appear in the foregoing list; compare Wallasey and Manchester.) It was shown that the price depended on the average consumption per consumer. York and Liverpool, at that time, sold about the same number of units per consumer at exactly the same price, though the output of Liverpool was ten times that of York. This disposed of the big undertaking fallacy. It could not have been done on the basis of units per head, or load factor.

The Conference has something to say about large consumers and units per head (page 19, section 10, No. 1 Subcommittee) :—

" The preceding figures as a whole emphasise the value of large individual loads in the development of an undertaking in rural areas, and serve to indicate that the extent and character of the demand in different rural areas vary somewhat widely. They also point to the conclusion that the basis of units sold per head of population does not afford a reliable criterion as to the general consumption of electricity in cases where large individual loads predominate, or as to the ability of occupants of residences to use electricity for domestic purposes."

In several places the Conference emphasises the importance and effect of the large consumer, and it will be noted that several engineers arrange their statistics on the basis of per consumer, capital, consumption, revenue, etc., as well as per head of population. Is it not most desirable that all statistics should be on the basis of per consumer (and any other if necessary) more especially when rateable value tariffs are contemplated ? I suggest that this is one of the most urgent points for any tariff committee to consider.

In developing rural areas there is an opportunity of escaping from the melancholy confusion of 30 years of load factor. Rateable value tariffs are tried and tested, and available for small consumers, and there is the logical expansion to a pure quantity tariff for really large consumers.

This market has not been spoilt by thoughtless offers of power at 1d. per unit for any trivial quantity. The Conference has already done an excellent service in studying and defining the upper limits at which electricity may be saleable in competition with other agencies. It is to be hoped that the new committee will "carry on" and that their recommendations will be at least consistent in principle, and not selections from load factor expediencies with rateable value trimmings.

BOOK REVIEWS.

Centrales Eléctriques (Electrical Central Stations).

By F. DROUIN. Pp. 580. (Paris: J. B. Baillière et Fils, 19, Rue Hautefeuille.) Paper cover, 85 Frs.; bound, 97 Frs.

This is one of the series of works in the " Encyclopedie D'Electricité Industrielle " organised with the co-operation of the French Institution of Civil Engineers, and prepared by M. F. Drouin, technical director of the Cie Générale D'Électricité with the co-operation of the leading French electrical societies.

The first chapter, after a short historical résumé, deals with the ratio of maximum demand to connected load. Diversity factors are dealt with, and a series of curves are given showing daily load variations on French stations; the long dinner hour from 12 to 2 has a marked influence, also " summer time." It is evident also that the so called " Semaine Anglaise " with Saturday afternoon " off," is getting popular. The system of representing load curves with the aid of a series of cut out cards is described, and interconnection discussed.

When dealing with distribution tensions it is pointed out that there have not been as many accidents as might be anticipated. Owing to the lower distribution pressure usual in France (115/200 V) a material proportion of power customers take current at h.t. The effect of h.t. distribution voltages on minimum transformer capacity and transformer light load losses is emphasised. Generator voltages are discussed. The supply of power as a by-product of coke-ovens, blast furnaces, metallurgical furnaces, and so on, is dealt with.

Chapter II deals with lay-out and buildings. The choice of the site, size and number of units. The desirability of having a single unit large enough to supply the charging current to the line is emphasised. The proportion of spare plant is examined. As with us the longitudinal arrangement of turbines seems to be the vogue with very large units; the use of a separate pump house between boiler and turbine sections, the importance of questions of floods, ash disposal and facilities for labour supply or housing for employees in matters relating to station sites are indicated; the importance of heating and ventilation during very cold weather is also pointed out.

Chapter III deals with matters relating to water circulation and supply. Spray ponds and chimney coolers are discussed, and feed water, its measurement, purification, distillation and de-aeration complete the chapter.

Fuels, coal and its storage, lignite, coke, peat, liquid fuels, natural and coke-oven gas and the weighing and handling of liquid and solid fuels are dealt with in Chapter IV. At St. Ouen, steel coal trucks are placed on a side slope and cleared through the doors in three minutes by means of a big water jet operated by a centrifugal pump. Ash handling and disposal is then discussed, followed by remarks on conveyor construction and upkeep, and water trough ash conveyors.

In Chapter V steam and its characteristics, boiler sizes and types, superheaters, economisers, air pre-heaters, furnaces and the smoke problem, the influence of combustion chamber volume, fire brick arches, sprinklers, chain grates and underfeed stokers, liquid fuel and gas furnaces and pulverisers are dealt with, then flue cleaning, chimneys of brick, boiler plates, and moulded concrete, artificial draught, with which the name of M. Prat is so closely connected; then follow additions to notes on boiler efficiency, boiler feed pumps and feed regulators.

Chapter VI deals with thermal prime movers, steam engines, Diesel engines and then steam turbines, their consumption, lubrication, re-heating, high pressures and bleeding, followed by condenser problems, air extraction, tube corrosion and the question of busbar, auxiliary electric, and the steam driving of auxiliaries are looked into.

Chapter VII is devoted to pipework and valves for steam and water, with notes on pipe insulation.

Chapter VIII deals with certain salient points relating to electric generators, choice of tension, cooling arrangements, frequency changers, synchronous condensers, boosters and station auxiliary services.

Chapter IX, of over 100 pages, deals with switchboards and their apparatus and connections, including voltage regulation, synchronisation, busbars, choke coils, relays, switchgear, including the Reyrolle compound-filled system; the chapter is concluded by some notes on transformer operation.

The last chapter gives a number of points on operation, including useful notes regarding upkeep of boilers, turbines, condensers, generators and switchgear, fire services, combustion, flue gas analysis, coal calorific values, central station efficiency, depreciation, construction factors and electricity tariffs.

The book should be very useful for students, and owing to the numerous practical points in it is worthy of study by many past that stage. The author has concentrated mainly on the steam side. He has not attempted to discuss electrical theories in a chapter or so; he assumes that his readers know such matters already. Each chapter has a good bibliography, and it is with pleasure that one notes that the author has been very broadminded in his treatment, giving credit in many cases to English engineers and constructors.

The arguments used are clear, graphs are freely adopted, and from cover to cover the work bears the imprint of a practical man.

THEODORE RICH.

BOOKS RECEIVED.

" Dynamische Lautsprecher." By Dr. Eugen Nesper. (Leipzig: Hachmeister and Thal.) Pp. 40. Price 2 marks.

" Uber Kondensatoren und ihre Eichung." By Dr. G. Zickner. (Leipzig: Hachmeister and Thal.) Pp. 60. Price 3 marks.

Science Abstracts. Sections A and B. Vol. 32, Part 3. No. 375. March 25th. Issued by the Institution of Electrical Engineers. (London: E. and F. N. Spon.) Single numbers, 3s.; annual subscription 30s., or 50s. for both sections.

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A GENERALISED COSTS ALIGNMENT CHART.

A Simple Scheme for Facilitating Comparison of Electricity Charges which is Applicable to any System of Rating—A Useful Refinement—Employment of the Scales—A Hypothetical Example.

By W. A. BARCLAY, M.A.

IN THE ELECTRICIAN of March 1st, 1929, the writer submitted an example of a type of alignment chart designed to give a rapid means of comparing the cost to the consumer of two specified modes of charging for current. Other and different charts could, of course, be constructed to illustrate other particular methods, and when once these are drawn out they afford a very convenient means of reckoning costs.

As pointed out in the article, other scales corresponding to other systems of charging can be drawn in for additional cases of special interest. The multiplication of such scales, while undoubtedly convenient for certain purposes, unfortunately complicates the diagram, which may get "crowded." It is, therefore, thought that a more general process, by which *costs on any system of rating can be compared*, may usefully supplement the former chart, which dealt with two systems only.

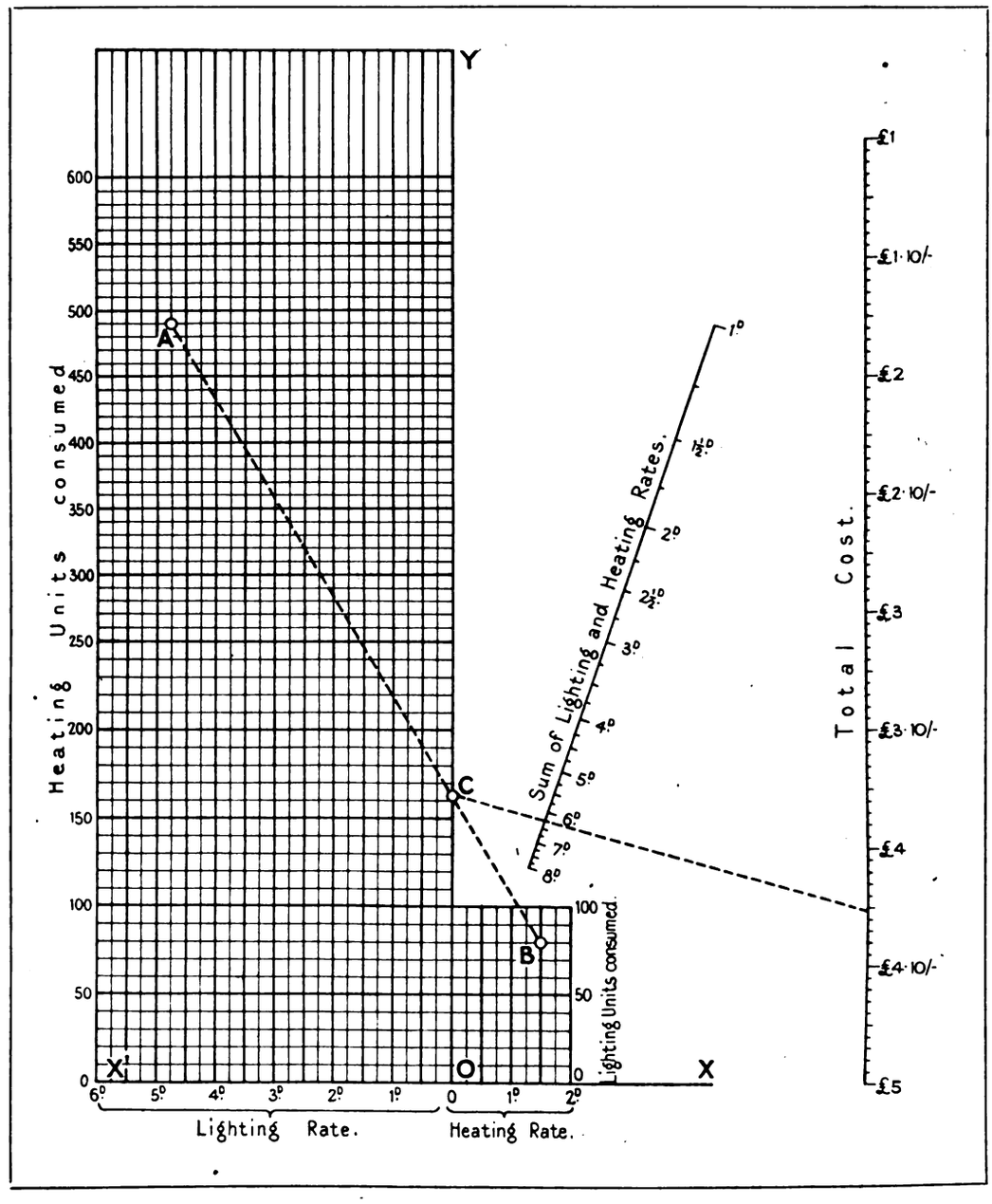
Let us suppose that current is supplied for lighting purposes at r_l pence per unit, and for heating at r_h pence per unit. Then, if a consumer takes l units for lighting and h units for heating, we shall have for P, the total costs in pounds,

$$240\,P = (l \times r_l) + (h \times r_h).$$

The chart which is reproduced herewith, is designed to solve this equation at sight for all values of the variables. It comprises an ordinary cartesian network XOY, in which the horizontal axis XOX^1 is graduated on either side of the origin for values of r_l and r_h, taken at intervals for every farthing. The vertical axis OY is graduated in units consumed.

The procedure in use is as follows. First find a point A whose abscissa, taken to the *left* of O is equal to r_l while its ordinate is h. Next, find B whose abscissa, this time to the *right* of O, is equal to r_h while its ordinate is l. Join AB, and let it meet OY in C. Now find on the slanting scale the graduation which represents the sum of the two rates r_l and r_h. If a line be now taken from C through this point and produced to meet the right-hand scale, the resulting point gives the total amount of the cost sought.

In practice there is no need to draw the lines indicated in the above construction. The positions of the necessary points may be found quite well by means of a ruler placed in position over the diagram, or even more conveniently by a piece of thread. It will be noted that the required cost is obtained by two applications of the index line. This is due to the fact that the present chart is more general in its scope than the previous diagram, which entailed but one setting of the index.



A refinement of which the diagram is capable may here be noted. It is the practice of some supply authorities to reduce the rate charged per unit after a certain number of units have been consumed. Thus, if after 250 units have been consumed for heating at rate r_h, any excess is charged for at the reduced rate r_h^1. This circumstance has been allowed for on the present chart, which has been constructed on the assumption that for all heating units over 250, the charge is three-quarters of the original rate. It will be seen that the scale of heating units has been reduced in this proportion above 250 on the diagram.

An example of the use of the chart will make the matter more clear. If lighting costs 4¾d. per unit, and heating 1½d. per unit for the first 250 units, and thereafter three-quarters rate, or 1⅛d. per unit, what is the cost of 80 lighting and 490 heating units?

The dotted lines on the diagram show the points A and B for these values. The point of intersection C of AB with the axis OY is joined to 6½d. on the slanting scale, this being the sum of the two rates. The cost is found to be slightly over £4 5s.

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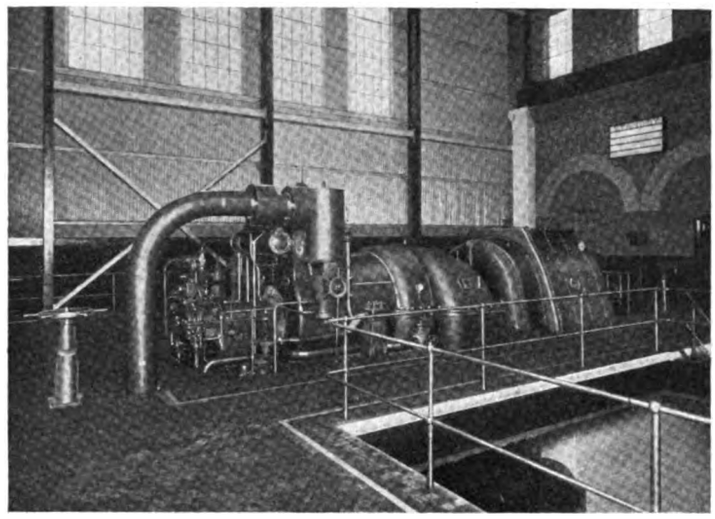
EXTENSIONS AT TORQUAY.

Official Inauguration of New Plant at Newton Abbot Station—The Latest Extensions Described—Special Provision for Overhead Circulating Water Delivery Pipe—Sandwich Firing with Coal and Coke Dust—The Control Gear.

IN view of the proximity of the I.M.E.A. Convention at Torquay, particular interest attaches to the latest extensions to the Newton Abbot power station of the Torquay Corporation, which were officially opened by the Mayoress of Torquay on Wednesday.

The extensions comprise a 7 500 kW turbo-alternator with surface condensing plant, a 50-ton electrically-driven travelling engine-room crane, two high pressure boilers with economisers, induced draught and other auxiliary plant, additional riverside works for the provision of circulating water for the condensers, a new railway siding for receiving supplies of coal from the G.W.R. Moretonhampstead branch line and an interesting system of coal handling and conveying plant.



The latest engine-room extensions at Newton Abbot, showing the new 7 500 kW B.T.-H. turbo-alternator.

The new engine room extensions occupy the site upon which the boiler house of the old Electric Supply Co.'s station was formerly situated, while the new boiler house extensions are erected upon the site of some disused clay pits, formerly utilised by the company as cooling ponds for condensing water.

These old ponds had been filled up with tipped material since the acquisition of the site by the Corporation, and owing to the uncertain bearing capacity of the ground the foundations of the new boiler house and other coal conveying plant had to be carried upon a system of reinforced concrete piles 14 in. square and ranging in length from 35 to 80 ft.

Piles for a further extension of the boiler house similar to that recently completed have already been driven, and a pile-supported reinforced concrete platform has also been completed beyond the new engine room in readiness for the accommodation of the next contemplated extensions of 10 000 kW.

The only portion of the old company's buildings now surviving is the corner of the station behind the ivy-covered frontage immediately adjoining the main entrance gates. These buildings accommodate the two 1 250 kW B.T.-H. turbo-alternators which were transferred from the old Torquay station at Beacon Quay. With reservations as to the Central Electricity Board's Scheme for South West England, these old sets will be removed and their site occupied by a new 10 000 kW or 12 500 kW turbo-alternator when occasion demands.

After the completion of the recent alterations and extensions, the station now contains generating plant of some 18 000 kW total maximum continuous rating.

All the old company's original plant has now been removed, with the exception of the 600 Ah D.P. battery which is still used with rotary converters in connection with the works power supply.

The original office buildings, which have been slightly extended, now provide accommodation for the fuel, oil and water testing laboratory, and for the local distribution staff.

The New Engine Room.

The new engine room behind the old building contains two 3 750 kW B.T.-H. turbo-alternators, the e.h.t. and l.t. switchgear and control room, and two B.T.-H. rotary convertors, each of 400 kW rating, for supplying the works power and a portion of the Newton Abbot town d.c. network.

The first section of the new boiler house parallel to the engine room contains four Stirling boilers with Green's economisers, induced draught plant, coal bunkers, elevator, etc.

The working steam pressure for this first section of the new station was fixed at 150 lb. per sq. in., with a superheat of 150° F., in order to obtain the benefit of the considerable saving in capital charges effected by the use of the old Torquay generating plant and the existing Newton Abbot boilers.

The latest extensions of both boiler house and engine room are laid out at right angles to the original engine room, and the steam conditions have been raised to 250 lb. and 650°

The h.p. and l.p. steam ranges are coupled by means of a Crosby reducing valve. The 3 750 kW turbo-alternators were originally designed for the higher working steam temperature, and the two smaller machines, transferred from Beacon Quay, are supplied through a British Arca desuperheating plant, which reduces the steam temperature to 500° F.

The latest generating unit is of 7 500 kW capacity, and, as in the case of the 3 750 kW machines, generates direct at the transmission pressure of 11 000 V at 50 periods. The pressure of the two smaller machines is stepped up from 2 200 V to the transmission pressure.

Circulating water is drawn from and returned to the River Teign by vertical spindle pumps situated in two pump houses on the river bank. Coal, which is obtained chiefly from the Forest of Dean, is delivered in trucks to the new railway siding, from which it is transferred to stock, or alternatively to the overhead bunkers in the boiler house by means of the recently installed mechanical coal handling plant.

Water Treatment Avoided.

The boiler make-up water, which is obtained from the Torquay Corporation Water Department, contains no scale-forming or corrosive constituents, and is, therefore, used direct without any treatment other than the preliminary "boiling" which it receives in the exhaust steam-heated feed tanks.

The whole of the boiler house plant was supplied by the Stirling Boiler Co., Ltd., and comprises six Stirling boilers of the five-drum type. The latest additions to the plant consist of two boilers each of 7 437 sq. ft. heating surface, evaporating upwards of 40 000 lb. of water from feed water entering the economisers at 100° F. to steam at 265 lb. per sq. in. superheated to a final temperature of 650° F.

Each boiler is fitted with a pair of Babcock and Wilcox chain grate stokers of 16 ft. long by 6 ft. wide, fitted with special narrow lap links for burning small coal and coke dust, of which latter fuel a considerable quantity is used. The superheaters are of the standard Stirling design.

The furnace arches are of the flat suspended "Liptak" type and each boiler is provided throughout with steam jet soot blowers of the Diamond power pattern for the purpose of keeping the heating surfaces free from external deposit.

A Green economiser is fitted immediately behind and adjoining each boiler. Mechanically-operated tube scrapers are fitted to each group, the soot falling down into hoppers in the basement below. Each boiler is fitted with a Sirocco induced draught fan mounted upon a platform situated above and behind the economiser.

The gases discharged from the fan are passed through a Sirocco grit arrestor, and thence into a short steel stack 60 ft. high above the firing floor level, and 4 ft. 9 in. internal diameter.

The steel framed coal bunkers arranged above and between the two boilers are designed to contain 50 tons of coal when full, and are divided into two compartments with a view to keeping coke dust separate from coal.

Each class of fuel is delivered through a separate travelling cylindrical chute into the boiler hoppers, which are divided to enable the fuel to be fired on the "sandwich" system.

Soot, ashes, riddlings and grit are delivered into their respective hoppers below the firing floor, and are removed from the basement in steel wagons.

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A special instrument panel equipped with a Bailey boiler meter, distance thermometers and draught gauges is provided in connection with each boiler, and each boiler is provided with an automatic feed water regulator of the Crosby pattern.

The feed pumphouse, which is situated in a bay between the boiler house and the latest engine room extension, contains two sets of feed pumps and feed tanks for serving respectively the high and low pressure boilers. The feed tanks are arranged above the pumps to give a head of 15 ft. upon the suction side. The tanks are in two groups, each of two compartments, and are heated by exhaust steam from the turbine driven feed pumps.

The two turbine pumps which serve the high pressure boilers are of J. P. Hall and Co.'s manufacture, and each designed to deliver upwards of 120 000 lb. of hot water per hour. The two low pressure turbine pumps are of J. and G. Weir and Co.'s manufacture, and each designed to deliver upwards of 100 000 lb. of hot water per hour. A three-phase motor driven pump by Mather and Platt, designed to deliver up to 80 000 lb. per hour is so arranged as to be interchangeable between the high and low pressure feed ranges.

The New Turbo-Alternator.

The new turbo-alternator, which was manufactured by the British Thomson-Houston Co. has a maximum continuous rating of 7 500 kW at 90% power factor. The machine runs at 3 000 r.p.m., and delivers three-phase electrical energy at 11 000 V 50 cycles.

For the purpose of withstanding accidental short circuit, the alternator has been designed to have an inherent protective reactance of 15%. The inherent regulation of the machine at 90% power factor is 35%, and at unit power factor 24%. The voltage of the alternator is maintained constant within 1·0% variation by means of an automatic voltage regulator of the Tirrill type.

The turbine is of the B.T.-H. Co.'s super-efficiency Curtis impulse type. The alternator is of the closed circuit air-cooled type, in which the ventilating air is circulated by means of fans on the electrical rotor, and cooled by passing over a cooler of the surface type supplied with cold water from the condenser circulating system.

The exciter, which is of the shunt connected commutating pole type, is directly coupled to the end of the alternator shaft by a flexible disc coupling.

The two 3 750 kW turbo-alternators which were installed respectively in 1924 and 1926, as well as the two earlier 1 250 kW machines, are also of the B.T.-H. Co.'s manufacture.

The condensing plant in connection with the new 7 500 kW machine is of the horizontal surface type, and was manufactured by Hick, Hargreaves and Co., Ltd., as sub-contractors to the B.T.-H. Co. The air extraction is performed by the Hick-Breguet ejectair, which is fitted with a special stabilising valve which automatically prevents the ejectors from becoming unstable at light loads. Extraction pumps are in duplicate and of the centrifugal type. They are direct coupled to direct current electric motors.

The condensing plant in connection with the 3 750 kW machines was manufactured by Cole, Marchent and Morley, Ltd., Bradford, as sub-contractors to the B.T.-H. Co. The air ejectors are of the Delas jet type, and extraction pumps are also provided in duplicate. The condensers of the two smallest machines are by the Mirrlees Watson Co., and the air ejectors are of the Delas jet type.

Circulating water is drawn from and returned to the River Teign. The design of the circulating system presented considerable difficulty, on account of the great seasonal variation of the depth of water in the river (amounting, according to flood, drought and tide, to as much as 17 ft.), and also to the intervention of the confluent river Lemon between the main river and the power station.

Two pumphouses situated on the river bank deliver circulating water to the condensers. No. 1 pumphouse, put into commission in July, 1924, contains three vertical spindle pumps by Mather and Platt. These pumps are so installed as to be 3 ft. below the deepest part of the river bed, so ensuring a pressure head upon them at all states of flood and tide. Each pump is designed to deliver upwards of 150 000 gallons per hour against a head of 30 ft., and is driven by a 40 H.P. variable speed d.c. motor, mounted on the motor floor, which is situated approximately 22 ft. above the basement floor.

The circulating water system operates as a closed syphon, and the motors are automatically controlled from the switch board in the station control room.

The river water is passed through rotating band screens of Brackett and Co.'s manufacture at the intake, for removing floating debris and preventing the passage of salmon fry through the pumps.

The flow and return pipes between No. 1 pumphouse, the power station and the river are of cast iron, 22 in. bore, embedded throughout their length in concrete. Barge traffic in the Lemon necessitated the sinking of these pipes below the bed of that river, and considerable engineering difficulty was encountered in the course of carrying out that portion of the work.

After passing through the condensers the circulating water is returned into the river Lemon, whence it flows back into the Teign. Special powers to do this were obtained by the Torquay Corporation Act (1027), and by virtue of that Act also the delivery pipe crosses the Lemon overhead on a lattice steel bridge, instead of underground as in the case of the pipeline from pumphouse No. 1.

The railway siding and coal handling and conveying plant also form part of the recently completed extensions. A railway siding branching from the Great Western Railway Co.'s Moretonhampstead branch line has been constructed upon a piece of land between the rivers Lemon and Whitelake, which was acquired for that purpose. The siding consists of a single track line, carried upon a reinforced concrete gantry construction. Coal wagons are delivered to the entrance to the siding by the railway company's locomotives, and thence hauled over a 30-ton weighbridge by an electrically-driven capstan.

After weighing, the loaded trucks are passed over a rotary tipper, which discharges the coal into a reinforced concrete hopper below the siding. The empty trucks are then passed on to the other end of the siding.

The coal is then hoisted by a continuous conveyor of the "drag link" type to the top of the reinforced concrete storage silo which has been constructed on the power station side of the river Lemon.

The silo, which provides the working storage of the station, has a full capacity of 1 000 tons. The conveyor passes over the top of the silo, and is so arranged as either to drop the coal into storage or to carry it on to a second "drag link" conveyor, which conveys it directly to the service bunkers in the boiler house. A third conveyor of the bucket type is arranged to receive coal discharged from the bottom of the silo and hoist it to No. 2 conveyor, which delivers it to the boiler house. The whole of the coal handling plant was supplied by E. Bennis and Co.

Switchgear.

The e.h.t. switchgear is of the cellular type designed and manufactured by the B.T.-H. Co., and is mounted in moulded stone cubicles erected on the engine room basement floor, with sheet steel hinged doors giving access at both front and back. Duplicate busbars mounted on compression type insulators are provided, and the oil circuit breakers, which are fitted with welded boiler plate tanks for each phase, are electrically operated from a vertical type control board installed on the control room gallery above. Each circuit equipment is provided with the usual isolating devices, instrument transformers, and instruments. The generator equipments include circulating current protective gear together with definite time limit overload relays, also automatic field suppression switches.

The two main outgoing feeders, to Torquay, are fitted with the latest form of B.T.-H. balanced current parallel feeder protective gear with definite time limit overload relays.

The neutral of the system is earthed through limiting resistances of the cast grid type mounted on suitable porcelain insulators and enclosed in expanded metal housings. These resistances can be isolated by means of oil circuit breakers which are electrically operated from the main control board.

The d.c. switchboard is of the B.T.-H. vertical flat back type, and is installed on the same gallery as the e.h.t. control board. It is arranged to control the d.c. side of the rotary converters, the 250 kW generator, the Newton Abbot town supply, and the various auxiliary circuits of the power station.

An illuminated diagram board at one end of the control room shows diagramatically the e.h.t. system supplied from the power station, and the switching at all sub-stations served by the system.

The whole of the scheme was initiated by and carried out in accordance with plans and specifications prepared by Mr. H. F. G. Woods, the borough electrical engineer.

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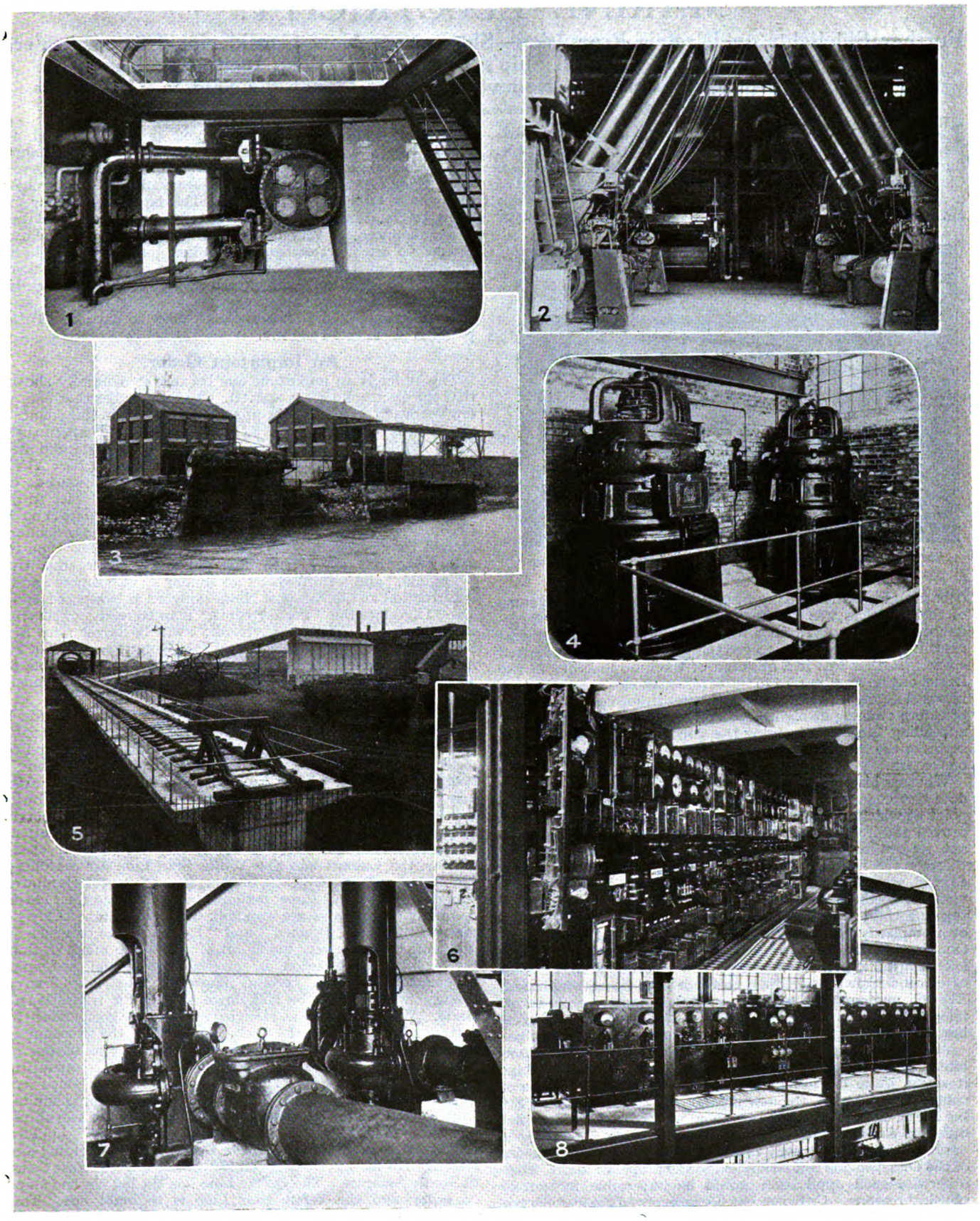

TORQUAY POWER STATION EXTENSIONS.

THE accompanying views of the Newton Abbot power station extensions, officially opened on Wednesday, show :—(1) *Basement of the engine room and surface condensing plant for the new turbo-alternator ;* (2) *Stokers and chutes for the new boilers ;* (3) *The riverside pumphouses, showing mechanical band screens and dredging plant ;* (4) *New circulating water pump motors inside No. 2 pumphouse ;* (5) *General view of siding and coal-handling plant ;* (6) *The e.h.t. control room ;* (7) *Vertical spindle c.w. pumps in the new pumphouse basement ;* (8) *E.H.T. compound-filled switchgear at the Upton Valley sub-station. Transformers and rotary convertors are installed on the floor below.*

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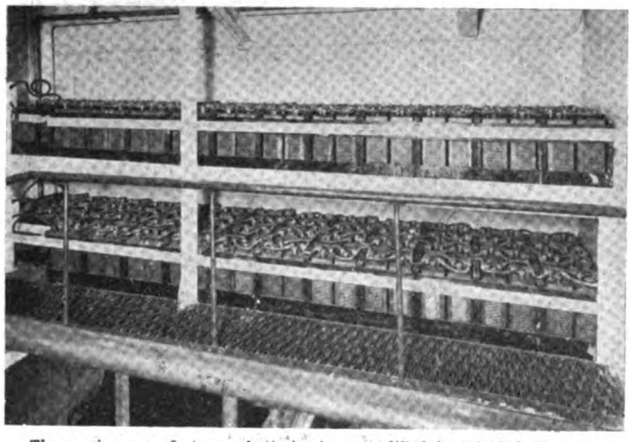
MARINE ELECTRICITY.

Further Sidelights on Electric Propulsion—Shipowners Now Considering Electric Liners for Important Routes—A Small Ship's Power Plant—The Increasing Use of Storage Batteries to Relieve the Main Generator Sets.

By A. C. HARDY, B.Sc., A.M.I.M.E. (Author of "Motor Shipping," "Merchant Ship Types," etc.).

IN shipping circles, electricity for propulsion is being discussed for an increasing range of ship types. Last week, during a demonstration run of the new, and first, cross-Channel motorship "Ulster Monarch," an important official of a railway company operating fast small cross-Channel ships out of the Channel ports suggested that the principal factor



The marine use of storage batteries is exemplified in this 900 Ah group installed on a large yacht.

debarring his own company from using Diesel motors on some of their services was not any lack of realisation of their undoubted economy. Neither was it, he suggested, for physical reasons—of being unable to get the power within the allotted space. Rather was it a question of the improbability of the Diesel engine standing up to the severe manœuvring conditions imposed on it. These conditions comprise a certain amount of astern running at high speed and a great deal of "backing and filling" in order to bring the ship alongside a quay at all states of the tide with a ship ahead of her tied up, and another one astern.

Whether his opinion on the Diesel engine was a correct one does not concern us here. It does serve as a very definite point at which to say that if the economy of the Diesel is well proved and if the right type of Diesel engine is available, could not its sterling qualities be transmitted to the propellers through the medium of electric motors? With pilot house control, maximum manœuvrability is assured because the ship virtually becomes a tramcar of the sea, in the same way that a tug or a train ferry does. It may, perhaps, seem rather like over-emphasis that this point should be continually stressed. One does so, however, in order to emphasise the point that if excessive manœuvring is required, then it is through the medium of electric transmission that this can best be accomplished. Electric manœuvring at least ensures a positive reply to all telegraph signals from the bridge, which no direct drive, however skilful the engineer on watch, can ever hope to give.

As there is only as yet a dawning recognition of the possibilities of electric propelling machinery for certain types of ships it seems quite desirable to emphasise this point. If, as is commonly supposed, the new mammoth White Star liner is to be Diesel-electrically powered, then you have an altogether different aspect to the question. In this case, electricity is very definitely being used as a means whereby the economy of the Diesel engine can be applied to the propeller shafts, when otherwise such application would be impossible for purely physical reasons. Criticism has been advanced against electric propulsion on account of the transmission losses incurred, but this, one submits, is not the correct way of looking at the matter. You cannot make an omelette without breaking eggs. In fact, if you want the omelette you've got to break eggs. And the omelette, in certain cases, is well worth eating.

Thirteen Big Electric Passenger Liners.

Whether it is worth eating, in the case of ships engaged in round-the-world service, or in long ocean hauls generally is a point worth consideration. This should not, however, prevent a feeling of gratification at the fact that one large shipowner with world-wide interests should have decided to build no fewer than six large electrically-propelled passenger liners. When these ships are complete, not allowing for others ordered after, there will be a total of 13 big electric first-class passenger liners built, building, or in service. This latest order is for six ships for the American Dollar Line. The new vessels will be, it is announced, of very up-to-date type and will cost about £1 400 000 each. Detailed particulars have not yet been published, but it has been announced that they will be about 650 ft. in length and will have a speed of about 20 knots. Passenger quarters for about 350 people will be provided, and it is even suggested that aeroplanes may be carried. Total power is given as 26 500 H.P.

An Important Order.

This order is an important one because it definitely shows that the electric liner has arrived. And remember that only a few years ago an electrically-propelled ship was, in this country at any rate, regarded somewhat in the nature of an experiment. The "California," completed last year for the International Mercantile Marine Corporation for service between New York and San Francisco via Panama marked the commencement of an awakening interest in this type of propulsion. Her trials were attended by a number of important marine men from both sides of the Atlantic, and her subsequent performance demonstrated the successful economy of operation of this type of ship. She has since been followed by a sister ship, the "Virginia," and a third vessel for similar service is now under construction at the Newport News shipyard at Newport News, Va. This ship, the "Pennsylvania," is to be ready for service in December. The "Pennsylvania" will be larger than her two sisters, and the importance of this 3-unit fleet lies not so much in its present duties, but in the fact that it is capable of operating on almost any first class passenger-cargo routes throughout the world.

On this side of the Atlantic our own "Viceroy of India" has started an interest in electric propulsion for large passenger liners which may very soon result in the placing of further orders, and there are strong rumours that an electric liner is being designed for one of the big shipping companies. We know definitely that when the new White Star liner is built she will be an electric ship and, at that, the largest electric ship in the world—unless the Cunard Line goes one better. At present it would seem, however, that like skilful chess players, the Cunard and the White Star Line are watching each other's moves, and each, further, is watching the Hamburg American Line. All three, perhaps, before putting their cards definitely on the table are watching the Norddeutcher Lloyd's new mammoths, "Bremen" and "Europa," one of which is now unfortunately very much out of action—so much so that her eventual completion is, according to some accounts, problematical. It is certain, however, that new luxury tonnage will have to be laid down shortly for transatlantic trade. When this is done, electricity has a very good chance of getting a large share of the work. Meanwhile, the situation as regards the 15 000-30 000 H.P. electric liner is by no means an unsatisfactory one. The "Viceroy of India" is operating successfully in service. Three "California"-type ships are built or on order, and the addition of a further three similar ships is contemplated. The Ward Line is building two ships, discussed in my article on "Marine Electricity" in THE ELECTRICIAN of March 1st. The Grace Line is building one electric liner for service between New York and the West Coast of South America. The Dollar Line has six big electric ships on order, and the White Star Line is to build one. This actually means a total of 17 "possible" electric liners, all of large type, which may be in service within the next four or five years.

So much for the big ships. We may return now to deal in somewhat more detail with one of the most electrical of small ships at present afloat. She is noteworthy in that her electrical generator sets, or power station, is sufficiently large to require a separate compartment forward of the main engine room. This power station contains three Diesel-driven generators, each of 110 kW, two of which are running when the ship is at sea. These generators are required to drive the

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whole of the auxiliary machinery in the main engine room, comprising cooling water pumps, fuel and lubricating oil pumps, fuel and lubricating oil centrifugal separators, bilge and ballast pumps and two large manœuvring air compressors, each driven by a 95 H.P. motor and arranged in the wings of the power station, where also is located the main switchboard.

Then, as far as deck gear is concerned, cargo winches, windlass, capstans, and steering gear are all electrically driven, the capstans and the windlass being controlled by motors of approximately 100 H.P. each, operated on the Ward-Leonard system. In addition, the steering gear is of electric-hydraulic type with two motors, one running and one standby. The water-tight doors are electrically operated. The engine room telegraphs are of Siemens electric type and so are the pyrometers for reading the temperature of the exhaust gases from the main engine manifolds. On the bridge there is an electrically operated cabinet for fire detection purposes, electrically operated clear-view screens which fling off rain and spray drops centrifugally, and electrically operated helm and revolution indicators. In addition, of course, there is a complete ship's telephone system.

The operating side of the ship, it will thus be seen, is almost amazingly electric for a small ship 345 ft. by 46 ft. by 19 ft. moulded. And one cannot help contrasting the difference between this ship and a corresponding steamer of, say, ten years ago, when the principal use on board ship for electricity was for lighting purposes only. The " Ulster Monarch," which is the ship we are considering at present, has an unusually elaborate electric lighting system for a cross-Channel vessel. In particular this applies to the cabins, where special lighting is arranged over the bunks. The lighting arrangement generally is in line with modern practice and is a great improvement on anything that has gone before. Lighting is even extended in a rather novel manner to the bell system for the cabins—an idea which may or may not be an advantage. When the passenger rings the bell the system is so arranged that luminous indicators direct the steward right to the door of the cabin. These lights can only be extinguished by the steward giving attention to that cabin, and a tell-tale indicator shows the chief steward if proper attention is being given in each section. The idea of this is to eliminate any disturbance to passengers through continuous ringing of bells.

Electricity is used extensively for cooking—also an unusual feature on cross-Channel ships—and is applied to the ranges, toasters, hot plates, and hot cupboards. In addition, there are electric hot water boilers in the deck pantries, and the hot running water in the passenger cabins is electrically heated. Electric heaters are fitted throughout the quarters, and the ventilation depends upon the circulation of air, whose temperature can be controlled, through special ducts, by electric fans. An emergency supply of electricity is provided by a 7½ kW generating set on deck.

Shaft-driven Generators and Storage Batteries.

These few items give, perhaps, a definite idea of the call of the shipbuilding industry upon the electrical industry in the building of a modern ship. Fundamentally it depends upon the fact that with Diesel generators shipboard electricity can be generated cheaply and used flexibly. Purposes such as those listed above would have been considered quite outside the scope of electricity in the ship of, say, ten years ago—largely because of the difficulty of generating the current to supply them. It is only actually within the last few years that electricity for cooking has been regarded at all favourably in marine circles. Remember that developments in shipboard electrical technique, while in general they parallel the land developments, are always circumscribed by the fact that a ship is a floating isolated body. In other words, nearly all the conditions are different from land conditions.

The " Ulster Monarch " has, in her upper casings, a storage battery set for use in connection with the electric-hydraulic steering gear, in the event of a complete shut down of the main generator sets in the power station below. The use of storage batteries on board ships seems to be developing into a definite technique which is probably capable of considerable development. One has noticed it applied to several recent modern motor yachts ; in this case, in conjunction with a shaft driven generator set. The use of shaft generated power is a point which often seems to escape the notice of shipping men, and yet after all it is merely a question of railway train lighting all over again, with the difference that whereas the train runs at the longest only seven or eight hours without a stop, the ship may run as long as seven or eight days without stopping. Storage batteries, moreover, take up very little space, and may be conveniently stowed away in an odd corner of the engine room.

An interesting case in point which shows the use to which storage batteries may be put on board ship, may be cited by quoting the work performed by a storage battery set on a ship designed for carrying steel plates. For cargo handling the ship has two 5-ton electric cranes, each driven by a 65 H.P. motor. The ship has a deadweight capacity of 2 078 tons and has 750 H.P. for main propulsion. Electric power for the ship is supplied by three 60 kW 240 V compound wound generators. Before the storage battery was fitted, the two generator sets had to be paralleled when the two cranes were in operation, and when the cranes started to lift the load ran up from 50 to 500 A. This caused the generator engines to smoke and knock (they were of Diesel type) ; they slowed down and the governors flew open. Two banks of Exide Ironclad batteries were fitted, and under this new system one generator set can be cut out entirely during crane operation, the other being quite sufficient, with the batteries floating on the main bus. Furthermore, when the ship is in port the generators can be released for overhaul, or the whole of the heating, lighting, and cooking can be run off the batteries. During peak loads on the cranes the batteries feed into the line, preventing overloading of the generator. When the hoist is finished, the procedure is reversed, and the generator charges the batteries. The generator engine operates at constant speed without overload, and there is no smoking or knocking.

With the exception of the example quoted above and of an increasing number of yachts, " battery " electricity is only making slow progress for active work on shipboard on cargo vessels. Its use for standby purposes on ships like the " Ulster Monarch " however, does definitely indicate an awakening interest in a form of power generation which is as cheap as it is reliable and flexible.

STATION AUXILIARIES.

The Determination of the Most Suitable Type of Drive.

By F. GEOFFREY MARSHALL.

IN the modern power station the reliability of the auxiliaries is as important as that of the turbo-alternator itself. It is therefore essential to take precautions to eliminate all possibility of a breakdown.

To attain this state of reliability, we, of course, only use machines of recognised and tested dependability ; we place them in accessible places to facilitate easy removal for exchange ; we keep duplicate parts handy ; and we aim for interchangeability of parts as much as is possible.

On the above points all agree. But on the question of types of drive we are all at " loggerheads."

For boiler feed pumps it is often customary to use high-speed turbines, but it is with the type of electrical drive that we are chiefly concerned, for this type of drive is generally used for circulating pumps, mechanical stokers and other main auxiliaries.

The question now arises : Should we use d.c. or a.c. for our power ? It is astonishing the amount of controversy that this question has entailed among station engineers.

Consider the various functions separately. Let us first consider the question of starting. For the d.c. motor we use the usual form of rheostatic startor. Small induction motors on a.c. work, as used for driving chain grate stokers, can be started up with a simple knife switch, but with large motors, such as those necessary to operate circulating pumps, this method cannot be used.

Here, then, is a disadvantage in using a.c. motors, as we need a special type of star-delta startor, or pole-changing device, to bring the induction motor up to speed. These types of startors are not so efficient as the rheostatic d.c. startors. The former only have two sets of speeds (i.e., in the case of the pole changing startors we have the two speeds corresponding to the two sets of poles, and in the other we simply have the star and delta speeds), while the latter have as many speeds as there are notches on the startor. Consequently the wear on the d.c. type which gradually brings the motor up to speed is considerably less than that of the a.c. startor.

As regards the question of motor performance, we can say that both types have been tried many times and have proved themselves to be perfectly satisfactory in this respect. In some cases the absence of commutator in the case of the a.c.

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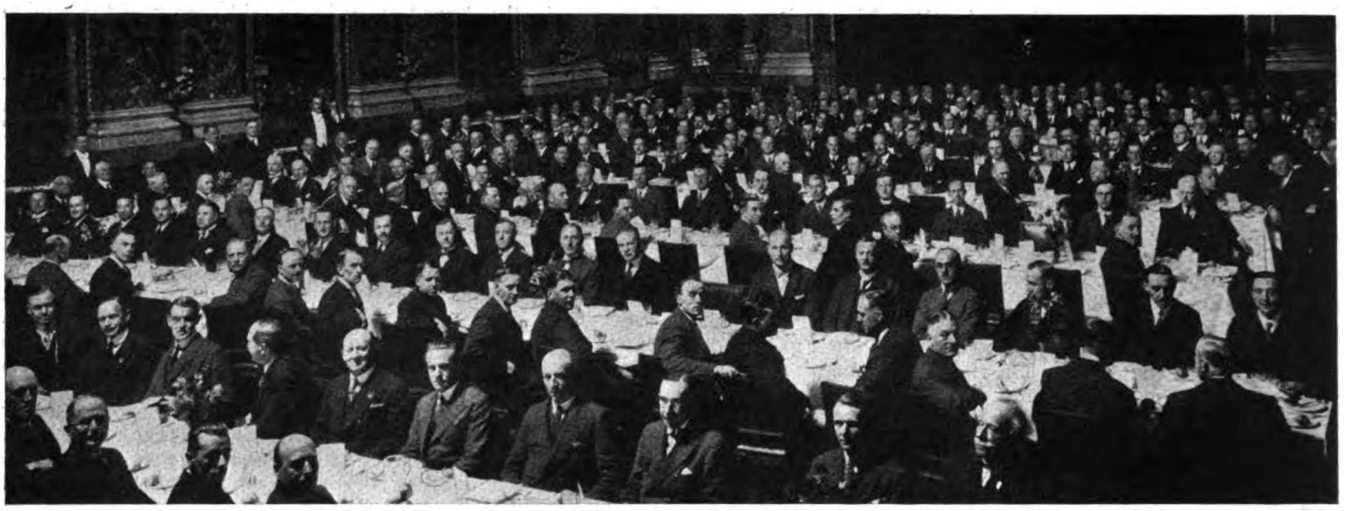

There was a record assembly of some 330 members of the Batti-Wallahs' Society and their friends at the Society's luncheon on April 25th, when Sir Hugo Hirst was the guest of honour.

induction motor has been sufficient to turn the scale in favour of this type. Twenty years ago this would have counted as an important point, but to-day commutators have been improved to such an extent that the point is hardly worthy of consideration.

Then we have the question of convenience of supply. In the modern power house it is, of course, comparatively easy to obtain either type. An a.c. supply is easily obtainable by using an additional transformer, or else separate tappings from another transformer, where a step-down type is used, whilst a d.c. supply needs a rotary convertor in addition to the above.

But against this we have the important question of a battery supply, and this is another big advantage that d.c. holds. If we are installing a battery set we need a d.c. system to keep it charged, and consequently the rotary convertor is already necessary. Moreover, in the case of a shut-down we have an immediate supply for the auxiliaries from the battery.

Sometimes it is customary to instal a small d.c. turbine specially for the purpose of feeding the auxiliaries. Here the direct current can feed through the batteries, and a convenient type of floating booster can be economically installed.

Power stations fitted with a.c. auxiliaries and using a battery, sometimes make the battery feed back through the rotary convertor to give an a.c. supply on to the busbars and hence provide an initial a.c. current in the case of a break-down, but this adds greatly to the complication of a system where a d.c. system of auxiliaries is just as economical.

Consequently the station engineer of to-day is realising that for auxiliaries the d.c. is to be preferred to the a.c. system.

AUSTRALIAN TRADE.

Sir Hugo Hirst's Impressions of Conditions and Prospects.

THERE was a record attendance of members of the Batti-Wallahs' Society and their friends at the luncheon, held at the Hotel Cecil, London, on April 25th, in celebration of the recent return from his mission to Australia of Sir Hugo Hirst. Mr. H. L. Howard, the president of the Society, was in the chair, and among those present were Sir John Snell, Sir John Brooke, Col. R. E. Crompton, Lt.-Col. K. Edgcumbe, Sir Harry Howard, Mr. W. W. Lackie, Mr. J. S. Highfield, Sir T. F. Purves, and Dr. S. L. Pearce.

Sir HUGO HIRST gave a most interesting account of his experiences in Australia as a member of the Government mission, and of the impressions which he had formed as the result of that visit. He had been greatly impressed by the difference between our view of conditions in Australia and those which actually existed. It was imperative that we should study those differences, and endeavour to supply the Australian market with what it wants rather than with what we have to spare.

Although Australia only had about 6 500 000 inhabitants, the purchasing power of that population was equal to that of approximately 16 000 000 in this country. Furthermore, some two-thirds of that population lived in four or five towns.

There was room in Australia for certain manufacturing activities and the question was being investigated from the point of view of what Australia was best fitted to produce. For the requirements which they did not themselves produce, the Australians would prefer to look to England in preference to any other source.

We did not always appreciate as we should that Australia was British and intended to remain British, and instead of regarding it as a foreign country we should look at it in much the same way as one of our own counties. Wherever he went in Australia he found an astonishing lack of knowledge of the achievements of the Mother Country, particularly of the progress made by our electrical manufacturing firms. The possibilities for reciprocity between England and Australia were immense, but they could only be based upon sound knowledge of Australian requirements. Australia wanted to take a more intimate part in developing the prestige of the British Empire.

Mr. HENRY S. HORNE, in proposing a vote of thanks to Sir Hugo, said there was nothing so vital to improved relations as closer contact between Australia and this country. In fact, the whole of the British Empire countries still held immense possibilities. He thought that while all present would appreciate the extent to which the electrical industry was indebted to Sir Hugo Hirst, the country's debt was almost immeasurable.

PHOTOMETRIC INTEGRATORS.

Issue of British Standard Specification.

THE British Engineering Standards Association has issued a British Standard Specification for Photometric Integrators. The specification deals with photometric integrators of either spherical or cubical shape. The integrator may be used for the measurement of the light output of tungsten filament electric lamps or for ascertaining the efficiency of translucent or dispersive reflector fittings, particulars for these fittings being dealt with in the B.S. Specification No. 324 and 232 respectively. The necessary constructional details are given for integrators of 24 in. and upwards in size and the requirements for the interior coating are defined.

Copies of this Specification (No. 354, 1929) may be obtained from the British Engineering Standards Association, Publications Department, 28, Victoria Street, S.W.1, price 2s. 2d., post free.

WIRELESS PICTURES.

It is not perhaps generally known that the Vienna transmissions of still pictures by the Fultograph method on 520 metres are often relayed by Linz on 350 metres. When Vienna is jammed this station is frequently to be found coming through well. In addition to the Koenigswusterhausen transmissions of still pictures, Berlin (Witzleben) has lately been conducting a transmission at eight o'clock on several evenings during the week, and sometimes this is relayed by other German stations.

Mr. J. A. Breen, an engineer on the staff of Wireless Pictures, Ltd., is conveying the first wireless picture transmitting and receiving apparatus to Australia. On his way he will stay for a week at Colombo, where the apparatus will be demonstrated to the Ceylon Government. At Sydney he will meet the Australian agent of the company, Mr. W. Blogg, who is well known in this country as the late managing director of Amplion (Australasia), Ltd. It is anticipated that Sydney (2FC) and Melbourne (3LO) will shortly arrange transmissions.

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CORRESPONDENCE.

The Editor welcomes the free expression in these columns of genuine opinion on matters of public interest, although he disclaims responsibility alike for the opinions themselves and the manner of their expression.

"The Incandescent Lamp Jubilee."

[To the Editor.]

Sir,—As one who likes to see credit given where credit is due, I was very glad to read the "Current Topic" in your April 26th issue drawing attention to the American scheme for celebrating—as American—the jubilee of an invention which is not American, but British.

The late Sir Joseph Swan's claim to have produced the first practical incandescent electric lamp is unassailable, and as the facts are now recorded in the proceedings of the I.E.E., it is surprising that the N.E.L.A. of America should be ignorant of the true facts. The forthcoming celebration will, in America, if allowed to proceed as planned, do great harm to the reputation of a British electrical pioneer, but a modification of the scheme, giving rightful credit to Swan, need not abate American pride in the many other remarkable achievements of Mr. Edison. Unless some definite step is taken to establish Swan's claim the world will naturally believe that the incandescent electric lamp was an American invention.—I am, etc.,

Birmingham. J. Perrott.
April 27th.

[To the Editor.]

Sir,—As Sir Joseph Swan's invention of the incandescent electric lamp was virtually the foundation of the modern electrical industry, and as this distinguished man of science was a president of the Institution of Electrical Engineers, it seems to be nothing less than the duty of the Institution to send to the National Electric Light Association of America a formal protest against their proposal, to which you refer in a leading article, to honour Mr. Edison for a British discovery which definitely preceded the Edison lamp.—I am, etc.,

London, S.W.1. "Veritas."
April 29th.

Ex-Siemens' Men.

[To the Editor.]

Sir,—At an enthusiastic meeting held at the Hotel Cecil on April 27th, it was decided to form The Association of Ex-Siemens' Men. At this meeting a portion of the committee and the officers were elected. The qualification for membership is that applicants should be ex-members of the Siemens' organisations, and should have served at least one year on the staff of such organisations.

Although it is somewhat late in the season to hold a re-union, it is hoped that there will be a good muster at the dinner to be held at the Hotel Cecil on Wednesday, May 29th next.

The undersigned has been appointed hon. secretary and treasurer and will be pleased to forward full particulars of the Association and also of the dinner re-union to any intending members.—I am, etc.,

Dagenham Dock, Essex. J. Snow Huddleston.
April 30th.

A Fuel Policy.

[To The Editor.]

Sir,—May I be permitted to express the hope that a comprehensive and practical programme of fuel reform will be one of the chief aims of our next Government?

Statesmen, scientists and economists are agreed that coal must for many generations continue to be the foundation of British industry; but no one seems yet to have evolved a really comprehensive policy for the scientific utilisation of coal and the co-ordination of the various new fuel industries to which it would give rise.

I venture to suggest that a properly co-ordinated plan of financial encouragement of fuel reform, in the shape of an oil subsidy or guaranteed loans for carbonisation plants would ensure the simultaneous development of (*a*) a great smokeless fuel industry; (*b*) a British coal petrol industry; and (*c*) the use of oil-electric transport by road and rail, and of British-made bunker oils in ships.—I am, etc.,

W. A. Bristow.

London, S.W.1.
April 22nd.

The Battersea Problem.

[To the Editor.]

Sir,—Mr. Brownlie states in his letter published in your April 26th issue, that "no one in the world has yet attempted to tackle the question of the elimination of sulphur in flue gases."

We would like to point out that Messrs. Siemens-Schuckert have installed, on the Continent, a large number of electric filter plants which successfully deal with the filtration of flue gases from large boiler plants, and with the precipitation of dust from gases emitted during various industrial processes.—We are, etc.,

Siemens-Schuckert (Great Britain), Ltd.

London, E.C.4.
April 30th.

FURTHER EXAMPLES OF SHODDY WIRING.

THE many examples of shoddy wiring which we have published of late should serve as a warning to supply engineers of the class of wiring work, done by unqualified contractors, which is still being found connected to the mains. The photograph, reproduced above by the courtesy of Mr. H. Moss, shows a bundle of wires where the metal sheathing had been ripped open and all kinds of connections made, one layer of black tape being then put on the wires. No bonding of any kind was carried out, no junction boxes were used, the wires were terribly overloaded, and a horrible mess resulted.

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NEWS IN BRIEF.

Canadian Import Duties—Retford School Lighting—Appointments Vacant—Societies' Meetings—Guildford Electrical Exhibition.

THE lighting of Marazion Church by electricity is under consideration.

Exeter has installed a new system of automatic signals for the control of street traffic.

Manchester's electric automatic signal devices and one-way traffic system were recently inspected by the Royal Commission on Transport.

Leicester Electricity Committee is to purchase land and premises for office accommodation for the electricity department.

At a meeting of the Physical Society on May 10th, at the Imperial College of Science, London, Dr. W. E. Sumpner will give a paper entitled "Heaviside's Fractional Differentiator."

Engineers of the Ontario Hydro-Electric Power Commission anticipate that within seven years all rural homes in old Ontario which can be economically served will have an electricity supply.

The Scottish Education Department has issued a circular containing the arrangements and conditions for the award of the national certificates and diplomas of the I.E.E. in conjunction with the department.

The recent decision of the Canadian Government that goods, in order to qualify for the British preferential tariff, should represent British labour and materials to the extent of 50%, is not at the moment being rigidly enforced, pending the settlement of details with the British Government, with regard to raw materials which are unobtainable in large quantities in the United Kingdom.

Hammersmith (London) B.C. requires a borough electrical engineer and manager.

An electrical exhibition is being held at the Village Hall, Guildford, during this week.

The Lord Mayor of Leeds is to be invited to lay a foundation stone in connection with the erection of the Kirkstall generating station.

St. Helens Corporation invites applications for the position of engineer and manager of the electricity undertaking.

Ilford Electricity Committee seeks sanction for a further loan of £5 000 for apparatus to be let out on hire to consumers.

It is claimed that Ontario has a greater density of h.t. power lines than any other country or state in the world.

Sheffield Electricity Department has been authorised to purchase, in consultation with the chairman of the Committee, 100 tons of electrolytic copper wire bars to be used in the manufacture of cables.

Poplar (London) Baths Committee proposes to make experiments in heating the baths establishments electrically, and to discard the transfer of steam, provided the change would not involve increased cost.

At a meeting of the Leeds and West Riding Branch of the Electrical Association for Women on April 24th, Mr. Harry Moss delivered a lecture entitled "Electrical Appliances in the Home." At a recent meeting of the Mid-Gloucestershire Branch, Mr. G. S. Francis delivered a lantern lecture dealing with electric lighting in modern, civic and commercial buildings.

LOOKING BACKWARD.

FIFTY years ago THE ELECTRICIAN *of May 3rd, 1879, recorded that:—*

Edison's loud-speaking telephone was demonstrated at the Royal Institution.

Mr. W. H. Preece recalled that the early telegraph lines were insulated with pitch and goose quills.

The "Patrick Stuart," a new cable repairing ship for the Persian Gulf cable, was inspected in London.

French 'bus horses were broken in by passing a weak electric current through the animals' mouths whenever they showed restiveness.

* * *

TWENTY-FIVE years ago, according to THE ELECTRICIAN *of May 6th, 1904:—*

It was stated that capital costs at many power stations were as high as £40, or even more, per kilowatt.

An employee of the Bristol Tramways Co. was summoned for furiously driving an electric trolley repairing wagon.

The County of London Electric Supply Co. abandoned its old title of County of London and Brush Provincial Electric Lighting Co.

* * *

TEN years ago it was reported in THE ELECTRICIAN, *dated May 2nd, 1919, that:—*

The American cables, taken over as a war measure, were handed back to the owners.

Mr. (now Sir) Arnold Gridley resigned his position as director of Electric Power Supply.

Mr. A. D. Hunter, secretary of Siemens Bros. Dynamo Works, Ltd., died after a short illness.

Notts Education Committee has decided to adopt electric light at King Edward VI Grammar School, Retford, at an estimated cost of £250.

Plymouth Hoe and Parks Committee has approved a scheme for the electrical illumination of Plymouth Hoe and Devonport Park, at a cost of £300.

The wireless telephone service between the Nauen (Germany) wireless station and Siam was opened on April 26th. A wavelength of 16.9 metres was used.

Tenders have recently been invited by the Commissioners of H.M. Works, etc., for the erection of a telephone exchange at Staines and the "Silverthorne" exchange at Chingford.

Members of Newcastle Junior Chamber of Commerce paid a visit to the Carville power station of the Newcastle Electric Supply Co., Ltd., last week, under the guidance of Mr. T. W. Todd, assistant station superintendent, and Mr. V. H. Wood, control engineer.

As from May 1st, the Great Northern Telegraph Co.'s rates for telegrams from Great Britain to Japan, Chosen, and Formosa, are as follows:—Ordinary telegrams, 2s. 9d. per word (reduced from 3s. 4d.); deferred telegrams, 1s. 4½d. per word (instead of 1s. 8d.); press telegrams, 8d. per word (instead of 9½d.).

The Scottish section of the Institution of Electrical Engineers met in the hall of the Technical College, Dundee, on April 26th, under the chairmanship of Mr. D. S. Munro, Glasgow. Mr. W. Holmes read a paper on "Load Levelling Relays and their Application in connection with Future Metering Problems," and Mr. H. C. Babb read a paper on the "Lothians Protection Gear."

Suitable land in Wood Lane, Chapel Allerton, has been procured by Leeds Electricity Committee, for the erection of a sub-station.

Hull Bridges Committee is considering the possibilities of operating the Scott Street bridge as well as the Drypool Bridge by electricity.

A junior scientific officer is required for the Admiralty Pool. He should have an honours degree, or the equivalent, in physics or electrical engineering.

Hull Electricity Committee recommends that the City Electrical Engineer be given authority to purchase selected type of apparatus and loan them to members of his staff for trial.

A special general meeting of the Institution of Mechanical Engineers will be held on May 10th, at 6 p.m., with a view to considering, and if thought fit, passing resolutions as to a Petition for a Royal Charter.

Changes in the method of charging for trunk telephone calls are announced. As hitherto, the minimum call will be three minutes, but, instead of all excess time being charged by multiples of three minutes, the excess time on calls for distances exceeding 35 miles will be charged *pro rata* at so much per minute.

The South Wales and Monmouthshire branch of the Electrical Association for Women commenced their spring programme last week with a visit to the cigar factory and welfare department of Messrs. J. R. Freeman and Sons, Ltd., Cardiff. The next fixture will be a cookery lecture and demonstration by Miss C. M. Burrows. On May 22nd a visit will be paid to the Cardiff Docks. On June 19th, there will be a visit to a Cardiff electrical firm, and the summer outing, also held in June, will include the Edison Swan Cable works at Lydbrook.

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PERSONAL.

BRIG.-GENERAL Everard Baring has joined the board of the London Electric Supply Corporation, Ltd.

Col. and Mrs. Kenelm Edgcumbe have arrived at 26, Lowndes Square, London, for the season.

Mr. P. W. Petter sailed to-day (Friday) on the s.s. "Berengaria" for a short trip to America and Canada.

Coun. E. Hartley, chairman of Kirkham Electricity Committee, has been appointed chairman of the Council.

Mr. B. C. Garman has been elected chairman of the Association of Supervising Electrical Engineers. See page 539.

Mr. W. Chamberlain, general manager of the tramways, was received into membership of the Belfast Rotary Club, last week.

Mr. Allan Grant has been appointed district engineer for that part of the Grampian Electricity Scheme, north of Perth but within the boundary of Perthshire.

Hebden Bridge Urban Council has adopted a recommendation by the Electricity Committee to stabilise the salary of the electrical engineer at £425 per annum.

During a visit to Brighton last week H.M. the Queen received the Mayor of Brighton, Ald. H. J. Galliers, the well-known Sussex electrical installation contractor.

Mr. G. A. Vowles, power house superintendent, Stoke-on-Trent, has intimated his intention of taking up a position in Hull. Mr. F. Favell has been appointed his successor.

Sir Oliver Lodge, F.R.S., is to deliver the nineteenth annual May lecture before the Institute of Metals on May 7th, the title of his lecture being "Some Ideas about Metals."

Mr. C. A. Hopkins, engineer and manager of Sunderland tramways, was last week presented with a gold hunter watch by members of the Wigan Old Boys' Rugby Union Club.

Mr. A. Behr, export manager of Petter's, Ltd., has left Yeovil on a visit to Paris, Nantes, Bilbao, Madrid, Lyons, Milan, Zurich, Langenthal, Brussels, Antwerp, and Rotterdam.

Sir Andrew Duncan and Mr. Archibald Page sailed on April 26th for Canada by the s.s. "Mount Royal," from Liverpool. They are expected to return to this country in June.

Coun. G. Caine, chairman of Rhyl Electricity Committee has been nominated to represent Rhyl for a period of three years on the North Wales and South Cheshire Joint Electricity Authority.

Prof. E. V. Appleton, Wheatstone professor of physics at King's College, London, has been awarded the Morris Liebmann Memorial Prize for 1929 by the American Institute of Radio Engineers.

Estate of the gross value of £237 503, with net personalty £210 131, was left by the late Sir John Denison-Pender, chairman of the Eastern and Associated Cable Companies, who died on March 6th, aged 73 years.

Mr. James C. Besly has been appointed electrician-in-chief to the Eastern Telegraph Co., in succession to the late Mr. C. W. Schaefer. The vacancy caused by Mr. Besly's promotion has been filled by Mr. K. L. Wood.

Sir J. A. Ewing, F.R.S., principal and vice-chancellor of Edinburgh University, was last week presented with the freedom of Edinburgh. Sir Alfred has also been elected an honorary member of the Institution of Civil Engineers.

Mr. J. W. Thomas, assistant general secretary of the Electrical Power Engineers' Association for the past nine years, has resigned in order to practise at the bar. Mr. Thomas has joined the Northern Circuit, and his chambers are at 60, King Street, Manchester.

In recognition of his 34 years' service with the Southport Electricity Department, Mr. C. Almond has been presented by his colleagues with a gold watch-chain with seal, and a pipe. The presentation was made by Mr. E. Moxon, borough electrical engineer, at a meeting of the Welfare Club. Mr. Moxon also presented Mr. W. Lymath with a case containing a fountain pen and pencil and a pocket wallet as a farewell gift. Mr. Lymath is taking up a position with the Post Office. Mr. A. W. N. Brown, who has secured an appointment at Bury St. Edmunds, was presented with an attaché case and pocket wallet.

Obituary.

VISCOUNT YOUNGER OF LECKIE, on Monday, aged 77 years. He was chairman of the Select Committee of the House of Lords, considering the Grampian electricity scheme.

MR. G. D. MALCOLM, on Monday, aged 39 years. He was meter superintendent of Stepney Electricity Department and chairman of the Meter and Instrument Section of the Institution of Electrical Engineers. See page 546.

IN PARLIAMENT.

Grampian Power Scheme Considered by House of Lords Committee.

THE Bill to authorise the use of the water power of certain streams in the Highlands, promoted by the Grampian Electricity Supply Co., came before a Select Committee of the House of Lords last week.

Mr. Tyldesley Jones, K.C., for the promoters, said this was one of a group of proposals which had come before that Committee from Scotland, but differed from those previously submitted. The Grampian Electricity Supply Co. was now supplying in the counties of Perth, Forfar, Inverness, and Stirling. It was proposed to extend by taking in the whole of Aberdeenshire, Banffshire, Elginshire, Nairnshire and Ross and Cromarty, as far as Dornoch Firth, and to erect hydro-electric stations.

Mr. Wm. M'Gill, a director of the company, said it was a part of their agreement with the Central Electricity Board that the company undertook to construct a 132 000 V transmission line, from the stations at Bannoch and Tummel to Abernethy. With a view to assisting this preliminary development, they had acquired the station at Arbroath in March, 1928.

Mr. Tyldesley Jones said the Bill contained proposals for the compulsory laying of distribution mains. When proposals were submitted to the Electricity Commissioners they would be given also to the local authorities.

Mr. Wm. McGill said the company anticipated a load, without new industries, of 12 000 kW. They had made a contract for the supply of 12 000 kW, as an interim measure, with the Central Electricity Board. This made a total demand of 24 000 kW without any further development.

Mr. Ian Murray said he was a director of the Scottish Power Co., which owns the capital of the statutory Grampian Co. The Scottish Power Co. had an authorised capital of £2 500 000 and an issued and paid-up capital of £485 000. The whole of the finance in connection with the present scheme could be provided by that company. The Grampian Co. now owned or controlled all the authorised company undertakings in their existing area. At present its plant capacity was 39 000 kW. If the load factor were 50%, the cost per kWh delivered on the grid at Abernethy would be 0·199d. The immediate demand from the new area was 10 000 kW, which would rapidly increase to 30 000 or 40 000 kW.

Mr. W. T. Halcrow, civil engineer, said, by a dam at Kilmorack Falls the height of the falls would be raised from about 70 to 114 ft. The five new power stations would produce on continuous load 59 190 kW, or 509 700 000 kWh per annum. The total estimated cost was £3 434 080.

Mr. W. J. E. Binnie gave particulars of the syphonic system, by which the head waters would be regulated.

Mr. Harry Richardson, general manager of the Metropolitan Electric Supply Co., estimated that by 1940 the Central Electricity Board would require for Central Scotland 481 250 kW in excess of plant existing to-day, and 50 000 kW for other parts of Scotland. If the Galloway scheme, the existing Grampian scheme and the new Strathglass scheme were developed to the limits of their capacity they would fall short of the demand in 1940 by 624 000 000 kWh per annum. The anticipated demand in Central Soctland in 1934 was 1 417 000 000 kWh.

Mr. W. Ormistead, fishery expert, gave details of an electric lift which it was proposed to instal to hoist the salmon over the dam on the river Farrar. The model of the lift, made by Mr. V. G. New, was shown, and it was stated that the dimensions of the proposed lift would be 16 ft. by 8 ft., and 2 ft. deep. The fish would swim into it and be tipped out at the top of the dam. The lift would operate automatically at any pre-arranged interval. See page 539.

Galloway Water Bill.

In the House of Commons on April 25th, Lt.-Col. Moore moved that the second reading of this Bill be deferred for six months. He opposed the Bill on behalf of miners and collieries and proprietors and tenants of land in Ayrshire, and fishing interests.

Brig.-Gen. Charteris said evidence given before the House of Lords Committee led to the conclusion that £47 000 a year would be saved in the provision of electricity if the Bill were passed in its original form.

Mr. W. Bennett suggested that the Company should be compelled to establish a sinking fund.

The Bill was read a second time.

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LEGAL INTELLIGENCE.

Appeal by Marconi Co. Concerning Patents Rights and Royalties.

IN the Chancery Division, on April 24th-25th, Mr. Justice Luxmoore had before him two appeals by the Marconi's Wireless Telegraph Company from a decision of Mr. W. S. Jarratt, Comptroller-General of the Patent Office, and his assistant, Mr. H. C. Haycroft, in favour of the applications of the Brownie Wireless Company and the Loewe Radio Company with respect to royalties payable to the Marconi Company on wireless receiving sets.

Sir Duncan Kerly, K.C., and Mr. Trevor Watson appeared for the appellants; Mr. R. Moritz, K.C., and Mr. Shelley for the Brownie Company; the Hon. R. Stafford Cripps, K.C., and Mr. McEwen for the Loewe Company; and Mr. Stafford Crossman for the Attorney-General.

Sir Duncan Kerly said there were common elements in the two appeals, but they would have to be taken separately, and he would deal with the Brownie case first. The Brownie Company was in effect a Mr. Barber, who had been engaged for two or three years in making crystal sets which did not infringe the patents. He also manufactured an apparatus called a two-valve amplifier, which if used with crystal sets was outside the patents, but which if used with a valve receiver might infringe the patents. Counsel, continuing, said Mr. Barber applied to the Marconi Company for a licence, and was told he could have one in the usual form, but he wanted a different one. Incidentally, he said he would have been satisfied with the usual licence but for the fact that he would have had to pay royalties on his amplifier set, because the royalty was payable on all valve holders. He then made his application for a compulsory licence. The Comptroller had come to the conclusion that the original licence was unreasonable, without one tittle of evidence as to its commercial working and as to the profits the manufacturers had made. He had reduced the royalty on certain Marconi valve holders from 12s. 6d. each to 10% on the wholesale selling price, subject to a minimum charge of 5s. on the first valve holder and 2s. 6d. on each additional valve holder.

His Lordship asked when the two patents expired.

Sir Duncan said they expired in June and October next, but the appellants had 13 patents altogether, one of which had eleven years to run. Their policy had been to impose a royalty of 12s. 6d. on each valve holder, whether the apparatus was going to infringe the patents or not. They pursued the course of making the licensee pay upon all goods of the class for which the invention was made. The policy of the Marconi Company, said counsel, had been to insist on goods for this country being British made.

Mr. Moritz said it was disputed that the Marconi Company did not grant licences to foreign firms, and it was said there were foreign corporations which appellants had licensed to bring apparatus into this country.

Evidence given by the Comptroller was read by counsels. The hearing was adjourned.

Local Authorities and War Bonuses.

Mr. Justice Eve in the Chancery Division, on April 26th, dismissed an action in which Mr. H. A. Stevens, a fitter employed by Hampstead Electricity Department, claimed a declaration that having enlisted in 1914, he was entitled under the terms of a resolution made by the Council, to certain war bonuses and increases of pay, which he would have received if he had remained in the employment of the Council.

The defendants counter-claimed that the words of the resolution meant the "full regular pay" at the time of enlistment and did not include war bonuses or increment of pay made after the date of enlistment.

Spurious "Osram" Lamps.

At Hull Police Court on April 22nd, the General Electric Co., Ltd., prosecuted Mr. T. L. Bower, trading as the Oakenshaw Trading Co., 5, South Street, Oakenshaw, Bradford, for trading in lamps bearing a false trade mark. Mr. L. A. Byrne prosecuted and Mr. J. A. Lee, of Bradford, defended.

Counsel for the prosecuting company said the lamps in this case were marked "Osram gasfilled"—"Made in France," whereas the General Electric Co.'s "Osram" lamps were made at the company's Hammersmith factory. The evidence showed that the defendant offered to supply Messrs. Miller and Garness, electrical contractors of Hull, with lamps marked "Osram gasfilled, Made in France" and that he supplied them with 50 lamps against a cheque for which a receipt was given Within a week or two the purchasing firm received complaint of lamp failure and communicated with the Hull Branch of the General Electric Co., Ltd., with the result that the fraud was discovered.

A certificate of the registered trade mark held by the company was produced, while a factory superintendent of the Osram Lamp Works gave evidence that the offending lamps were not made at these works and were spurious imitations.

Defendant said he had been in the lamp business since 1922 and admitted the sale of 50 lamps as alleged by the prosecution, but denied that he knew they bore the offending mark.

The Stipendiary found the defendant guilty of selling lamps improperly marked and fined him £15 and £15 15s. costs or 51 days' imprisonment. Two remaining summonses by the prosecutors against the defendant were withdrawn.

Lamp Patents.

In the Chancery Division, before Mr. Justice Romer, on April 23rd, Mr. Trevor Watson, on behalf of the British Thomson-Houston Co., Ltd., moved for an injunction against the Unity Manufacturing Co, of Water Street, Liverpool, to restrain infringement of the plaintiffs' patent relating to gasfilled electric lamps. Counsel said the defendants were willing to treat the motion as the trial of the action, and to submit to the usual order for an injunction and delivery up of the infringing articles.

Mr. Watson also moved in two similar cases by the same plaintiffs against the Zenith Electrical Supplies Co., of South Castle Street, Liverpool, and the Harwol Specialities Co., of Strand Street, Liverpool. In each case the defendants consented to a similar order.

Counsel for the Harwol Co. said the costs of the inquiry as to damages would be reserved.

Mr. Justice Romer: In each of the three cases there will be a consent order.

ILLUMINATION DESIGN COURSE.

Preliminary Details of the Programme—Many New Subjects Included.

THE nineteenth illumination design course, which is being organised by the E.L.M.A. Lighting Service Bureau, will be held from June 10th to 14th. This course will be in many ways new, and will include a number of subjects not dealt with in previous courses. In addition, since the Lighting Service Bureau has been to a great extent redesigned, greater facilities are available for the demonstrations accompanying the lectures.

The details for the different days are as follows, the figures in parentheses representing the time.

JUNE 10TH.—(9.45 a.m.) registration; (10.15 a.m.) reception by Director of E.L.M.A.; (10.30 a.m.) a review of lighting progress; (11.15 a.m.) an explanation of lighting units; (12 noon) light measurement; (2 p.m.) light and visibility; (2.45 p.m.) theory and characteristics of electric lamps; (4 p.m.) illumination design. JUNE 11TH.—(9.45 a.m.) characteristics and development of lighting equipment; (10.45 a.m.) business opportunities in shop window lighting; (11.45 a.m.) modern lighting for shop interiors; (2 p.m.) office and school lighting; (2.45 p.m.) economics of industrial lighting; (4 p.m.) electrical advertising. JUNE 11TH.—(9.45 a.m.) industrial lighting designs; (10.45 a.m.) the advantages of glareless lamps; (11.15 a.m.) marketing E.L.M.A. lamps; (11.45 a.m.) floodlighting; (2 p.m.) the application of colour in lighting; (3 p.m.) street lighting and traffic control; (4.15 p.m.) special lighting problems. JUNE 13TH.—(9.45 a.m.) possibilities in residential lighting; (11.15 a.m.) modern developments in lighting; (2 p.m.) sports lighting; (2.45 p.m.) salesmanship; (3.45 p.m.) lighting service and general discussion; (7 p.m.) dinner. JUNE 14TH.—Arrangements will be made during this day for visits to interesting lighting installations, electricity showrooms, etc.

I.E.E. WIRELESS SECTION COMMITTEE, 1929-30.

The following have been nominated by the Wireless Section Committee to serve on the Committee from October 1st, 1929:—CHAIRMAN: Capt. C. E. Kennedy-Purvis; ORDINARY MEMBERS: Messrs. R. H. Barfield, A. J. Gill, L. C. Pocock, Prof. E. Mallett, and Comdr. J. A. Slee. The following will continue to serve as members of the Committee:—The President of the Institution; the Chairman of the Papers Committee; a nominee of the Council; a nominee of the General Purposes Committee; Mr. F. W. Davey; Mr. J. Hollingworth; Lt.-Col. A. G. Lee; Mr. E. B. Moullin; Mr. G. H. Nash; Mr. C. E. Rickard; and Mr. P. K. Turner, together with one representative each to be nominated by:—The Admiralty, the Air Ministry, the General Post Office, and the War Office.

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BUSINESS OPENINGS.

Latest Particulars of Electrical Engineering and Wiring Installation Contracts for which Tenders are being Invited at Home and Abroad.

WE give below the latest particulars of contracts for which tenders are invited. The closing date is given, when available.

CONGREGATIONAL CHURCH, SUMMIT, LITTLEBOROUGH.—Electric wiring and fitting of Church and Sunday school. Particulars from Mr. A. Fielden, 10, Deanhead, Littleborough.

STOCKPORT CORPORATION.—Twelve months' supply of electric lamps. Forms of tender, etc., from the Secretary, Electricity Offices, 23, Teviot Dale, Stockport.

STOKE-ON-TRENT CORPORATION.—Overhead wiring and services to 257 houses. Specification, etc., from the City Electrical Engineer, St. George's Chambers, Kingsway, Stoke-on-Trent; deposit £2.

Overhead Lines.

GRIMSBY CORPORATION, May 3rd.—Supply and erection of about 10 miles of 33 000 V overhead line. Specification (No. 260) from Mr. S. R. Windle, borough electrical engineer, Grimsby.

MANCHESTER CORPORATION, May 3rd.—Supply, during twelve months, of electric kettles (specification 236), electricity meters (237), air-break circuit breakers (244), star delta switch startors (245), a.c. industrial electric motors (246), potential and current transformers (247), cables (248) and time switches (249). Specifications, etc., from Mr. H. C. Lamb, Electricity Department, Town Hall, Manchester; deposit £1 1s. for each.

SWANAGE URBAN DISTRICT COUNCIL, May 3rd.—Electric light installation in town hall. Specification, etc., from the Surveyor, Town Hall, Swanage.

WALTHAMSTOW EDUCATION COMMITTEE, May 3rd.—Electrical installation in Billet Road School, Walthamstow. Specification, etc., from Mr. G. R. Spurr, Electricity Works, Exeter Road, Walthamstow, London, E.17; deposit £1.

CENTRAL ELECTRICITY BOARD, May 4th.—Supply and erection of 33 000 V and lower voltage cables, under the South-East England electricity scheme. Specification (No. S.E.E.-G.C.1) and form of tender from Mr. Richard H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

SOWERBY EDUCATION AUTHORITY, May 4th.—Electric light installation at Sowerby New Road Council School. Specifications, etc., from Mr. A. Beilby, Education Offices, Sowerby Bridge.

WEST RIDING EDUCATION COMMITTEE, May 4th.—Electric light installation in Ardsley (E. and W.) Westerton Council School. Specification, etc., from Mr. P. Beaumont, 8, St. John's North, Wakefield.

BELFAST CORPORATION, May 6th.—Supply of 12 sets of electrical equipment for tramcars. Specification, etc., from the General Manager, Corporation Tramways, Sandy Row, Belfast.

EDINBURGH EDUCATION AUTHORITY, May 6th.—Electric lighting installation in Gorgie New Special School and Annexe to Trinity Academy, Bangholm Recreation ground. Schedules etc., from the Education Offices, Castle Terrace, Edinburgh.

ISLINGTON (LONDON) BOROUGH COUNCIL, May 6th.—Supply and installation of two lead batteries for Edison refuse collecting vehicles, having carrying capacity of 3½ to 4 tons. Further particulars from the Cleansing Superintendent, Liverpool Road, N.1.

MARYLEBONE (LONDON) BOROUGH COUNCIL, May 6th.—Supplies of l.t. and e.h.t. underground cables during 12 months from June 1st. Specification, etc., from the Chief Electrical Engineer, Electricity Department, Town Hall, Marylebone, W.1.

WEST RIDING EDUCATION COMMITTEE, May 6th.—Electric light installation in Mexborough Secondary School extensions. Specification, etc., from Education Officer, County Hall, Wakefield.

GRIMSBY CORPORATION, May 8th.—Extra high pressure and pilot cables. Specification (No. 261) from Mr. S. R. Windle, borough electrical engineer.

ST. HELENS (ISLE OF WIGHT) URBAN DISTRICT COUNCIL, May 8th.—Electric light installation at Puckpool Park. Specifications, etc., from the Clerk, Council Offices, High Park, Ryde.

WALTHAMSTOW URBAN DISTRICT COUNCIL, May 8th.—Supply of (*a*) l.t. distributor and service cables, and (*b*) e.h.t. and l.t. feeder cables to contract No. 66. Specifications from Mr. G. R. Spurr, Electricity Works, Exeter Road, London, E.17; deposit £1 for each.

WEST MIDLANDS JOINT ELECTRICITY AUTHORITY, May 10th.—(a) Main 33 000 V switchgear, each circuit breaker having rupturing capacity of not less than 1 500 000 kVA; (b) auxiliary 33 000 V switchgear, each circuit breaker having rupturing capacity of not less than 500 000 kVA, with group feeder reactors, for Ironbridge power station. Specification (No. 4) and form of tender from Mr. E. F. Hetherington, chief engineer and manager, Phœnix Buildings, Dudley Road, Wolverhampton; deposit £2 2s.

WEST MIDLANDS JOINT ELECTRICITY AUTHORITY, May 10th.—(1) One 50 000 kW turbo-alternator, with step-up transformers, etc.; (2) condensing plant, boiler-feed pumps, evaporators, etc.; (3) circulating water pumps, etc., for Ironbridge power station. Specifications (No. 2) and form of tender from Mr. E. F. Hetherington, chief engineer and manager, Phœnix Buildings, Dudley Road, Wolverhampton; deposit £2 2s.

STOCKPORT CORPORATION, May 11th.—Supply of two wireless sets, for elementary schools. Specification can be seen at the Education Offices, Town Hall, Stockport.

GLASGOW CORPORATION, May 16th.—Supply of (2) l.t., paper insulated, one, two, three and four core and e.h.t. cables; (3) small i.r. insulated cables and flexibles; (4) electric cookers; (5) meters; (6) arc lamp carbons; (12) electric kettles, for 12 months. Specifications from the General Manager, Electricity Department, 75, Waterloo Street, Glasgow, C.2. State whether cable schedule (2) or (3) is required.

HULL CORPORATION, May 16th.—Supply and laying of underground cables. Specifications, etc., from Mr. J. N. Waite, city electrical engineer and manager, Electricity Works, Sculcoates Lane, Hull; deposit £2 2s.

CHERTSEY GUARDIANS, May 18th.—Electric lighting installation at the Institution, Ottershaw, near Chertsey. Specifications from Mr. F. J. Wareham, clerk, Council Offices, West Byfleet, Surrey.

EDINBURGH DISTRICT BOARD OF CONTROL, May 21st.—Electrical work in connection with erection of two higher grade blocks and mortuary, at Gogarburn, Edinburgh. Schedules from Mr. S. Kaye, 14, Hill Street, Edinburgh, not later than to-day (May 3rd).

BETHNAL GREEN (LONDON) BOROUGH COUNCIL, May 22nd.—Electric lighting installations in two blocks of tenement buildings. Specification, etc., from Mr. H. W. Couzens, 9, Old Queen Street, London, S.W.1; deposit £2 2s.

CENTRAL ELECTRICITY BOARD, May 25th.—Supply and erection of 33 000 V metal clad switchgear, in connection with South-East England Electricity Scheme. Specification (No. S.E.E.—G.S.1) from Mr. Richard H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

SUTTON AND CHEAM URBAN DISTRICT COUNCIL, June 7th.—Installation of fire alarm system, connected with the fire station. Plans showing positions of fire alarm boxes, etc., from the Engineer and Surveyor.

Overseas.

UNLESS otherwise stated, particulars of overseas contracts are to be had from the Department of Overseas Trade (Room 52), 35, Old Queen Street, Westminster, London, S.W.1. *Note.—An asterisk denotes that local representation is, in practice, essential.*

LOURENÇO MARQUES PORT AND RAILWAYS BOARD, May 3rd (extension of time).—Diesel driven generating set of 50 kVA and electrically driven water pumping set. (Reference B 5 264).

LOURENCO MARQUES PORT AND RAILWAYS BOARD, May 6th.—Supply of electric motors, turntables, drilling machine, etc. (Reference A.X. 7 765.)

STATE ELECTRICITY WORKS, MONTEVIDEO, May 6th.—Supply of electric cables and accessories. (Reference B.X. 5 178.)

WINNIPEG MUNICIPALITY, May 6th.—Supply of switching equipment at Slave Falls. (Reference B.X. 5 250.)

BRAY URBAN DISTRICT COUNCIL, May 7th.—Supply and erection of (*a*) steam crane, and (*b*) electric crane, to lift three tons,

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at Bray Harbour. Further particulars from Mr. E. M. Murphy, 27, Molesworth Street, Dublin.

NEW ZEALAND PUBLIC WORKS DEPARTMENT, May 7th.—Supply of two electric motor-driven centrifugal pumps. (Reference A.X. 7 738.)

ASSAM-BENGAL RAILWAY CO., LTD., May 8th.—Supply of turbo-alternator set for Pahartali. Specification (£1 1s., not returnable) from the Company's Offices, 80, Bishopsgate, London, E.C.2.

MELBOURNE METROPOLITAN TRAMWAYS BOARD, May 9th.—Air brake equipment (contract No. 690). (Reference A.X. 7 862.)

EGYPTIAN MINISTRY OF PUBLIC WORKS, May 15th.—Supply and erection at Government Printing Office, Cairo, of 120 kW d.c. Diesel electric generating set, with foundations, artesian well, electrically-driven water cooling pump, etc. Forms of tender, etc. (10s. 6d.) from Chief Inspecting Engineer, 41, Tothill Street, London, S.W.1.

VICTORIAN RAILWAY COMMISSION, May 15th.—Supply of one geared, three-phase, electric winding engine (contract No. C.M. 778). (Reference A.X. 760.)

SOUTH AFRICAN POSTS AND TELEGRAPHS, May 23rd.—Supply of rubber covered wire and telephone cable (contract No. 153). (Reference B.X. 5 229.)

CLUJ (ROUMANIA) MUNICIPALITY, May 30th.—Compressor for cooling plant of ammonia system, with air-cooling coils, and a.c. motor and condenser, at the Slaughter House. (Reference A.X. 7 838.)

SOUTH AFRICAN POSTS AND TELEGRAPHS, May 30th.—Supply of telegraph materials, tubular arms, crossheads, bases, stay plates, etc. (tender No. 152). (Reference A.X. 7 767.)

TANGANYIKA GOVERNMENT, June 1st.—Concession for utilisation of Pangani River Falls for the development of electric power. Copies of the draft concession may be obtained from the Crown Agents for the Colonies, 4, Millbank, London, S.W.1.

MOROCCAN POSTS, TELEGRAPHS AND TELEPHONES, June 6th.—Supply of copper and bronze wire. Application for permission to submit quotations must be made by May 6th. (Reference A.X. 7 800.)

NEW ZEALAND POSTS AND TELEGRAPHS, June 18th.—Supply of telephone cords (No. P. and T. 151/1425). (Reference B.X. 5 251.)

POSTMASTER-GENERAL'S DEPARTMENT, Melbourne, June 18th.—Supply of switchboard cable (contract C. 427). (Reference B.X. 5 228.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, June 20th.—Two 5-ton electrically-driven hoist blocks, with overhead conductors, runway girders and switches (tender No. 1 446). (Reference T/A.X. 7 867.)

Electric Cranes for South Africa.

SOUTH AFRICAN RAILWAYS AND HARBOURS, June 20th.—Supply of one 10-ton and three 4-ton, electric level luffing cranes (tender No. 1 437). (Reference A.X. 7 828.)

NEW SOUTH WALES PUBLIC WORKS DEPARTMENT, June 22nd.—Supply and erection of transformers, with certain spares, for Burrinjuck hydro-electric development (contract No. 29/29). (Reference B.X. 5 230.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, June 25th.—Supply of protected type, telephone cable terminal boxes (schedule C.430). (Reference B.X. 5 231.)

STATE ELECTRICITY WORKS, MONTEVIDEO, July 8th.—Construction and equipment of 50 000 kW power station.

NEW ZEALAND PUBLIC WORKS DEPARTMENT, July 16th.—Supply of 250 galvanised steel transmission line towers to carry copper conductors, or 190 towers to carry steel-core aluminium conductors. (Reference A.X 7 735.)

Tenders Accepted.

WAR OFFICE.—Edison Swan Electric Co., Ltd., supply of zinc plates.

ROTHERHAM CORPORATION.—General Electric Co., Ltd., supply of transformers for 12 months.

ST. PANCRAS (LONDON) BOROUGH COUNCIL.—Siemens Bros. and Co., Ltd., supply of l.t. cable, £1 208 13s. 8d.

METROPOLITAN ELECTRIC TRAMWAYS, LTD.—British Thomson-Houston Co., Ltd., supply of 140 " B.-T.H. 509 " traction motors.

LONDON AND NORTH EASTERN RAILWAY.—Siemens Electric Lamps and Supplies, Ltd., 12 months' supply of Siemens standard lighting lamps, carbon filament lamps and train lighting lamps; Metro-Vick Supplies, part contract for Cosmos vacuum and gas-filled lamps for 12 months; Edison Swan Electric Co., Ltd., supply of electric lamps.

LEEDS CORPORATION.—Hackbridge Electric Construction Co., Ltd., supply of three 10 500 kVA transformers at Kirkstall power station, with spare transformer and other requirements, £11 680; British Electric Transformer Co., Ltd., supply of four 1 000 kVA sub-station transformers, £777 per set, and additional transformers over a period of two years at special prices; W. T. Henley's Telegraph Works Co., Ltd. (£1 194), Enfield Cable Works, Ltd. (£2 556), and Macintosh Cable Co., Ltd. (£3 110), cables.

MARYLEBONE (LONDON) BOROUGH COUNCIL.—British Thomson-Houston Co., Ltd., supply of 2-bearing motor-convertor set, for installation at Council's generating station, £9 429 11s. 3d.; A. Reyrolle and Co., Ltd., supply of switchgear for Blandford Street sub-station, £4 110 9s.; British Brown-Boveri, Ltd., supply of two rectifier sets for installation at Blandford Street sub-station, £17 412; Ferguson, Pailin, Ltd., supply of switchgear for generating station, Aberdeen Place, £1 996. (All recommended.)

MANCHESTER CORPORATION.—Harland Engineering Co., Ltd., conversion of automatic rotary convertor plant; Electro-Mechanical Brake Co., Ltd., supply of maximum traction trucks. Additional plant at Lostock booster station—Metropolitan-Vickers Electrical Co., Ltd., transformer; Ferguson, Pailin and Co., switchgear; Whipp and Bourne, d.c. circuit breakers and field regulator; Brookhirst Switchgear, Ltd., electric for motor starting and control gear. Annual supplies of tramways stores—Metropolitan-Vickers Electrical Co., Ltd., automatic circuit breakers; electro-mechanical brake parts; lightning arresters, etc.; Edison Swan Electric Co., Ltd., cables, electric handlamps, bell wire, etc.; Metro-Vick Supplies, Ltd., cells for bell circuits; General Electric Co., Ltd., circuit tubing fuses, switches, magnet coils, etc.; British Insulated Cables, Ltd., insulated bolts and bolts for bridge hangers.

MEMBERS of the Electrical Association for Women on the occasion of their visit to the works of M. K. Electric, Ltd., at Edmonton, London, N., and the Enfield works of Belling and Co. on April 16th. A brief description of the tour was given in last week's issue.

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WORK IN PROSPECT.

BARNES.—School, Castlenau, to cost £18 320, for Surrey Education Committee. Particulars from the secretary, Mr. W. Finny, Kingston-on-Thames.

BRANSTONE.—Development of estate for 1 000 houses. Particulars from Mr. Frank Rist, Branstone Road, Burton-on-Trent.

BURY (LANCS).—Housing scheme (32), for Town Council. Particulars, the borough engineer, Mr. J. Ainsworth Settle.

CHERTSEY.—Additional housing scheme (100), for the Urban Council. Particulars from the Surveyor.

EYNESBURY.—Primitive Methodist Church. Particulars from George Wrycroft and Sons, St. Neots, Hunts.

HITCHIN.—Extensions, boys' grammar school, to cost £34 000. Particulars from the Director of Education, Hertford.

HULL.—Extensions, Royal Infirmary, to cost £24 000, for the Board of Management. Particulars from the Secretary.

HYTHE (KENT).—Additional housing scheme. Particulars from the Borough Surveyor.

LIVERPOOL.—Bus garage, for the Ribble Motor Services, Ltd.

MARKFIELD.—Isolation hospital, to cost £120 000, for Leicestershire County Council. Particulars from the Clerk, Leicester.

MILTON REGIS.—Houses (92). Contractors, Blackwell and Meyer, Bexleyheath.

PURFLEET.—Houses. Contractors, Falkus (Public Works), Ltd., (14), and Pavitt Bros., Ltd. (20).

REPTON.—Extensions, Repton School Chapel, to cost £10 000. Particulars from the Clerk to the Governors.

SEDGEFIELD.—Housing scheme (56), for the Rural Council. Particulars from the surveyor, Mr. James Stones.

SHEFFIELD.—Modern store, for Roberts Bros., Ltd., Rockingham House, The Moor.

SKELMANTHORPE.—School (470 places), for West Riding Education Committee. Particulars from the clerk, Mr. F. A. Darwin, County Hall, Wakefield.

SPENBOROUGH.—Shelters and public conveniences for the Urban Council. Particulars from the surveyor, Mr. A. Rothera, Cleckheaton.

ST. ALBANS.—Fire station, for the City Council. Particulars from the City Surveyor.

ST. HELENS.—Houses (158), Grange Park Estate, for the Town Council. Particulars from the contractors, William Chappell and Sons, Ltd., Sheffield.

STOURBRIDGE.—School, Enville Street, for Worcestershire Education Committee. Particulars from the architect, Mr. A. V. Rowe, 38, Foregate Street, Worcester.—Cinema theatre, High Street, for Messrs. W. Lloyd and C. Bray, Dudley. Particulars from Mr. George Frederick Webb, Dudley.

SWINDON.—Police station, Gorse Hill, to cost £15 495, for Wilts County Council. Particulars from the contractors, Blackford and Son, Colne.

TWICKENHAM.—Housing scheme (2 500), and shops, Jubilee Farm Estate, for Messrs. Barkers.

UDDINGSTON.—Housing scheme (28), Muiredge, for Lanarkshire County Council. Particulars from Mr. P. C. Smith, District Offices, Hamilton.

UPMINSTER (ESSEX).—Extensions to parish church to cost £5 000. Particulars from the contractors, William Bell and Sons, Saffron Walden.

WATFORD.—Extensions to Grammar Schools. Particulars from the clerk, Mr. F. Wilson, 7, Church Street.

WELLINGBOROUGH.—Houses for the Urban Council. Particulars from the contractors, Mr. R. Marriott, Rushden, C. Adams and Co., and Stevens and Co.

WINDSOR.—School (820 places), for the Borough Education Committee. Particulars from the architects, Leathart and Granger.

Further Housing Schemes.

WIVELISCOMBE.—Housing scheme, for the Urban Council. Particulars from the architects, Roberts and Willman, 2, Hammet Street, Taunton.

WOLVERHAMPTON.—Houses (128), for the Town Council. Particulars from the contractor, Mr. A. Powell.

WOODSTOCK.—Housing scheme (18), Tidlington, for the Rural Council. Particulars from Mr. C. W. Page, Horse Fair.

WORCESTER.—Houses (34), for the City Council. Particulars from the contractors, W. J. Simms, Sons and Cooke, Ltd., Nottingham.

REDUCTION OF CHARGES.

THE following reduced charges for electricity are announced. Figures in parentheses indicate the former rates:—*Torquay*, ¾d. per kWh (⅞d. in borough and 1d. in Newton Abbot, Abbots Kerswell, Coffinswell and King's Kerswell), 1¼d. in remainder of area of supply (1⅝d.); power rates revised, lowest rate ¾d. (1d.). *Willesden*, "all-in" rate, 3s. 6d. per lamp per annum, plus ⅝d. per kWh, for all purposes, or 2½% per quarter of rateable value, plus ⅝d. per kWh; or flat rate, lighting, 4d., heating or power (domestic), 0·9d.; long hour lighting of signs, business premises, etc., ½d. per quarter for every watt of lighting installed, plus 1d. per kWh; power or heating, 0·9d. per kWh (not applying to motor generators used for lighting); in factories using electricity for lighting and power 10% of quantity used for power may be allowed for lighting at 1d. on application; picture palaces and theatres, flat rate 2½d., or bulk supply tariff; bulk supply, 20s. per quarter per kWh demand, plus 0·7d. per kWh for consumption not exceeding 10 000 kWh per quarter, 0·65d. per kWh between 10 000 and 50 000 kWh, 0·6d. between 50 000 and 200 000, 0·55d. between 200 000 and 500 000, all in excess 0·5d.

Reductions at Oswestry.

Oswestry Electric Lighting and Power Co., lighting, 8d. (10d.); power, 3d. (6d). *Chesterfield*, supplies to cinemas and theatres, between April and September, inclusive, 2d. per kWh. *Eastbourne*, domestic rate under "all-in" tariff, ½d. (¾d.), no meter rents chargeable; flat rate for power, heating, cooking, etc., ¾d. (1d.); flat rate for lighting, 4d. per kWh for first 2 500 kWh per quarter, 3¾d. for second 2 500, 3d. for third 2 500, all over 7 500 2½d. *Leeds*, alternative charge to consumers requiring large quantities of electricity for lighting purposes, £10 per kW of maximum demand, plus 5d. per kWh provided annual requirements for lighting are not less than 100 000 kWh, and that suitable accommodation for transformers and switchgear is provided by consumer, which plant may also be used by corporation for supplying other consumers. *Birkenhead*, lighting, 4½d. per kWh (4¾d.), reduction of 1s. 5d. per kWh, large industrial consumers in cases where the consumption exceeds 25 000 kWh per annum. *Formby*, lighting, 6½d.; power, 1½d., consumers having option of alternative charge of 5% on the rateable value up to £60, plus 1d. per kWh for all purposes. *Thames Valley Electric Supply Co., Ltd.*, lighting, 8½d. first 100 kWh; 7½d. per kWh for remainder; heating, 1¾d.; power, 2¾d. per kWh for first 1 000, 1¾d. per kWh for remainder. *Padiham*, where rateable value is under £15, lighting, 2d. per kWh (6d.) for all in excess of 60 kWh during December and March quarters, and all in excess of 20 in quarters ending in June and September. Same reduction where rateable value exceeds £15 but under £25 for units in excess of 80 in December and March quarters and 30 in June and September quarters; where rateable value is over £25 reduction will apply to consumption in excess of 140 kWh in December and March quarters and 50 in June and September quarters; domestic heating and power reduced in similar ratio. *Bolton*, heating and cooking on business premises, ¾d. (1d.); domestic and lighting, 4½d. less 2½%, (4¾d.); industrial power, reduction about 3%. *Wallasey*, lighting, 3¾d. (4¼d.) with 5% discount for payment within 21 days. *Godalming Urban Electric Supply Co., Ltd.*, lighting, 9d. (10d.) per unit; flat rate of 3½d. for power and heating. *Heckmondwike*, heating and cooking, 1d. per kWh, less 2½% for prompt payment. *Hawkhurst* (*Weald Electricity Supply Co., Ltd.*), lighting, 10½d. (11d.) *St. Helens*, domestic supplies on rateable value system, 5% per quarter on rateable value, plus 1d. per kWh or fixed charge at 5% per quarter on rateable value; or £1 per quarter, whichever is the greater, plus §d. per kWh, or flat rates of 4d. for lighting and 1d. for heating, cooking, and domestic power, plus 2s. 6d. per annum meter rent. *Calne*, lighting, 7½d. with minimum charge of 10s. per quarter, power up to 100 kWh per quarter 3½d.; 100 to 200, 3¼d.; 200 to 300, 3d.; 300 to 400, 2¾d.; beyond, 2½d., minimum charge 10s. per quarter. *Canterbury*, heating, cooking and domestic purposes, other than lighting, 1¼d. (1½d.); large power consumers supplied with a.c. extra high pressure current, £6 per annum per kVA, plus ½d. per kWh, electricity used for lighting not to be more than 10% of total. *Beckenham*, "all-in" tariffs, 8% on the first £75 of rateable value (10%), 3% on rateable value above £75 (4%). Consumers not using an electric cooker to have price of electricity for the summer quarters reduced to 1d. (1½d.), and those using cookers to ¾d. (1d.). *Reigate*, lighting, 5½d. (6d.); heating, 1d. (2d.); cooking and power, 1d. (1½d.).

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ELECTRICITY SUPPLY.

Walsall and Unemployment Relief—Extensions of Mains at Tynemouth—Additions to Manchester Undertaking—Dartford and Assisted Wiring—Wicklow and the Shannon Scheme—Prepayment Meters for Battersea.

ASHFORD (Kent) U.D.C. is to apply for an Order to supply additional parishes.

Walsall Electricity Committee proposes to carry out extensions of mains as an unemployment relief scheme, at a cost of £7 000.

Tynemouth Electricity Committee has obtained sanction to borrow £11 000 for mains, services, transformers, and switchgear.

Battersea Electricity Committee has obtained sanction to borrow £200 831 for extension of the borough council's generating station.

Barnes U.D.C. electricity department is about to lay a feeder from East Sheen sub-station to Sheen Lane at York Avenue, at a cost of about £2 000.

The Kent Electric Power Co. proposes to lay underground cables through Faversham for the purpose of connecting up the rural district.

Barnsley Electricity Committee recommends the purchase of three transformers at an estimated cost of £670. The Committee seeks sanction to borrow £6 693 for the extension of h.t. and l.t. mains.

Southend T.C. has applied for a loan of £48 516 for e.h.t. ring mains, to permit of a.c. distribution in the North Eastern, North Western, and Western areas of the borough. A partial supply in bulk is to be taken from the County of London Electric Supply Co.

Poplar (London) Electricity Committee seeks sanction to borrow £2 750 for cable extensions at West India Docks, and £2 023 for cable extension from Wick Lane sub-station.—The Committee is to convert the remaining 88 gas lamps to electricity, at a cost of £345.

Croydon Lighting and Electricity Committee recommends an expenditure of £1 400 on switchgear, transformers, and e.h.t. cable in connection with the Thornton Heath (tramway depôt) sub-station. Tenders have been accepted for the erection of five sub-stations.

It will be necessary to increase the supply of electricity in Faversham before the autumn. The T.C. has decided to appoint a deputation to seek an interview with the Commissioners in order to explain the position and obtain information as to the steps that can be taken in the matter.

The annual estimates of Manchester Electricity Committee make provision for an expenditure of £124 000 on land, buildings, and machinery for generating stations; £80 000 for transformer stations, stores, depots, etc.; £357 000 for mains and services; and £8 000 for street lighting.

Apparatus for the elimination of smoke, etc., has had an extended trial at St. Pancras (London) Council's King's Road power station. The Electricity Committee reports that the apparatus has not proved successful in remedying the conditions, in respect of which complaints are continually being received from the L.C.C.

A Special Order has been secured by the West Cornwall Electricity Supply Co. for the boroughs of Helston, St. Ives, and Penryn, the urban districts of St. Just, Madron, Paul, Ludgvan, Hayle, Phillack, Padstow and Wadebridge, the rural districts of West Penwith, Helston, East Kerrier, Truro, and St. Columb Major, and part of the rural district of Redruth.

Ealing Electricity Committee is to instal a 1 500 kW Scott-connected three-phase super-tension transformer set, with booster regulator. It has also been decided to instal a spare set of the same capacity by September next. Super-tension mains between the transformer cubicle, the operating chamber and the coupler switches are also to be provided.

Penge U.D.C. has adopted a recommendation by the Works Committee that the time has arrived when the increase of 33⅓% in the charges for electricity made in 1920 by the South Metropolitan Electric Light and Power Co. is no longer justifiable, and that the company be informed that the Council is no longer prepared to pay the increase.

An Order to supply premises at Pitses, in Limehurst rural district, has been obtained by Oldham Electricity Committee. The profit on the electricity undertaking for the past year, £29 570, is to be transferred to reserve fund.—The Electricity Committee seeks sanction to borrow £7 048 for equipment for the new generating station at Chadderton.

A special sub-committee of Plymouth Electricity Committee has drawn up a scale of special discounts for consumers who repay the balance of the cost of their installations, at the termination of any year up to the fourth year of rental. The sub-committee also recommends the adoption of a scheme for the hire-purchase of radiators in hotels and boarding houses.

Brighton Lighting Committee is to supply the factory of Messrs. Gigins, Ltd., bakers, Portslade, at 12½% above the price for the time being in force to ordinary consumers in Brighton for power and lighting purposes respectively. The Committee has decided to expend a sum not exceeding £750 on festoon lighting northwards around the Valley Gardens and the Level during the current year.

Application is being made by Lancaster Corporation for a Special Order to give a supply in the district of the Lunesdale and Lancaster Unions. Mr. G. C. Milnes, borough electrical engineer, reports that to supply the villages of Slyne and Hest Bank would cost £8 895. The capital charges on mains and cost of generation are about £1 134, while the estimated revenue in the first full year's working would be only £1 083.

Stretford Electricity Committee has adopted an "all-in" tariff for supplies to private houses, as an alternative to the present flat rate. For houses up to £50 rateable value the charge will be 15% on the rateable value, plus ½d. per kW. In the case of rateable values over £50 the fixed charge will be 15% up to £50, and 7½% on the remainder. These rates are contingent upon the use of electrical appliances other than lamps.

At the Stoke-on-Trent Corporation Hospital, during the half-year ended December 31st, the substitution of Corporation electricity supply for steam-driven dynamos has resulted in a net saving of £50.—Mains are to be laid at a cost of £1 500 to give a supply of electricity to 230 houses proposed to be erected by the Housing Committee between Vivian Road and Warrington Street, Fenton. The charge for current is to be 1s. per lamp per week.

Dartford U.D.C. has adopted schemes for the assisted wiring of private houses. In one case the consumer is to be debited with the cost plus 15%, 20% to be paid as deposit, and the balance to be spread over three, four, and five years as desired. In the other case the consumer is to be debited with the cost plus 15% and pay 2d. per kWh in addition to the ordinary charge, the minimum annual repayment to be 16s. 8d. for each £5 expended in providing the installation.

Wicklow U.D.C. wants to know what its electricity is to cost under the Shannon scheme. The Electricity Supply Board said that it should get current cheaper than any other town, as it was handing over to the Supply Board, power house, new overhead mains and wires, iron standards, modern machinery and equipment, etc., which the Board had to furnish in other towns. Mr. Lalor said, at a recent meeting of the Council, that they had handed over too easily, and they should have a representative of the Board with them to go into the question of cheaper current.

Battersea (London) Electricity Committee has decided to instal prepayment meters, when desired, in connection with the rental wiring scheme, and to charge a flat rate of 6d. per unit to cover both the fixed quarterly charge and the unit charge for electricity consumed, the consumer to guarantee such annual consumption of electricity as will ensure the repayment of installation charges, etc., within ten years or less; or a consumer may pay the fixed charge for the installation, etc., quarterly, and pay for the electricity consumed through a prepayment meter at the ordinary rates.

The Antrim Electricity Supply Co. expects to be in a position to supply power to users in a large part of Co. Antrim and a portion of Co. Derry by October of this year. The first part of the overhead transmission lines will be 35 miles long, and will extend from a point near Monkstown to Cullybackey, north of Ballymena. It is stated that steps will be taken to ensure that the line and the poles on which it will be carried will not mar the scenery of the countryside. At a later stage, the transmission line will be extended as far north as Coleraine. The hydro-electric plant will be situated at Caronroe.

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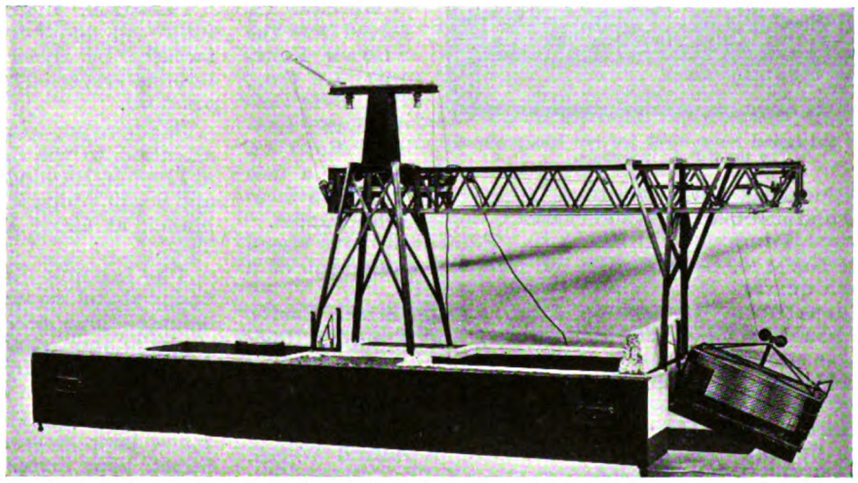
ELECTRICAL NEWS OF THE WEEK IN PICTURES.

The window of Edward Dewhurst, Ltd., of Preston, which was awarded 1st prize in the "Hoover Week" window display competition. This contest gains in popularity every year, and, just as it should be, electrical contractors and electricity supply departments are always awarded a number of the prizes. This year's competition was no exception, and the names of the successful electrical entrants are given on page 540.

Electrical voice reproduction is to play a big part in the campaign for the forthcoming election. Broadcasting, and the relaying by land line of speeches to different halls have already been used, and now Mr. Baldwin has made a special "talkie" for distribution throughout the country. This photograph, taken in the grounds at 10, Downing Street, shows the microphone suspended above the head of the speaker.

Mr. B. C. Garman, who has been elected chairman of the Association of Supervising Electrical Engineers. It will be remembered that Mr. Garman was awarded 1st prize in last year's W. E. Highfield Shield Competition.



A model of the electric "lift" which, it is suggested, should be used on the River Farrar, in connection with the Grampian electricity scheme, now under consideration by a House of Lords Committee. The apparatus has been designed to meet the objection to the suggested 100-ft. dam, enabling the salmon in the river still to make their way upstream. If the scheme is adopted, the fish will enter a pool by leaping, and then swim through a bottle neck passage into a cage containing two feet of water. See page 533.

The new showrooms and offices of the Eastbourne Electricity Department, in Grove Road, showing, on the left, a corner of the interior, and, right, a general view of the 90-ft. frontage. In co-operation with Mr. J. K. Brydges, borough electri al engineer, the Eastbourne Branch of the Electrical Contractors' Association has arranged for part of the showrooms to be stocked by local members. A portion of the basement of the building has been set out as demonstration rooms, in the form of kitchen, scullery, and bathroom, fitted with all the modern appliances, while the remaining portion of the same floor is used for storing cookers, etc.

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TRADE PUBLICATIONS.

A SPECIAL leaflet devoted to lamps has been published by the OMEGA LAMPWORKS, LTD., Rodney Place, London, S.W19.

BIRMINGHAM ELECTRIC FURNACES, LTD., 55, George Street, Birmingham, have issued a new brochure relative to their products.

A new and topical poster which has just been produced by the E.D.A., in colours.

The current issue of the "Standard News," published by Standard Electric Stove Co., of Toledo, Ohio, has been received.

GENT AND CO., LTD., Faraday Works, Leicester, have published Book 5, section 4, dealing with observatory time transmission.

We have received from the SLOAN ELECTRICAL CO., LTD., 8–12, Golden Lane, London, E.C.1, a copy of a new catalogue dealing with electrical accessories, porcelain insulators and line materials, and electrical domestic appliances.

BRUCE PEEBLES AND CO., LTD., Edinburgh, have issued leaflet No. 170, dealing with the electrical equipment of a modern quarry.

CAMPBELL AND ISHERWOOD, LTD., Raleigh Street, Bootle, have issued leaflet E.P.T. 9, illustrating and describing their portable electric hand drills, etc.

Booklet No. 20, giving net prices of C.M.A. and Nonanzo cables, has been issued by W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Holborn Viaduct, London, E.C.1.

The FULLER ACCUMULATOR CO., LTD., Woodland Works, Chadwell Heath, Essex, has published list No. 103, which gives a complete list of new types of automobile batteries.

A new booklet relating to "Philiray" shop window reflectors has been published by PHILIPS LAMPS, LTD., of 145, Charing Cross Road, London, W.C.2. The reference is No. 403.

"Control of Synchronous Motors and the Problem of Power Factor Correction" is the title given to a new publication by BROOKHIRST SWITCHGEAR, LTD., of Northgate Works, Chester.

Leaflet No. X243, dealing with standard leakage relays, d.c. type, for tripping circuit breakers has been published by J. G. STATTER AND CO., Queen Anne's Chambers, Westminster, London, S.W.1.

A new leaflet illustrating and describing the "Type Two" electric iron has been published by the TELEPHONE MANUFACTURING CO., LTD., Hollingsworth Works, West Dulwich, London, S.E.21.

The WHOLESALE FITTINGS CO., LTD., 23-27, Commercial Street, London, E.1, has published catalogue No. W. 195, dealing with radio components, loud speakers and accessories. The issue comprises some 150 pages and is profusely illustrated.

BRITISH INSULATED CABLES LTD., Prescot, Lancs, have issued a leaflet dealing with rust-proof rubber insulated wires and cables, which replaces H. 95, and leaflet P.F. 51, replacing P. 63, and describing demand indicators has also been published.

List No. 5 281, dealing with auto-transformer starting equipments for squirrel cage motors, salient pole synchronous motors and condensers, has been published by the BRITISH THOMSON-HOUSTON CO., LTD., Rugby. List No. 2420 C*, dealing with rotary convertors and cancelling list No. 2 420 B, has also been published.

BUSINESS ITEMS.

THE address of the DIAMOND FIBRE CO., LTD., has been changed to 79, Knightrider Street, London, E.C.4.

The address of ALLOY WELDING PROCESSES, LTD., has been changed to Ferry Lane Works, Forest Road, London, E.17.

The business hitherto carried on as Langham Radio has been acquired by LANGHAM RADIO, LTD., of Exhibition Works, Wembley.

Messrs. BRAYSHAW, electrical contractors, of Colton Street, Bolsover, have opened new premises at Devonshire House, Holywell Street, Chesterfield.

On and after May 6th the permanent offices of the Central England Area, of the Central Electricity Board, will be situated at 53, Wake Green Road, Moseley, Birmingham.

I. GROVES AND CO., electrical engineers, 5, Cranbury Place, and J. W. SCOTT AND CO., LTD., electrical engineers, Java Road, Docks, have been elected members of the Southampton Chamber of Commerce.

J. DYSON AND CO., LTD., announce the transference of the Hull branch to premises, complete with radio and electrical showrooms, at 39, Beverley Road, Hull. This is immediately opposite the old address.

A new company has been registered under the title of PARKER FOUNDRY (1929) LTD., Derby, to take over the Parker Foundry Co., Ltd. The managing director of the new company is Mr. T. McLean.

Mr. H. E. DRABBLE, electrical contractor, of Staveley, Chesterfield, has removed his retail department from 1, Market Street, to 4, Ponten Street. In future, the former address will be used as a battery service depot only.

FERRANTI, LTD., Hollinwood, Lancs, announce that in future all audio frequency and output transformers manufactured by them will have their primary and secondary terminals reversed from what have hitherto been their standard positions.

BLACKSTONE AND CO., LTD., Stamford, have drawn our attention to the fact that in addition to existing branches at London, Birmingham, Bristol, Dublin, Glasgow, Manchester and South Wales, it has been found necessary to open a further branch at Groat House, Collingwood Street, Newcastle-on-Tyne.

The LONDON ELECTRIC FIRM, of Croydon, has recently designed and manufactured for a Continental state, for frontier defence, three searchlights 7 ft. in diameter, with a candle power of approximately 3 500 million. The lights are electrically controlled from a distance and arranged for working up to an elevation of 90°.

The BRITISH THOMSON-HOUSTON CO., LTD., has opened a new lamp stores in Blackburn at "Old Bank," Old Bank Street, King Street, which is associated with the Manchester branch of the company. A Norwich stores has also been opened at Cambridge House, 26, Tombland. It is understood that another "Mazda" lamp stores will be opened in Derby shortly.

Marconiphone public address amplifiers were installed at Godstone Church on April 24th, for relaying the whole of a marriage service to the bedside of the bride's mother, an invalid. A similar installation was carried out a year ago, and the two ceremonies are believed to be without counterpart. To ensure that no detail should be lost, five Marconi-Reisz microphones were placed at strategic points, and the Post Office cleared the line for a distance of five miles for the relay.

As usual a number of electricity supply departments and electrical contractors entered for this year's "Hoover Week" window display contest, the first and third prizes being won by EDWARD DEWHURST, LTD., of Preston, and PARKER, WINDER AND ACHURCH, LTD., of Birmingham, respectively. The window which was awarded the first prize is illustrated on page 539, and was arranged at the top with a large sign in pelmet form bearing the words, "Free gifts for all who purchase a Hoover." These free gifts were health, comfort, beauty, cleanliness, leisure and happiness. Cut-out figures, symbolical of the gifts, were arranged in suitable positions in the window and connected to the "Hoover" by ribbons. The floor was covered in shades of rich purple, whilst the cleaner was set on a dais on orange satin. The background of the window was also in purple. Flowers of yellow and purple were used to provide a spring-like atmosphere. Consolation prizes were awarded to the Borough of Southport, the West Hampshire Electricity Co., Ltd., and the Corporation of Burton-on-Trent.

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MERCHANDISE MARKS.

Hearing of Evidence with Respect to Imported Glassware.

A BOARD of Trade Committee under the Merchandise Marks Act, 1926, began an Inquiry on Monday, at the offices of the Board, into an application for the marking with an indication of origin of domestic, fancy, and illuminating blown glassware of all descriptions (other than electric lamp bulbs); pressed glassware of all descriptions; bottles, jars and other containers of glass. The Committee consisted of Sir H. Llewellyn Smith (chairman), Mr. F. N. Barnes, and Mr. F. R. Davenport.

The original application included lamp-blown ware and scientific glassware, including tubing and rod, but these will be dealt with as a separate application, the date of the hearing of which, however, has not yet been fixed. The applicants were the Glass Manufacturers' Federation; the British Flint Glass Manufacturers' Association and the Northern Association of Pressed Glass Manufacturers, supported by other trade associations, as well as a number of firms. Mr. Wethered (barrister) appeared for the applicants.

The principal opponents were the China and Glass Ware Section of the London Chamber of Commerce, supported by the Electrical Importers and Traders' Association, the Chloride Electrical Storage Co., Ltd., and other British manufacturers, represented by Mr. A. Comyns Carr, K.C., Mr. L. Macaskie and Mr. Horace Samuel.

Mr. Wethered, dealing with domestic, fancy and illuminating blown glassware—other than electric lamp bulbs—said the application in this case was made by the British Flint Glass Manufacturers Association, consisting of eight firms, supported by James Powell and Sons (Whitefriars) Ltd., the Stourbridge Glass Co., Ltd., and the New English Glass Manufacturers, Ltd., although these latter were not members of the Association. The trade unions also supported the application. Imports had increased from a value of £1 768 985 in 1921, to £2 247 939 in 1927, and the complaint was made that foreign makers so copied British designs and trade names that it was practically impossible to distinguish the foreign from the British. It was often found also, that the foreign articles were mixed with British-made goods. It was suggested that an indication of origin could be given by means of an acid transfer or sand blasting, as had been the practice for some years by some British firms. In reply to an allegation by the opponents that there is practically no illuminating glass made in this country, it was pointed out that there were 11 firms engaged in this branch of the trade, and the output of six of them last year reached £65 000. Taking the Board of Trade figures, it appeared that British firms made 25 % of the lighting glass required in this country.

The chairman, referring to the request for an importation Order, said that a Sales Order did not necessarily mean fixing a label.

Manufacturers' Views.

Mr. Wethered agreed, but said it seemed that resort would have to be made to a label, and, in the opinion of British manufacturers, it was not a good thing to do.

Mr. W. G. Riley (John Walsh, Walsh, Ltd., Birmingham) said his firm had a turnover of £10 000 per annum in illuminating glassware, most of which was made to special order and no catalogue was issued.

Mr. Macaskie, in cross-examination, put it to witness that if lighting shades were marked on the upper neck, as had been suggested by one of the samples exhibited, the mark would be covered up when the shade was attached to the fitting and therefore the ultimate purchaser would never see the mark, yet the Act said the mark should be conspicuous.

Witness replied that shades were sold by manufacturers to wholesalers without fittings and therefore the mark would be seen.

Counsel also suggested that a mark in any other part would disfigure the articles and also give the impression, when a foreign marked globe or shade was attached to British-made fittings, that the whole thing was foreign.

Witness would not agree.

Mr. John Northwood (Stevens and Williams, Ltd., Brierley Hill) said his firm had an output of £20 000 per annum in illuminating glassware, the output consisting of all kinds of lighting glass except heat resisting glass. He submitted samples of illuminating glassware marked on the upper neck and, together with the previous witness, contended that as shades were sold separately from the fittings the mark would be seen, and in his opinion it would not matter whether the mark was covered subsequently.

Mr. Comyns Carr suggested that it was a common practice for lighting contractors to send individual customers to select lighting fittings from manufacturers' showrooms, and that as these fittings were invariably in position, the ultimate customer would not see a mark placed as suggested.

Witness said that the ultimate purchaser would inspect the glassware in his house before it was attached to the fittings and he would then see the mark.

Mr. Comyns Carr suggested that a stick-on label would be better, because, as witness had no objection to the mark being covered up, subsequently to purchase, it would not matter if the stick-on label came off in time. Witness objected.

Mr. Comyns Carr continued that as the Act specifically stated that the mark should be on the goods at the time of sale, it did not matter whether the mark came off after the purchaser had bought the goods and knew what he had bought.

The chairman also pointed out that the Merchandise Marks Act was concerned only with the goods as sold and that so far as the Act was concerned it did not matter what the purchaser did to the goods after he had bought them.

Mr. Northwood insisted that any marking should be permanent.

The inquiry was adjourned until May 6th.

"THE ELECTRICIAN" TABLES.

Details of British, Colonial, and Foreign Electricity Supply Undertakings.

THE forty-second edition of THE ELECTRICIAN Annual Tables of Electricity Undertakings was issued last week by Ernest Benn, Ltd., Bouverie House, Fleet Street, E.C.4, at the usual price of 10s. net, plus 9d. and 1s. for postage to addresses in the U.K. and abroad, respectively. The matter contained in the tables has been revised up to the last possible moment, and details are given of many new undertakings, as well as information of projected schemes. The tables contain information relating to British electricity supply undertakings, smaller British undertakings, schemes projected, etc., British electric power companies, dominion and colonial electricity supply undertakings, smaller dominion and colonial undertakings, grouped geographically, foreign electricity supply undertakings, smaller foreign undertakings, also arranged geographically, and dominion and colonial and foreign electric railways and tramways.

A new index, includes, in alphabetical order, not only all the British undertakings and power companies dealt with in tables A. B. and C., but also the towns and parishes receiving supply in bulk.

The particulars of the electricity supply undertakings include the district supplied; its population; the owners of the undertaking; the name of the chief engineer; the system of generation, transmission, and distribution; generation, transmission, and consumers' voltages; the numbers and types of public lamps in use; aggregate horse-power of motors connected to the system; total connections and maximum load in kW; the prices charged for lighting, power, heating, and cooking; and, in most cases, details of the steam raising and generating plant, the fuel used, and its price; the output of electricity for the past year, the number of showrooms, motor, cooker and heater hire and hire purchase, and assisted wiring schemes; the price of gas in the district, etc.

In the case of the colonial and foreign electric railways and tramways, the names of the owners of the systems and the chief officials are given; also particulars of power house plant; rolling stock; brakes; gauge and length of track; weight of rails; line equipment; line voltage; the bonding of rails, etc.

The tables relate to 800 British and over 1 300 colonial and foreign undertakings, and contain 220 pages of information arranged in a compact and handy form. The publication is the only one of its kind.

E.C.A. CONFERENCE.

Supplementing the particulars already given of the provisional arrangements made for the fourth annual conference of the Electrical Contractors' Association, to be held at Bournemouth on June 26th, 27th, and 28th, we are informed that the following papers will be read and discussed:—"The Mutual Responsibility of Contractors, Manufacturers and Supply Undertakings—(*a*) to the Electrical Industry, and (*b*) to the Public," by Mr. A. G. Bruty; and "Possibilities for Contractors in Rural Electrification," by Mr. H. R. Taunton.

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COMPANY NEWS.

Terms of Acquisition of Shares in Cables and Wireless, Ltd.—Associated Electrical Industries' Report—Philips Glowlampworks Expansion—Electricity Supply in South Wales—Shropshire, Worcestershire and Staffs Co.'s Meeting.

GENERAL ELECTRIC ordinary shares have relapsed, rather more than losing last week's advance in price. English Electric 6% preference have fallen 1s. 3d., to nearly 8s., and Thomson-Houston debentures are a couple of points down. Brush Electrical shares, on the other hand, are slightly better. Shropshire, Worcestershire and Staffordshire Power "B" ordinary shares have risen half-a-crown and are now quoted £2. Eastern Telegraph Stock is unchanged at 28o, but Marconi's Wireless shares are up 1s. 2d., and Marconi's International Marine have retained last week's improvement. London United Trams 1st deb. stock is a point up.

Last Annl. Divd.	Description	This Week.	Last Week.	1926 to 1928. Highest.	Lowest
	Electricity Supply.				
(d)	Brompton & Kensington Ord. ..	26/-*	26/6	35/6	23/9
4	Central Elec. Sup. 4% Deb. ..	94	94	95½	88½
(a)	Charing Cross Elec. Ord. (£1) ..	26/-	26/-	51/-	24/3
4½	,, ,, ,, 4½% C.P. (£1)	17/6	17/6	18/3	16/6
(b)	Chelsea Elec. Sup. Ord.	26/-*	27/-	45/3	24/-
10	City of Lond. Elec. L'ting Ord. ..	33/1½	31/10½	52/10½	26/-
6	,, ,, ,, ,, ,, 6% C.P.	23/-	23/-	24/3	21/6
10	County Lon. Elec. Sup. Ord. ..	55/-*	55/6	68/6	25/9
6	,, ,, ,, ,, 6% C.P.	23/-	23/-	24/-	21/3
(c)	Kensington & K'bridge Ord. (£1)	26/6	26/6	27/6	23/9
1/9⅜	Lon. Elec. Sup. Ord. (£1) ..	27/-	27/-	37/6	23/-
1/9⅜	Metro. Elec. Sup. Ord.	41/3	41/3	53/-	24/9
4½	,, ,, ,, 4½% C.P. ..	17/6	17/6	18/3	16/3
7½	N'castle & Dis. Elec. Ltg. Ord. ..	27/6	27/6	31/9	17/6
6/28	N'castle-upon-Tyne Elec. Sup. Ord.	25/-	25/-	30/3	19/3
6	N Metro. Elec. 6% C.P.	23/-*	23/-	23/9	20/10
6	Notting Hill 6% C.P. (£10) ..	10½	10½	11½	9½
(c)	St. James & P.M. Ord (£1) ..	27/6	27/6	28/6	23/6
1/4½	Shrops. Worcs. & Staffs. Power B. Ord.	40/-	37/6	37/6	21/4
1/9½	W'minster Elec. Sup. Ord. (£1) ..	26/-	26/-	52/9	24/-
4½	,, ,, ,, 4½% C.P. (£1)	17/6	17/6	17/10½	16/7½
8	Yorks. Elec. Power Ord.	34/-	34/-	38/9	24/6
6	,, ,, ,, 6% C.P. ..	24/-	24/-	26/9	20/7
	Railways and Tramways.				
8	Brit. Elec. Trac. Pfd. Ord. Stk. ..	128	128	152	117
6	,, ,, ,, 6% Pf. Stk.	127½	128½	133	103½
4	Cent. Lon. Ry. Ord. Stk. (asstd.)	72	72	72	54
4	,, ,, ,, 4% Deb.	80	80	83	77½
4	City & S. Lon. 4% Perp. Deb. ..	78½	79½	81	76¼
5	Lon. Elec. Rly. Cons. Ord. Stk. ..	73¾	73¾	75¼	42¼
4	,, ,, ,, ,, 4% Pf. Stk.	73	73	77	68
4	,, ,, ,, ,, 4% Deb. ..	80	80	83	76½
5	Lon. & Sub. Trac. A. Deb. ..	95½	95½	97½	74
4	Lon. Un. Trams. 1st Deb... ..	62	61	63	39
4½	Met. Elec. Trams, 4½% Deb. ..	72	72	73½	62
5	,, ,, ,, 5% Deb. ..	67½	67½	70½	65½
3½	Met. Rly. Cons. Ord. Stk... ..	60	60½	81	54½
3½	,, ,, ,, 3½% Pf. Stk. ..	63	64	67	60½
3½	,, ,, ,, 3½% Deb. ..	70	70	73½	67½
5	Met. Dis. Rly. Ord. Stk.	76	76	77½	52½
4½	,, ,, ,, 4½% 1st Pref. ..	81½	80½	84	74½
6	,, ,, ,, 6% Perp. Deb. ..	116½	116½	118½	110
4	S. Met. Elec. Trams, 4% Deb. ..	70	70	70	64½
7	Underground Electric Rlys. Ord.	23/6	23/6	28/2	11/-
—	Yorks. (W.R.) Trams, Ord. ..	5/-	5/-	16/-	3/-
4½	,, ,, ,, 1st Deb. ..	59	59	78	60
	Electrical Manufacturing.				
7	Brit. Elec. Transformer 7% C.P...	15/-	15/-	19/10	4/6
15	Brit. Insulated Cables Ord. ..	92/6	92/6	86/3	56/-
6	,, ,, ,, 6% C.P. ..	22/6	22/6	23/10	21/-
7	British Thomson-Houston Pref. ..	23/9'	23/9	24/9	19/7
7	,, ,, ,, 7% Deb.	1 03½*	105½	109½	102½
10	Brush Electrical Ord.	28/1½	27/6	30/9	24/-
15	Callender's Cable Ord.	87/6	87/6	91/3	66/-
6½	,, ,, 6½% C.P. ..	25/-	25/-	25/9	22/-
7½	,, ,, 7½% B. Pref. ..	27/6	27/6	28/3	25/-
8	Crompton-Parkinson 8% Cum. Pf.	25/-	25/-	27/-	14/-
6	,, ,, 6% Cum. 2nd Pf.	18/-	18/-	19/6	9/7
7½	Edison Swan Elec. 1st Pref. ..	25/7½	25/7½	13/-	7/4½
5	,, ,, ,, 1st Deb. Stk.	86½	86½	92	81½
7½	Elec. Construction Ord.	20/-	20/-	32/6	23/6
7	,, ,, 7% C.P. ..	22/6	22/6	22/9	21/-
—	English Elec. Ord.	6/3	6/3	15/9	5/-
—	,, ,, 6% C.P. ..	8/1½	9/4½	18/9	7/-
7	Ericsson Telephones 7% Pref. ..	20/-	20/-	22/7½	17/6
35	Ever Ready (Gt. Britain) Ord. ..	23/6	23/6	92/3	18/1
6	Ferranti 6% Pref.	18/-	18/-	19/1½	16/9
7	,, 7% 2nd Pref.	21/3	21/3	19/3	13/9
10	General Elec. Ord.	60/-	65/-	46/6	26/6
‡25	W. T. Henley's Ord.	120/-	120/-	120/-	69/3
12½	Johnson & Phillips Ord.	36/3	36/3	67/11	34/-
7½	Lon. Elec. Wire & Smith's Pref...	23/9	23/9	25/-	22/3
7½	Siemens Bros. & Co. Ord. ..	27/6	27/6	30/6	24/9
10	Telegraph Const. Ord. (£12) ..	24½	21½	30½	20
	Telegraph.				
3½	Anglo-Am. Tele. Ord. Stk. ..	61½	61½	63½	56½
10	Eastern Ord. Stk.	280	280	273	135
3½	,, 3½% Pref. Stk.	67½	67½	70½	59
4	,, 4% Deb.	79½	79½	81½	74
10	Eastern Extension Ord. (£10) ..	28	28	27½	14
22	Gt. Northern Telegraph (£10) ..	33	33	43½	26
10	Indo-European (£25)	54½	55½	48½	30
20	Marconi's Wireless T. Ord. ..	85/-	83/9	84/4	12/-
15	,, Int. Mar.	65/-	65/-	90/-	16/6
10	Western Tel. Ord. (£1)	27½	28	27½	12½

(a) 19.4d. per share. (b) 1s. 9·3d. per share. (c) 1s. 6·949d. per share.
(d) 1s. 8·706d. per share. (e) 1s. 7·181d. per share. ‡ Including 1s. bonus.

READING ELECTRIC SUPPLY CO., LTD.—Div. 10% for past year (same).

CONSTANTINOPLE TELEPHONE CO.—Int. at rate of 3½% (3/6 p. sh.) is payable on sh. cap.

QUEBEC POWER CO.—Div. of $½ p. sh on common shs. for qrter. ended March 31 is announced.

S. SMITH AND SONS (MOTOR ACCESSORIES), LTD.—Intm. div. 5% on pfd. ord. shs. is recommended.

AMERICAN ELECTRIC POWER CORPORATION.—Qrtrly. divs. declared: $1·50 on $ pfd. and $1·75 on $7 pfd. stk.

MONTREAL LIGHT, HEAT AND POWER CONSOLIDATED.—Div. on common shs. of 60 cents p. sh. for qrtr. endg. March 31.

HENGELO ELECTRICAL AND MECHANICAL APPARATUS FACTORY (HOLLAND).—Divs. of 5% on ord. and 7½% on pref. shs. (same as last year) are announced.

MALACCA ELECTRIC LIGHTING CO.—Net pft. for 1928, after provisn. for depreciatn., reserve ($20 000), etc., $107 999. Fin. div., 7½%, makg. 12½% for year. Fwd., $14 249.

ANGLO-PORTUGUESE TELEPHONE CO., LTD.—Fin. div. of 5%, less tax, on ord. shs., makg. 8% for year, and div. of 8%, less tax, on fully-paid "A" ord. shs., are notified.

CRAIGPARK ELECTRIC CABLE CO., LTD.—After writing off £3 000 for depreciation and placing £9 000 to res., div. of 5% has been declared on ord. shs. for year ended March 30 last, agst. 4%.

ORIENTAL TELEPHONE AND ELECTRIC CO., LTD.—Fin. divs. recmmdd. for year ended Dec. 31, 1928, 3½% on pref. shs., less tax, makg. 7% for year, and 8% on ord. shs., tax free, makg. 12% for year.

A. RIST (1927), LTD.—Net pft. for 1928, after makg. provisn. for depreciatn. and taxatn., £3 605, out of which fixed div. of 8% on cum. participatg. pfd. ord. shrs. for 13 months to Dec. 31, 1928, has been paid. Fwd. £572.

MEXICAN LIGHT AND POWER CO., LTD.—Divs. at rate of 7% p.a. for half-year endg. Apl. 30, 1929, on 7% cum. pref. shs., and at rate of 4% p.a. for half-year endg. Apl. 30 on 4% cum. red. 2nd pref. shs., are announced.

CANADA POWER AND PAPER CORPORATION.—First annual rpt. (for 1928) shows gross rev. $5 376 585. Bond and deb. int. $2 813 088. To depreciatn. and depletn. res., $1 322 405. After mtg. pfd. and common divs. of subsidiary cos., $1 050 440 surplus is $180 648.

ASSOCIATED GAS AND ELECTRIC SYSTEM.—Earngs. for 1928, $42 163 550, agst. $35 296 741; net earngs., $19 170 637, agst. $17 032 086. After provisn. for pfd. divs., int. charges and depreciatn. ($2 439 874), amt. left for divs. and surplus is $6 495 592, agst. $6 258 653.

RADIO VICTOR CORPORATION OF AMERICA.—The Radio Corporatn. of America announces the formatn. of the Radio Victor Corporatn. of America, a subsidiary to the Radio Corporatn., which will take over the sales activities of the R.C.A. and the Victor Talking Machine Co.

EVER READY CO. (GREAT BRITAIN), LTD.—Directors recmmd. paymt. of fin. div. for year ended Mar. 31., 1929, on pref. shs. 5%, makg. maximum of 10% for year; on old ord. shs. 25%, makg. 35% for year (same); and on 296 000 ord. shs. issued fully paid as bonus in Jan., 1929, 25%.

MEXICAN TELEPHONE CO. ERICSSON.—This co., affiliated with L. M. Ericsson Telephone Co., of Stockholm, has taken up a loan of 10 800 000 Swedish kr., with int. of 6%, and issued at par. Loan is to be redeemed durg. period 1939–1949, but with right to convert same from year 1934 at a redemptn. rate of 105% and downwards.

RICHMOND (SURREY) ELECTRIC LIGHT AND POWER CO., LTD.—Blce. from rev. acct., £46 486, after provisn. for all exes., total amt. available being £48 677, includg. £2 190 brt. in. To sinkg. fund, £1 395; res. for depreciatn., etc., £8 000; res. for taxatn., £3 000, gen. res. £10 000, leavg. £26 281. Fin. div. 7% on ord. shs., makg. 11% for year. Fwd. £4 281.

CITY ELECTRIC LIGHT CO., LTD. (BRISBANE).—Accts. for year ended Jan. 31, 1929, show credit blce., after provisn. for sinkg. fund, renewals acct., res. fund, and employees' providt. fund, of £120 308. Intm. div., amtg. to £59 138, paid in Sept. last. Further div. of 3% has since bn. paid on 6% pref. shs., 3½% on 7% pref. shs., and 5% on ord. shs., State tax free. Fwd. £39.

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NIGERIAN ELECTRICITY SUPPLY CORPORATION, LTD.—Subscriptions were invited recently for an issue of 450 000 £1 pfd. ord. shs. at par. Co. was formed to acquire and comple. the constructn. and equipmt. of a hydro-electc. installatn. to supply electy. to cos. engaged in tin mining on the Bauchi Plateau of Northern Nigeria. Three generatg. units of 2 000 H.P. each are under constructn., and the plant will be increased later to 10 000 H.P.

CABLES AND WIRELESS, LTD.—It is anticipated that circulars will be posted by the Bank of England on May 17 to ordinary stkhldrs. of the Eastern Telegraph Co., Ltd., ord. shhldrs. of the Eastern Extension Australasia and China Telegraph Co., Ltd., and the Western Telegraph Co., Ltd., and £1 pref., £1 ord. and 10s. ord. shhldrs. of Marconi's Wireless Telegraph Co., Ltd., giving terms of the offer of exchange of their respective hldgs. for shs. in Cables and Wireless, Ltd.

BOURNEMOUTH AND POOLE ELECTRICITY SUPPLY CO., LTD.—Rev. for 1928, £272 477, agst. £261 005 in 1927, blce. to net rev. acct. £170 382, agst. £261 005, plus £7 290 brt. in. Int. on deb. stk. to Dec. 1928, less tax, £6 750; leasehold and spl. redemptn. funds and int., £1 154, to res. for depreciatn., renewals, etc., £35 000; to res. for taxatn., £6 000; to gen. res. £25 000. Intm. and fin. divs. on 4½% and 6% pref. shs. and intm. div. at 6% on ord. shs. have been paid. Fin. div. at 9%. less tax, on ord. shs. is recommended, makg. 15% for year, Fwd. £6 268.

ASSOCIATED ELECTRICAL INDUSTRIES, LTD.— Rpt. for 1928 shows pfts. £258 772, against £254 749. Int. on deb. stk. £41 454 (same), written off works, machinery, plant, etc., £56 655, agst. £53 181, to gen. res. £25 000 (same). Div. on 8% cum. pref. shs. absorbs £78 915, and div. on ord. shs. 6% (same), £54 573. Fwd. £101 850, compared with £99 676. In Nov. last co. acquired issued ord. shs. of British Thomson-Houston Co., great majority of issued ord. shs. of Edison Swan Electric Co. and practically all issued share cap. of Ferguson, Pailin, Ltd. No divs. from these cos. have been taken into accts. for 1928.

PHILIPS' GLOWLAMPWORKS, LTD. (EINDHOVEN).—Gross pft. for 1928, £2 434 000, agst. £1 175 000. After writing off a sum for blds. and machinery, blce. is £1 560 000, agst. £963 000. Divs., 21% on ord. and 9% on pref. shs. (same as last year). A new issue is to be made during this month of £1 367 000 ord. shs. at 250% and £440 000 cum. pref. shs. at 130% in proportion of two new shs. to each one held. Factories at home and abroad have worked at full capacity and output has largely increased. Considerable additns. have been made to bldgs. and plant, and a further large extensn. to Eindhoven factory is to be made during current year. It is also intended to extend the factories elsewhere in Holland and in foreign countries.

BRITISH THOMSON-HOUSTON CO., LTD.—Pft. for 1928, before charging int. on debs. and loans, £422 729, agst. £462 444 plus £200 513 brt. in. Int. on debs., £152 225; to depreciation, etc., £119 951. After paying pref. div., a div. of 4%, less tax, on ord. shs. is recommended. Fwd., £203 066. Rpt. states that volume of factory output was comparable with that of preceding year, but pfts. remain unsatisfactory. Ref. is also made to the acquisition by Associated Electrical Industries, Ltd., of all the ord. shs. of the B.T.H. Co. and all the shares owned by the latter co. in the Edison Swan Electric Co., Ltd., and Ferguson, Pailin, Ltd., and it is stated that steps are being taken to put into effect as rapidly as possible the economies and co-operative efforts which are the object of the arrangements. Loans which at Dec. 31, 1927, stood at £1 310 000, have now been reduced to £335 000.

Company Meetings.

WORMIT ELECTRIC LIGHT CO., LTD.—At the meeting on April 25th, the report, which was adopted, showed that a dividend of 7½% had been declared. An extraordinary general meeting was held subsequently to consider the offer of the Fife Power Co. to buy out the Wormit Electric Co. at £2 000, which entitles the shareholders to receive 20s. for every 15s. subscribed. In addition to the £2 000, the directors are to be given £500 for their services. After discussion it was decided to accept the offer, and that the company be wound up voluntarily.

HOPKINSONS, LTD.—Mr. R. A. Hopkinson, presiding at the meeting on April 26th, said with the improvement in the coal trade there was an increasing interest in their patent mechanical and electrical mine signal indicators, and when colliery company funds were fuller, no doubt they would receive a share of orders for these instruments. During the past year they had been occupied in the manufacture of their patent electric valve controls, for which they had several months' orders still in front of them. After referring to other figures in the report, the chairman said they proposed to pay a final dividend of 5%, less tax, making 10% for the year.

BABCOCK AND WILCOX, LTD.—Sir John Dewrance, presiding at the meeting last week, said during the past year the company had spent on bringing its plant up to date a sum of money which was in excess of the capital of the company at the time he was appointed chairman thirty years ago. The result of that was that the company was in a good position to execute all the orders that it had in hand or could book immediately. The associated companies had been very successful during the year, particularly the Spanish company. During the year competition seemed to have been extremely great, but there were signs that the trade of the country was improving. This year they were not able to make the shareholders quite the same return as last year. The difference, £8 000, was due to circumstances which the directors hoped would not recur.

Regenerators on Indo-European Telegraph Line.

INDO-EUROPEAN TELEGRAPH CO., LTD.—Mr. H. L. M. Tritton, presiding at the meeting on April 25th, said the company's relations with the various governments, through whose territory their line passed, continued to be satisfactory. During the year arrangements were made, in co-operation with the Indo-European Telegraph Department, for the installation of regenerators at various points on the line. The system was in operation on one line, in both directions, between London and Karachi, and had produced a very material increase in speed. Steps had been taken to improve still further the service between the Continent and Persia and India, for which purpose there existed a special line from Berlin. He asked shareholders last year to bear in mind that the company's revenue during the year under review would be bound to show a diminution by reason of the beam wireless competition. The falling off in revenue, whether owing to this competition or whether to the reduced rate, would have been still more apparent, but for a certain expansion of traffic following on the reductions and an increase in the company's subsidiary traffics. The company was not included in the merger, but shareholders might rest assured that their interests were protected under the terms of the joint purse agreements. The report was adopted and the dividend and bonus, making a total distribution of 10% for the year, were approved.

SOUTH WALES POWER CO., LTD.—Mr. W. North Lewis, presiding at the meeting on April 26th, said the interests of the South Wales Power Co. and the South Wales Electrical Power Distribution Co. (the Parliamentary company) were identical and the particulars which he would give referred to the latter. The profit for the past year was £89 060, against £125 068 in the previous year, and the balance handed over to the South Wales Power Co. enabled it to meet in full its 1st mortgage debenture interest and sinking fund and its preference dividend and to carry forward £477, increasing the balance forward to £21 182. The year through which they had just passed was one of the worst ever experienced in the coal trade of South Wales. This meant a serious curtailment of demand from some of their largest consumers. The directors had adopted a policy of lower prices and simpler tariffs, and by this means had retained business in danger of being lost and secured new business. The fall in output as compared with 1927 only amounted to 7%. Since the beginning of the year there had been an improvement in the coal trade, and this was reflected in their output. Bulk supplies to public authority and company distributors showed an increase of 4%. In the Power Co.'s Electric Lighting Order areas the aggregated results had been much better. On this side the number of consumers had increased by 18%, units sold by 11%. In 1928 the weight of coal used per kW fell from 1.701 lb. to 1.61 or 5½%, and almost every other item of cost showed some reduction. The average price received fell from 1.013d. to 0.906d., or a reduction of 10%. He mentioned last year that the company had placed an order for a 25 000 kW turbine. The erection of this plant was practically complete, and they anticipated that it would enable them to still further improve cost of production. Mr. J. W. Beauchamp, Mr. Chamen's successor in the office of engineer and general manager, had entered upon his duties at a time of great difficulty, and the Board had pleasure in acknowledging the able and strenuous manner in which he had set about the task of extending and consolidating the business of the company.

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SHROPSHIRE, WORCESTERSHIRE AND STAFFORDSHIRE POWER CO.

Mr. E. Garcke on Company's Good Prospects—Financial Position Satisfactory—Arrangements for Inter-connection with Other Supply Undertakings.

THE ordinary general meeting of the Shropshire, Worcestershire and Staffordshire Electric Power Co. was held on Tuesday at 88, Kingsway, London, W.C., Mr. E. Garcke (chairman of the company) presiding.

The Chairman, in moving the adoption of the report and accounts, said that the revenue account showed a total credit of close on £350 000 for 1928, as compared with £322 000 for the preceding year. The debits were £161 000 compared with £146 000. They were proposing to pay a dividend on the "B" ordinary shares of 7½% for the year 1928, compared with 7% for 1927, and, the capital having been increased during the past year, the total dividend charges amounted to £96 000, or an increase of £16 000 on the preceding year. They carried to the reserve appropriation account the balance of £92 621, to which was added the premium received on shares issued last year, £54 125, sundry other items, £3 519, or a total at the credit of the appropriation account of £150 265. From that total they wrote off the balance of £18 936, commission and discount paid on previous issues of capital. They placed £50 000 to reserve account, the same amount as in the preceding year, and after adding the charge in respect of the Endowment Fund of £2 392, there remained a balance to be carried forward to next year of £78 937, compared with £45 628 which was brought in from the preceding year.

It was natural to expect the general development of their business to cause an increase in their expenses, but he must draw the shareholders' attention to the large increase in the amount paid in rates. In 1928 they paid £24 156, against £16 178 in the previous year, and £14 103 the year before.

Turning to the balance sheet, at December 31st last the issued share capital appeared at £1 705 000, an increase of £555 000 during the year. Their loan capital and other forms of indebtedness showed a total of £1 590 000, a reduction of £35 000. The general financial position was satisfactory and the prospects were good.

The real inwardness of their present position was the conviction they hoped to justify that a large part of the capital spent represented assets the value of which was on the upgrade. It was not so much a question of making provisions for wasting assets as of assessing the fruitful potentialities of their enterprise. Their chief concern at the present time was the tendency for capital expansion to exceed the revenue-earning power in the initial period of expenditure. To express it quite tersely, it meant that as a result of highly efficient propaganda and publicity organisation, which the company had developed, the number of intending consumers connected to their mains was large, and the necessary interest charges on capital had to be borne before the expenditure on mains and equipment was remunerative. With even a small revival of trade their revenue was likely to improve considerably.

Arrangements for inter-connection of supply had been made with the City of Birmingham on the east of their area and with the West Gloucester Power Co. and Wessex Electricity Co. on the South. Negotiations with similar objects were proceeding with the Hereford Corporation on the west, and with the West Midlands Joint Electricity Authority on the north. They were also supplying current in bulk to the Corporation of Cheltenham. Their distribution area covered nearly the whole of the County of Worcestershire, considerable portions of Staffordshire, Shropshire, Gloucestershire, Warwickshire, Herefordshire and Oxfordshire, giving a total area of approximately 1 800 sq. miles in parts of seven counties. Within that area they had a number of separate electricity undertakings. In addition to those previously reported were Banbury, in Oxfordshire, Ledbury, in Herefordshire, Stratford-on-Avon, in Warwickshire, Shipston-on-Stour, in Gloucestershire, and Church Stretton, in Shropshire.

The company's area offered many exceptional features which might claim favourable attention of industrialists, for it was well served by railways, good roads and a network of canals. The company had established an estates department, which was in a position to provide information concerning sites, and availability of labour to industrialists in search of the most economic conditions for enterprise, including the supply of cheap electric power.

The report and accounts were adopted, and a resolution was passed creating 350 000 new shares of £1 each to be called 6% cumulative preference shares.

COMMERCIAL INFORMATION.

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debt. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

ALLCOCK, Mr. H. E., Thundersley, wireless engineer. £30 8s. 2d. March 6th.

BAINES, Mr. G. T., High Street, Gorleston-on-Sea, radio dealer. £15 2s. 8d. March 19th.

BENN, Mr. L., St. Annes Road, Southend (trading as SOUTH-END ELECTRIC LAMP CO.). £10 2s. 4d. March 4th.

BLOOD, Mr. R., Ebbenstein Road, Colwyn Bay, wireless dealer. £18 18s. 9d. February 26th.

BROADWAY LIGHTING CO., 204, The Broadway, Cricklewood. £11 9s. 10d. February 27th.

BROWNING, Mr. T. E., 28, Pleydell Avenue, Stamford Brook, wireless factor. £18 3s. March 8th.

ELECTRICAL AND MEDICAL DISTRIBUTING CO., 6, Harlow Moor Drive, Harrogate. £16 3s. 2d. March 6th.

GASGOIGNE, Mr. H., 40, Cricklade Street, Cirencester, wireless dealer. £12 18s. 7d. March 7th.

GURRIN, Mr. W., 35, South End Road, Hampstead, wireless dealer. £22 15s. 7d. February 21st.

HAMBLING, CLAPP AND CO., LTD., 21, Garrick Street, W.C., wireless factors. £22 13s. 4d. March 15th.

MAKIN (GEORGE), LTD., Friargate, Preston, wireless dealers. £14 17s. 7d. March 11th.

RUNNYMEDE ENGINEERING AND ELECTRICAL CO., Dacre House, Victoria Street, Westminster. £15 7s. 7d. October 24th.

SHEEN ELECTRICAL CO., 37, Sheen Road, Richmond, electrical engineers. £30 19s. 7d. February 20th.

Bill of Sale.

HILL, Alex. Henry James, 1, South Street, Greenwich, electrical engineer. Dated April 13th, filed April 17th. £50.

Deeds of Arrangement.

THORNTON, Florence (wife of Frank Thornton), trading as FRANK THORNTON AND CO., 8, Croft Street, Burnley, electrical and wireless engineer. Dated April 17, filed April 24. Trustee, F. Clarkson, Bank Chambers, Hargreaves Street, Burnley, accountant. Liabilities unsecured, £335; assets, less secured claims, £170.

THOMAS, Arthur Glyn, trading as FURNEAUX AND THOMAS, opposite Victoria Station, Swansea, electrical engineer and contractor. Dated April 18, filed April 24. Trustee, F. E. Bendall, 35, Windsor Place, Cardiff, accountant. Secured creditors, £187; liabilities unsecured, £5 521; assets, less secured claims, £1 199.

Mortgages.

[NOTE.—*The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—allowed by the date of the Summary, but such total may have been reduced.*]

HARRIS, WILLIAMS (MANUFACTURERS), LTD., London, E.C., electricians. Registered April 5th, £2 250 debenture, to T. Hall, 37, Groat Market, Newcastle-on-Tyne, solicitor; general charge.

Satisfactions.

BAXTER AND CAUNTER, LTD., London, W., electrical engineers. Satisfaction registered April 11th, £4 000, part of amount, registered June 26th, 1924, and £3 066 13s. 4d. and £1 333 6s. 8d., registered July 12th, 1926.

ELECTRIC CONSTRUCTION CO., LTD., London, W.C. Satisfaction registered April 11th, £5 850, part of amount outstanding July 1st, 1908.

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Private Meetings, etc.

[Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.]

ALLAN (WILLIAM) AND CO. (LIVERPOOL), LTD., 62, Dale Street, Liverpool, electrical factors. The statutory meeting of creditors in this voluntary winding-up was held last week at the Law Association Rooms, Liverpool. The liquidators submitted a statement of affairs which showed ranking liabilities of £5 187, of which £5 111 was due to the trade, and £76 in respect of instalments on a car. The assets were estimated to realise £3 000, from which had to be deducted £108 for preferential claims, leaving net assets of £2 952, or a deficiency of £2 235. The assets included stocks £2 018, estimated to realise £1 500, and book debts £1 400, expected to produce £1 300. The company was registered in January 1928, with a nominal capital of £3 000, of which £2 000 has been issued. Shares to the value of £1 500 were issued for cash, and the balance of £500 were allotted for consideration other than cash. The deficiency, so far as the shareholders were concerned, was £4 235, accounted for by losses on trading totalling approximately £2 800, and the depreciation of the assets. Voluntary liquidation was decided upon as proceedings had been commenced by certain creditors. According to the balance sheet last December there was an amount due to the bank in respect of which third party guarantees had been given. The claim of the bank had, however, since been discharged. During the year to December 31st last, the sales were £16 420, with a gross profit of £1 180; but expenses totalled £3 479, and there was a net loss of £2 299. During the present year, the sales had been £3 347, with a gross profit of £107, and a net loss of £538. During the discussion, it was stated that one of the two liquidators had been a director of the company. A resolution was passed in favour of an application being made to the Court for the appointment of Mr. J. Airey (who had been elected to the chair by the meeting) as liquidator, together with a committee of inspection consisting of Mr. Parkin S. Booth, Liverpool, and the representatives of Siemens Electric Co., London, and Ferranti's, Ltd., London.

The principal creditors are :—Philips Lamps, Ltd., London, £387; Pye, W. G., and Co., London, £283; General Electric Co., Ltd., Liverpool, £364; Siemens Electric Co., London, £790; Cossor, A. C., Ltd., Manchester, £295; Ferranti Ltd., London, £237; McMichael, Ltd., London, £183; Mullard's Wireless Co., London, £175; Ferodo, Ltd., Manchester, £169; Watson, W., and Co., Ltd., Liverpool, £105; Marconiphone Co., London, £102.

INTERNATIONAL ELECTRIC CO., LTD., Ashley Road, Tottenham, N., telephone manufacturers. A meeting of the creditors of this company, convened by Messrs. Stoneham and Sons, solicitors, of 108a, Cannon Street, E.C., was held last week at the Midland Hotel, St. Pancras. A large number of creditors were in attendance, and the chair was occupied by Col. Simpson who was stated to be the largest shareholder and a director. Mr. Stoneham said that the company had been registered in 1911 and in 1927 Col. Simpson took a hand in the management. He (Mr. Stoneham) was called in in the autumn of 1927 and he found that Col. Simpson had advanced without any security a sum of £10 000. There was a prior charge on the company's assets of not less than £90,000 and the amount might ultimately be found to be nearer £100 000. In 1927 the debenture holders expressed themselves willing to stand aside and not take any immediate steps for the protection of their interests. An agreement was entered into under which Col. Simpson was given a certain amount of authority in regard to the affairs of the company but he was given no security whatever. Col. Simpson had found for this company no less than £44 800. Certain negotiations had taken place recently and he thought there was a possibility of a reconstruction on sound lines, and that the company could then attain a new lease of life. It was quite evident that on the basis of the figures he had submitted to them there was not the slightest chance of the trade creditors receiving one penny piece if a liquidation were to ensue. He appealed to the creditors to grant a moratorium, because under this scheme there was a prospect of some kind. He was empowered to put before the creditors the suggestion that had been made and if they would grant this moratorium for six months the debenture holders (Williams Deacon's Bank) would give their support and creditors would, he hoped, support the company to the extent of supplying raw material, and goods at competitive prices, against cash or guaranteed payment. It was also undertaken that if a receiver were appointed and this resulted in a realisation then the creditors would be guaranteed to be paid ten per cent. on the amount of their present debts. Mr. Stoneham said that three creditors had taken action but it was hoped that these would fall in with the scheme. The total unsecured claims at the present time so far as trade creditors were concerned were £10 251. A long discussion ensued, in the course of which many creditors expressed their views, and the representative of Mansell Booth and Co., the second largest creditors, and who had taken proceedings, stated that he could not at present undertake to fall in with the proposal made. Eventually a resolution was proposed that the trade creditors should agree to grant a moratorium for six months from the 18th instant on such terms, being not less than 10 per cent., as the committee representing three of the principal creditors agreed to. This resolution was seconded and carried.

E.A. MANUFACTURING CO., LTD. This Birmingham company, manufacturing electrical accessories, was registered in November, 1926, with a capital of £1 500, increased a year later to £3 000, in £1 shares, all of which have been issued for cash. The directors at the end of 1928 were Harold Seymore Scott, with 1 000 shares; Henry Ravely Guest, 400 shares; Frank Ernest Hands, 200 shares; Ernest Everton, 1 000 shares; and Dora Everton, 400 shares. Messrs. Scott and Everton, as debenture holders, have appointed a receiver.

London Gazette, etc.

Company Winding-up Voluntarily.

BEASLEY'S, LTD. By reason of its liabilities, April 23rd. E. C. Williams, incorporated accountant, 65, Oxford Street, Whitstable, appointed as liquidator. Meeting of creditors at 65, Oxford Street, Whitstable, Thursday, May 9th, at 2.30 p.m.

Notices of Dividends.

POWELL, Hector Baden, 10, Union Street, Hereford, wireless dealer. Second and final dividend. 1¼d. per £, payable, May 10th' Official Receiver's Office, 133, Saint Owen Street, Hereford.

SCOTT, Montagu James, 134, Regent Street, trading as MONTAGU J. SCOTT AND CO., electrical engineer and contractor. Supplemental dividend, 2s. 1½d. per £, payable Bankruptcy Buildings, Carey Street, London, W.C.2.

TEMPLE, Edward and BURKETT, Jane Eva, Mrs., trading as THE WESTOE ELECTRICAL CO., 105, Canterbury Street, South Shields, Durham, wireless dealers and electrical contractors. First and final dividend, 2s. 8d. per £, payable, May 8th, Trustee's Office, 48, Pilgrim Street, Newcastle-upon-Tyne.

Partnership Dissolved.

H. G. WESTLAKE (Henry George WESTLAKE and Albert Sidney WATERTON), electrical and wireless engineers, 16, Fountain Street, Halifax, by mutual consent as from April 1st, 1929. Debts received and paid by A. S. Waterton, who will continue the business.

Bankruptcy Proceedings.

JOLIVARD, Kenneth Paul James, electrical engineer, 66, Victoria Street, Westminster, London, S.W. This debtor attended before Mr. Registrar Francke in the London Bankruptcy Court last week for his public examination. His liabilities, according to his statement of affairs, amount to £1 486, of which £1 469 are unsecured, and his assets are valued at £68 net. It appeared that before June, 1924, the debtor was in employment. He then began business on his own account as an electrical contractor at the above address. He had no capital. He traded under the style of K. Jolivard and Co. and the business proved a success until 1927. Since then, however, it had gradually declined and in July last, in consequence of keen competition and pressure by creditors, he was obliged to discontinue. He was afterwards without occupation, and he attributed his insolvency to lack of capital, to bad trade, and to keen competition.

The examination was concluded.

METAL AND CHEMICAL PRICES.

TUESDAY, April 30th.

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£78 5 0	—	£2 15 0
Electro Wirebars	,,	£84 0 0	—	—
H.C. Wires, basis	per lb.	11⅛d.	—	—
Sheet	,,	1s. 0d.	—	—
Phosphor Bronze—				
Wire (Telephone) basis	per lb.	1s. 2⅛d.	—	—
Brass 60/40—				
Rod, basis	per lb.	9d.	—	—
Sheet ,,	,,	10⅛d.	—	—
Wire ,,	,,	11⅛d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£3 11 0	—	—
Galvanised Steel Wire, basis 8 S.W.G.	,,	£14 15 0	—	—
Lead Pig—				
English	per ton	£26 0 0	—	5s. 0d.
Foreign or Colonial	,,	£24 7 6	—	10s. 0d.
Tin—				
Ingot	per ton	£198 15 0	5s. 0d.	—
Wire, basis	per lb.	2s. 7¼d.	—	—
Aluminium Ingots	per ton	£95 0 0	—	—
Spelter	,,	£26 15 0	—	—
Mercury	per bottle	£22 5 0	—	—

Sulphur—Flowers, Ton £12 0 0 *Copper Sulphate*—Ton £25 to £25 10 0
,, Roll, ,, £10 10 0 *Boric Acid* (Crystals) ,, £30
Sulphuric Acid (Pyrites, 168°) Ton £6 15 0 *Sodium Chlorate*—Per lb. 2⅛d.
Sodium Bichromate—Per lb. 3½d.
Rubber—Para fine, 11d.; plantation, 1st latex, 9⅛d.
∴ The metal prices are supplied by British Insulated Cables Ltd.

THE LEAD MARKET.

The lead market last week opened a little firmer, but according to James Forster and Co. prices since then lost ground daily. The backwardation has also contracted slightly. The American market is steady but quiet with the official price unchanged at 7 cents. per lb.

Closing prices on April 26th were £24 7s. 6d. for April, £24 5s. for May, £24 1s. 3d. for June, and £23 18s. 9d. for July, 8s. 9d. to 6s. 3d. lower on the week.

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PATENT RECORD.

The following information is prepared from the Illustrated Official Journal (Patents, by permission of the Controller of H.M. Stationery Office. Printed copies of full Patent Specifications, when accepted, may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at 1s. each.

Specifications Accepted.

289 374 LANDIS AND GYR SOC. ANON. Driving system for electric induction meters. (25/4/27.)
307 647 J. E. POLLAK (HERMSDORF-SCHOMBURG-ISOLATOREN GES.). Lead-through insulators. (5/4/28.)
307 648 A. F. BURGESS (J. H. GRAVELL). Method of and apparatus for electric resistance welding. (13/4/28.)
307 651 J. MCCALLUM. Electrical conductors. (18/4/28.)
291 373 E. JAEGER ETABLISSEMENTS. Electric contacts, particularly for electrically actuated clockwork. (31/5/27.)
289 809 BRITISH THOMSON-HOUSTON CO., LTD. Cutters for electric fuses. (2/5/27.)
290 176 G. SOMAJNI. Electrodynamic braking-apparatus for use in electric vehicles. (7/5/27.)
290 678 INTERNATIONAL GENERAL ELECTRIC CO., INC. Electric braking systems. (19/5/27.)
292 945 G. MAAG-ECKENFELDER. Contact pins for electric plugs. (27/6/27.)
300 252 E. REISZ. Circuit arrangements suitable for biassing electrostatic loud speakers. (10/11/27.)
292 996 W. E. DATE. Electric motor control systems. (29/6/27.)
298 598 F. DWORZAK. Electric welding. (12/10/27.)
292 537 SIEMENS-SCHUCKERTWERKE AKT.-GES. Circuit connection for direct-current electric machines with two shunt windings. (21/6/27.)
307 673 GENERAL ELECTRIC CO., LTD., and H. W. CRON. Fastenings for cables and casings. (22/6/28.)
307 684 A. H. MARKS and P. RUSSELL (legal representatives of E. C. R. MARKS, deceased). (BATTERIEN-UND ELEMENTE-FABRIK SYSTEM ZEILER AKT.-GES.). Soldering of conductors to small electric batteries. (16/7/28.)
307 389 F. MERK. Circuit arrangement for automatic telephone exchanges. (5/12/27.)
307 390 W. S. SMITH, H. J. GARNETT, and H. C. CHANNON. Electrical insulating materials. (2/9/27.)
300 618 BASTIAN-MORLEY CO. Heating-apparatus. (13/4/27.)
307 534 GENERAL ELECTRIC CO., LTD., and N. E. BARBER. Refrigerating apparatus. (9/12/27.)
307 545 A. WHITAKER, M. B. MANIFOLD and GRAMOPHONE CO., LTD. Controlling intensity of a beam of light in accordance with electrical oscillations, for use, for example, in recording sound. (10/12/27.)
295 351 SOC. DES ETAB. INDUSTRIELS DE E. C. ET DE A. GRAMMONT. Ionic valve with two anodes and two grids. (10/8/27.)
282 632 ARCTURUS RADIO CO. Power-operated vacuum tube construction, and circuit therefor. (24/12/26.)
307 955 BRITISH THOMSON-HOUSTON CO., LTD., L. M. T. BELL, and F. E. SMITH. High-tension ignition devices. (18/11/27.)
307 982 S. G. S. DICKER (N. V. Philips' Gloeilampenfabrieken). Electric discharge tubes. (21/11/27.)
307 718 J. STONE AND CO., LTD., and A. H. DARKER. Thermostatic controls for dynamo-electric machines. (6/12/27.)
307 957 H. G. BELL, T. W. ROSS, and ASSOCIATED ELECTRICAL INDUSTRIES, LTD. Protective gear for alternating-current systems. (7/12/27.)
307 767 P. WILSON. Mounting of vibrating reeds, more particularly for use in connection with electromagnetic gramophone pick-ups, loud-speakers, and the like. (9/12/27.)
282 739 SIEMENS-SCHUCKERTWERKE AKT.-GES. Mechanical relay for transmitting moving impulses. (24/12/26.)
307 726 J. STONE AND CO., LTD., C. J. LYTH, and F. J. PIKE. Methods of and apparatus for electrolytically depositing metal on tubes. (12/12/27.)
307 959 STANDARD TELEPHONES AND CABLES, LTD., and J. R. GOULD. Automatic or semi-automatic telephone systems and apparatus. (13/12/27.)
307 812 BRITISH THOMSON-HOUSTON CO., LTD., and L. J. DAVIES. Thermionic valves. (13/12/27.)
307 960 F. WARBURTON. Telegraph printers. (13/12/27.)
307 774 N. EVILL. Electric lamp standards and fitments therefor for use on arm-chairs and other articles of furniture. (13/12/27.)
307 855 MUIRHEAD AND CO., LTD., E. S. HEURTLEY, and J. V. FOLL. Electrically-driven tuning forks or reeds. (13/12/27.)
307 781 AUTOMATIC TELEPHONE MANUFACTURING CO., LTD., and C. R. WOODLAND. Mounting arrangements for fuse panels and the like as used in telephone exchanges. (13/12/27.)
307 961 A. EIDINOW and HEWITTIC ELECTRIC CO., LTD. Apparatus for the production of ultra-violet light. (13/12/27.)
307 856 E. Y. ROBINSON and ASSOCIATED ELECTRICAL INDUSTRIES, LTD. Vacuum electric tube devices. (13/12/27.)
307 857 E. Y. ROBINSON and ASSOCIATED ELECTRICAL INDUSTRIES, LTD. Vacuum electric tube devices. (13/12/27.)
307 962 A. K. CROAD (Hanovia Chemical and Manufacturing Co.). Process for securing good electrical contact with crystalline cuprous oxide. (14/12/27.)
282 401 W. A. MAAS and P. F. GRINSTEAD. Electrically operated typewriting-machines. (14/12/26.)
283 201 ASSOCIATED TELEPHONE AND TELEGRAPH CO. Telephone systems. (7/1/27.)
307 964 A. V. TOMLINSON (Westinghouse Air Brake Co.). Electrically-controlled fluid-pressure apparatus, particularly applicable for operating brakes. (15/12/27.)
307 966 W. E. BEATTY (BELL TELEPHONE LABORATORIES, INC.). Insulating-materials and methods of production thereof. (15/12/27.)
307 967 A. GREEN. Impulse-transmitting devices for electric switches or make-and-break contacts. (16/12/27.)
307 973 W. S. SMITH, H. C. CHANNON, A. L. MEYERS, and N. G. R. PARTRIDGE. Loaded electrical conductors. (16/12/27.)
307 977 STANDARD TELEPHONES AND CABLES, LTD., and E. P. G. WRIGHT. Automatic or semi-automatic telephone systems and apparatus. (17/12/27.)

Applications for Patents.

February 20th.

5 641 MARCONI'S WIRELESS TELEGRAPH CO., LTD. Radio communication systems, etc. (20/2/28, U.S.)
5 593 G. METCALF. Electric switch.
5 604 J. A. MUNRO. Electric switches.
5 688 C. W. NADAL and E. A. V. SANFTLEBEN. Number dials for telephone systems, etc.
5 591 R. T. NORTON. Electric wires, etc.
5 661 S. L. PRICE. Electromagnetic sound-reproducing devices.
5 670 G. PRIECHENFRIED and WIRELESS PICTURES (1928), LTD. Electrical transmission of pictures, etc.
5 596 D. E. ROGERS and VERITYS, LTD. Electrical switches.
5 673 SIEMENS-ELEKTROWARME GES. Electric irons. (28/2/28. Germany.)
5 572 H. F. YELLAND. Electric switchgear.

February 21st.

5 747 J. H. BAKER. Telephone systems.
5 809 C. R. BATES. Electric fuses.
5 569 F. B. BENSON. Signal amplifiers for wireless apparatus.
5 768 BRITISH POWER RAILWAY SIGNAL CO., LTD., J. H. GRAHAM, — PARSONS, and RELAY AUTOMATIC TELEPHONE CO., LTD. Signalling apparatus, etc.
5 735 J. N. CHAVIARA and J. F. GILL. Apparatus for regulation, etc., of electric currents.
5 718 T. CLARKE, E. EYRE, and W. HARRISON. Casings for electric lampholders.
5 820 GARRARD ENGINEERING AND MANUFACTURING CO., LTD., and H. V. SLADE. Controllers for electric motors.
5 806 C. LORENZ AKT.-GES. Apparatus for picture telegraphy, etc. (21/2/28, Germany.)
5 785 N. W. MCLACHLAN. Thermionic amplifiers.
5 770 A. W. MALEY and E. M. TAUNTON. Braking electrically propelled rail vehicles.
5 757 G. MARR. Electric switches.
5 758 DR. P. MEYER AKT.-GES. Mercury switches. (23/2/28, Germany.)
5 711 L. A. RAMSDEN. Electric signs.
5 779 SIEMENS AND HALSKE A.G. Electric remote control installations. (29/2/28, Germany.)
5 801, 5 803 F. S. SMITH. Transformers.
5 802 F. S. SMITH. High voltage terminal.
5 746 STANDARD TELEPHONES AND CABLES, LTD. Carrier telegraph alarm system. (6/3/28, U.S.)
5 747 STANDARD TELEPHONES AND CABLES, LTD. Telephone systems.
5 759 STANDARD TELEPHONES AND CABLES, LTD. (WESTERN ELECTRIC CO.). Method of producing carbon granules.
5 813 STANDARD TELEPHONES AND CABLES, LTD. (WESTERN ELECTRIC CO.). Secret signalling methods. (21/2/28, U.S.)
5 703 B. H. STARK. Holders for electric trolley pulleys.

February 22nd.

5 940 A. E. ANGOLD and GENERAL ELECTRIC CO., LTD. Switches, etc.
5 941 A. E. ANGOLD and GENERAL ELECTRIC CO., LTD. Automatic control of electric power supply units.
5 861 E. ASCH. Thermionic amplifiers. (22/2/28, Germany.)
5 924 AUTOMATIC TELEPHONE MANUFACTURING CO., LTD., and T. B. BLASHILL. Circuit arrangements employing gas discharge tubes.
5 918 BRITISH THOMSON-HOUSTON CO., LTD., R. L. CHANTRILL, and F. J. LANE. Electric protective arrangements.
5 935 A. H. CURTIS and IGRANIC ELECTRIC CO., LTD. Electrical contacts.
5 917 ELEKTRIZITATS AKT.-GES. HYDRAWERK. Electric condensers. (22/2/28, Germany.)
5 840 W. FENTON. Electric cigarette lighters.
5 939 GENERAL ELECTRIC CO., LTD., M. S. H. HUNT, and C. W. STOPFORD. Thermostatic electric switches.
5 928 L. MELLERSH-JACKSON (SIEMENS AND HALSKE A. G.). Electromagnetic relays.
5 891 T. D. KELLY and G. E. LEAVEY. Electric furnaces.
5 837 S. LOEWE. Electron discharge devices. (22/2/28, Germany.)
5 930 E. H. NEWMAN. Means for supplying h.t. current to thermionic valves.
5 931 E. H. NEWMAN. Wireless receiving apparatus.
5 890 A. J. ROWE. Thermionic valve amplifying circuits.
5 927 SIEMENS-SCHUCKERTWERKE A.G. Transformers. (25/2/28, Germany.)
5 872 W. B. SMITS. Electrical resistances. (23/2/28, Czecho-Slovakia.)
5 820 SOC. ANON. CALOR, and L. TROUILHET. Electric irons.
5 894 J. B. TAUNTON. Electric lampholders.
5 874 H. WALTER. Cable telegraphic transmission, etc.

February 23rd.

6 048 BENJAMIN ELECTRIC, LTD. Securing glass covers to reflector shades, etc. (1/3/28, U.S.)
6 016 BRITISH THOMSON-HOUSTON CO., LTD., C. G. MAYO, and J. C. READ. Mercury arc rectifiers.
6 017 BRITISH THOMSON-HOUSTON CO., LTD., H. DE B. KNIGHT, and J. C. READ. Electrical measuring instruments.
6 043 FEDERAL TELEGRAPH CO. Piezo-electric crystal apparatus. (25/2/28, U.S.)
6 051 C. GILLINGS. Telephone systems.
5 969, 5 970 T. R. HOLLIS. Suspension chains for electroliers, etc.
6 047 H. L. JAMES and E. LEVEY. Luminous devices for electric switches.
6 015 J. KOHNSTAM. Electric switches.
6 001 E. H. NEWMAN. Wireless receiving apparatus.
5 973 S. SINCLAIR. Safety device for thermionic valves.
6 014 WESTERN ELECTRIC CO., LTD. (BELL TELEPHONE LABORATORIES, INC.). Insulating materials.

February 25th.

6 088 ARCTURUS RADIO TUBE CO. Filament for vacuum tubes. (25/2/28, U.S.)
6 115 G. BAMBURG. Primary battery.
6 196 R. BERTRAND. Electric wave apparatus for production of music. (25/2/28, France.)
6 086 F. J. BRISLEE and BRITISH INSULATED CABLES, LTD. Insulation of electric wires, etc.
6 159 BRITISH THOMSON-HOUSTON CO., LTD. Electron discharge devices. (10/4/28, U.S.)
6 218, 6 219 C. O. BROWNE GRAMOPHONE CO., LTD., and A. WHITAKER. Mercury vapour discharge devices.

COMING EVENTS.

Saturday, May 4th.

INSTITUTION OF ELECTRICAL ENGINEERS (LONDON STUDENTS' SECTION).—Visit to Mr. R. Borlase Matthews's "all-electric" farm, East Grinstead, Sussex.

Tuesday, May 7th.

ELECTRICAL CONTRACTORS' ASSOCIATION (DERBY BRANCH).—Ordinary meeting.
INSTITUTE OF METALS.—36, Victoria Street, Westminster. Lecture by Sir Oliver Lodge, F.R.S., on "Some Ideas about Metals."
INSTITUTION OF CIVIL ENGINEERS.—Great George Street, Westminster. 35th James Forrest Lecture on "Roads and Road Transport," by Sir Henry P. Maybury. 6 *p.m.*
TELEVISION SOCIETY.—Engineers' Club, Coventry Street, London. Paper by Capt. R. Wilson on "Some Practical Considerations in the Building of Television Apparatus." 8 *p.m.*

Wednesday, May 8th.

ELECTRICAL CONTRACTORS' ASSOCIATION (EASTBOURNE SUB-BRANCH).—South Street. Ordinary meeting.
ELECTRICAL CONTRACTORS' ASSOCIATION (SHEFFIELD BRANCH).—Ordinary meeting. 5.30 *p.m.*
OVERHEAD LINES ASSOCIATION.—Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London. Paper by Col. W. A. Vignoles on "Getting Consumers in Rural Areas." 5.30 *p.m.*
POLYTECHNIC SCHOOL OF ENGINEERING.—307-311, Regent Street, London. Lecture I (Course of six lectures) by Mr. W. H. Date on "Thermionic Valves." 6.30 *p.m.*

Thursday, May 9th.

ELECTRICAL CONTRACTORS' ASSOCIATION (EAST YORKS BRANCH).—Metropole Hall, Hull. Ordinary meeting.
ELECTRICAL CONTRACTORS' ASSOCIATION (BIRMINGHAM BRANCH).—Ordinary meeting.
ELECTRICAL CONTRACTORS' ASSOCIATION (NOTTINGHAM BRANCH).—Ordinary meeting.
INSTITUTION OF ELECTRICAL ENGINEERS.—Savoy Place, Victoria Embankment, London. Annual general meeting. 6 *p.m.*

The meeting of the Meter and Instrument Section of the Institution of Electrical Engineers, which was to have taken place to-day (Friday) at 7 p.m., has been cancelled. See page 533.

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THE ELECTRICIAN

Established 1861. The Oldest Weekly Illustrated Journal of

Electrical Engineering, Industry, Science and Finance.

Bouverie House, 154, Fleet Street, London, E.C.4. Telegrams: "Benbrotric, Fleet, London."
Telephone: City 0244 (Ten lines).

[Closed on Saturdays in accordance with the "Five-Day Week" plan adopted by Benn Brothers, Ltd., and its associated organisations.]

No. 2658. [No. 19. Vol. CII.] Friday, May 10, 1929. Annual Subscription, 25s. Overseas, 30s.

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Current Topics.

Raw Materials.

COMMENCING with the special Raw Materials and Manufacturers' Supplies issue published last November, we planned to publish a detailed survey of the raw materials and specialised manufacturing equipment available to electrical firms. In the second issue of each month we are dealing in turn with every class of material, and the whole series, which will occupy an extensive period, promises a wealth of useful, and mainly hitherto unpublished information. Already we have dealt with synthetic resin products, insulating varnishes, untreated fabrics for insulating purposes, metals for conductors, etc., and in the present issue special attention is devoted to pressboard, the development of which material for electrical purposes furnishes a remarkable instance of the rapid rise in the status of a third-rate insulator to a degree of suitability for some of the most important applications in the manufacture of high voltage apparatus, including the insulation of big transformers for the "grid." As the subject has received such little attention in the past, the information now given by Messrs. DUNTON AND MUIR should prove useful, as illustrating recent improvements in the characteristics of pressboard, and indicating the important position now occupied by this material for insulating purposes. It is of incidental interest that until the outbreak of the Great War our supplies of this material, both for its original use in the finishing and pressing of woven fabrics, and for the electrical employment for which it was adapted, were all received from foreign sources. It was the difficulty of war-time restrictions which led British electrical manufacturers to investigate the electrical possibilities of pressboards, and it is pleasing to note that those investigations paved the way for the home-production of supplies and their substitution for some of the costly materials used in the manufacture of transformers prior to 1914.

Education in Installation Work.

To those who have noted with apprehension the dearth of technically trained personnel in some sections of the industry, the foresight shown by the Electrical Contractors' Association in taking a practical part in the training of apprentices in the installation trade, has, for some years, been a source of gratification. By advocating the extension of indentured apprentices, by offering facilities for lads to receive adequate training, aud by the regular provision of gold, silver and bronze medals with money awards to apprentices of outstanding ability, the E.C.A. has already gone far towards ensuring that steady influx of competent employees which is so desirable in the interests of contractors and public alike. The Association's efforts in this direction have been carried a stage further by the formation, in co-operation with the City and Guilds of London Institute, of an Advisory Committee on Electrical Installation Work, including representatives both of the industry and a number of educational authorities. This committee has drafted a new scheme of syllabuses and of certificates in electrical installation work, and this has been adopted by the City and Guilds for the purpose of their examinations and by the E.C.A. in connection with its apprenticeship scheme. An important recommendation is made to education authorities that preparatory courses should be provided for boys aged from 14 to 16 years, and designed to cover the critical period of two years between the elementary and the technical school. It is hoped that by such courses the interest of boys may be turned from the usual "blind alley" occupations and in the direction of electrical matters, with a view to their subsequent entry into the electrical industry.

The Central Board's Report.

ELSEWHERE in this issue we give some of the salient features in the first annual report of the Central Electricity Board, which covers the period from the Board's appointment to December 31st last. For an official publication it is surprisingly well-produced, and the large and pleasant-looking type in which it has been set up is an invitation to detailed study of what is a thoroughly interesting and workmanlike production. The story it tells is one of steady, co-ordinated work in one well-defined direction, and, regarded as the first mile-post on the road to a national interconnected supply network, it can only be regarded as a remarkable piece of work. In the short period of its existence the Board has adopted schemes providing for 74·6% of the population of the country, but as this publication is concentrated in only 42·8% of the total area, it is inevitable that the part of the Board's work which is still before it, i.e., the adoption of schemes to cater for the remaining 25·4% of the people who are scattered over 57·2% of the area of the whole country, will present difficulties which have been absent from earlier schemes. So far as they have gone with their work—and this report gives some idea of the vast amount of detail involved—

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the Board has interpreted in the happiest possible manner the spirit as well as the letter of the much abused Electricity (Supply) Act of 1926.

Newcastle's Great Show.

NEXT Tuesday the North-East Coast is, in its characteristically big way, opening an exhibition which for size and interest can be rated as second only to Wembley. The main purpose of the North-East Coast Exhibition is to restore the flagging fortunes of an area which has pioneered many important industrial developments and has recently suffered the economic changes which have rendered many of the local industries unprofitable. In the place of these vanished activities it is hoped to found new industries which will benefit by the wonderful facilities of convenient siting and "cheap and abundant" supplies of electricity which are ready to hand. This bold bid is one that we can all hope to see succeed. Electrically and generally, Tyneside industry has many interesting things to show, and we hope that all who can will make an early opportunity to pay a personal visit to Newcastle's great exhibition.

Window Displays.

THOSE electrical contractors and supply undertakings who have taken part in the E.D.A. Selling Campaign will be interested to learn of a Window Display Competition which has been organised by the London "Evening News" and the British Association of Display Men, details of which will be found elsewhere in this issue. Since the competition is to be held during the last few days in May, electrical entrants need have no fear that the May cooking display of the E.D.A. will be materially affected; neither will the June arrangements be interfered with. In fact, the enterprising contractor may arrange three different windows in as many weeks, each one telling a different story. The competition in question includes a section devoted to windows showing "things to use," including, of course, domestic and other electrical appliances, and in this class lies the contractor's opportunity to show his skill. The goods shown must be of British manufacture, and preliminary judging of their presentation will be carried out by a personal visit of the judges. With the experience gained from battery manufacturers' competitions, electric sweeper competitions, C.E.D.A.C., etc., the electrical retail trade should now be in a position to show a window strong in originality and compelling as a sales force; further, since electrical goods do not appeal to a specialised public, the subject of the display may range from the reception of wireless pictures to the heating of water by electricity.

Battersea Again.

LIKE many of our readers we dislike the sort of publicity that the electrical industry is securing in the daily Press, following the protests that have been so widely made against the erection of the new power station at Battersea and the extension of the Fulham station. Leading articles, correspondence columns, and even Royal Academy banquets, now seem incomplete unless some reference is made to the vexed question. The grounds of complaint are —quite without foundation—widening to include black smoke and grit, and the sources of complaint are being similarly expanded, first to Brimsdown, next to the Clarence Dock station at Liverpool. As we have urged before, no electricity supply undertaking should ever merit the description "soulless utility," which was so publicly applied by the Archbishop of Canterbury, and it cannot command public support when the public believes that the benefits it confers in one way are more than counterbalanced by the real or imaginary nuisance and damage it may cause in another way. This public criticism, we feel, is getting out of hand, and steps should be taken to cope with it without delay. Hardly anyone in the land can be in ignorance of the case against Battersea, and other projects of a similar nature, but the general public has yet to hear an authoritative, convincing statement of the other side of the question. If we can make out a good case for proceeding against public opinion as expressed to-day, let us boldly tackle the problem of converting the objectors. To ignore the protests, in the hope that the storm will blow over, only serves to stiffen the backs of the opposition. A suitably-phrased statement issued by the Electricity Commissioners would do much, at this juncture, to put the matter on a more satisfactory footing.

E.T.B.I. Progress.

AMPLE proof is afforded in the annual report of the Electrical Trades' Benevolent Institution, not only of the growing importance of its activities, but also of its improving finances. Each year sees an increase in the number of people assisted, and during the year under review over 400 grants were made, against 221 for the preceding year. Once again, however, the Council are able to report that every qualified applicant has received assistance. An extension of the Institution's beneficent work has been the initiation of a pensions scheme, and since April, 1928, seven pensions have been awarded. The results have been so gratifying that the scheme will probably be extended in the current year to enable more beneficiaries to enjoy the advantages of a fixed income. The Institution does not seem to be sufficiently well known among those classes of electrical men who are most likely to stand at some time in need of its assistance, and as participation on a contributory basis is now possible for all, at a cost of as little as five shillings a year, we hope that employers and others interested will make special personal efforts to secure an increase in the number of associates, who, for their contribution of little more than a penny a week, are entitled to the benefits of membership of the Institution.

The National Radio Exhibition.

THIS year's radio exhibition, which will be held at Olympia during September, will be the first to be held in London at which the public may listen to organised loud-speaker demonstrations on the stands of the exhibitors. In contrast to the "pig in a poke" methods of previous years the man-in-the-street visiting this year's show will, at least, hear working what he buys before he takes it home, and though demonstrations of actual broadcast reception will not be permitted to exhibitors, a common transmission will be supplied by the organisers of the show at certain times of the day. Whether this transmission will be in the nature of a relay of broadcast reception, gramophone records, or the exhibition band, we do not know, but whatever it is to be it will, we feel sure, afford considerable opportunities for increased trade, permitting, as it will, the separation of the "sheep from the goats" in the way of loud-speaker units. Though we still favour the German method of erecting broadcast reception cabinets for wireless exhibition purposes, the common transmission scheme of the Radio Manufacturers' Association is a good one, for wherever a loud-speaker is working its output will, in substance, if not in quality, be the same as its neighbours, thus avoiding the medley of sounds likely to result from other methods where special cabinets are not provided. The condition attached to these demonstrations—that no amplifiers be used—is also good, for the public is thus assured that all instruments will receive a common "signal strength" and may therefore be judged on their individual merits.

Illumination Design.

WE are glad to note that a further Illumination Design Course is being planned by the E.L.M.A. Lighting Service Bureau. The nineteenth of the series is to be held from June 10th to 14th, and the subjects to be dealt with include a number which have not received attention in previous courses. The value of these efforts is so widely recognised that it is unnecessary for us to emphasise the fact that attendance is amply repaid. It may be added, however, that the recent remodelling of the interior of the premises provides considerably improved facilities for realistic demonstrations to accompany the lectures.

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ELECTRICAL PRESSBOARDS.

Developments which have led to Important Applications in the Manufacture of High Voltage Apparatus—Improved Electrical Characteristics—Manufacturing Processes.

By A. R. DUNTON, A.M I.E.E., and A. W. MUIR, D S.O., M.C., B.Sc.

THE development of electrical pressboards constitutes a remarkable, if not unique, example of a material rising in a few years from the status of a third-rate insulator to that of one suitable for the most important applications in the manufacture of high voltage apparatus. In spite of this the subject has received little attention in articles and other publications dealing with insulating materials, and it is safe to say that the majority of engineers have not realised the improvements which have been effected in the characteristics of pressboard, and the important position now occupied by this material for insulating purposes.

Variously known as pressboard, presspahn or fullerboard, the material was originally manufactured for use in the finishing and pressing of woven fabrics, and it is from this use that its name is derived. Prior to 1914 the supplies of the material, both for its original purpose and for electrical applications for which it was adopted, were derived largely from Germany and America. It was the stoppage of one source, and restrictions upon supplies from the other, that led electrical manufacturers in this country to seek their requirements from British makers, and to co-operate with those makers for the production of a material of better electrical characteristics. One particular object of the investigations was to produce an inexpensive substitute for the costly materials then employed in transformer manufacture.

Important Results.

An account, probably the only one published, of some of this research work, which has led to very important results, is given in an article by A. P. M. Fleming and Allan Monkhouse in THE ELECTRICIAN of November 25th, 1921. In that article the authors describe an investigation carried out by Messrs. B. S. and W. Whiteley, Ltd., and the Metropolitan Vickers Research Department, and the development of an early form of one of the new varieties of pressboard in which

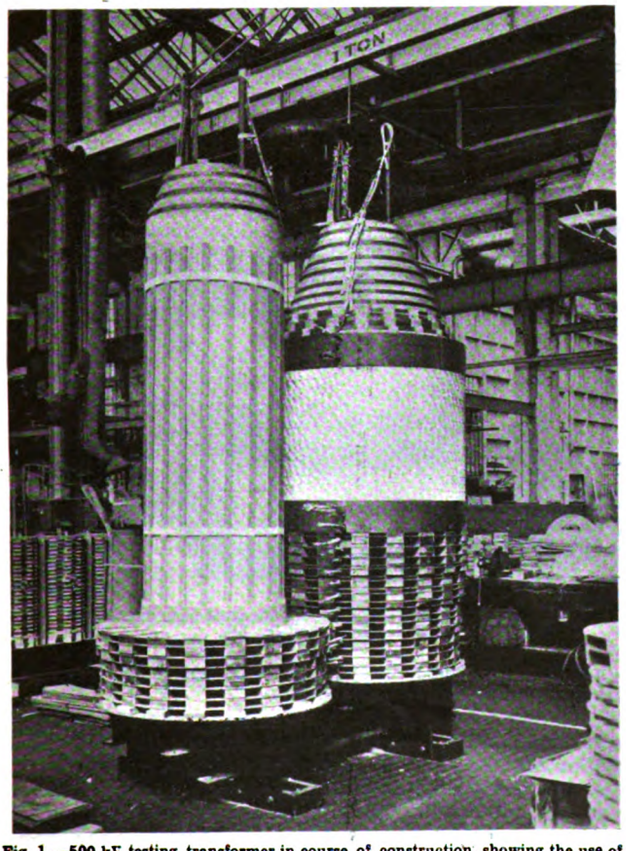

Fig. 1.—500 kV testing transformer in course of construction, showing the use of pressboard insulation.

greatly improved electrical characteristics have been obtained. In the investigation samples from a large number of British and foreign manufacturers were examined by X-rays, under the microscope, by chemical analysis and by electrical tests. The X-ray examination disclosed in some samples the presence of metallic particles, probably due to such things as buttons, pins, and other fastenings getting into the beaters with old

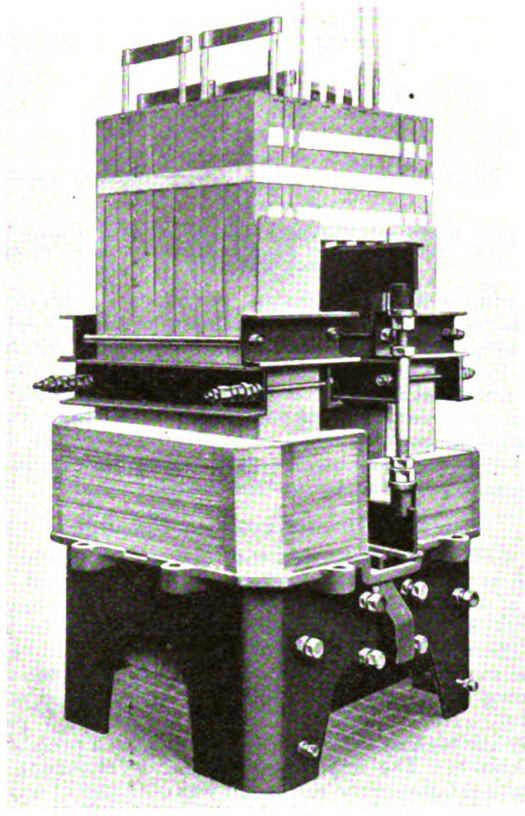

Fig. 2.—66 kV transformer under construction with pressboard insulation.

rags, ropes, packings, etc., used as the raw materials. Apart from this weakness, which was easily remedied, the investigation showed that the nature of the fibre employed was an important factor in determining the electrical strength. The conclusions reached in this respect were summarised as follows :—

(1) Wood-pulp boards are too stiff for most purposes and liable to age rapidly, although their electric strength is good.
(2) Cotton-pulp boards are soft, porous, yield a high electric strength, and are very pliable.
(3) Jute and hemp pulp boards show a high electric strength, but being made from highly lignified fibres they become very brittle after prolonged immersion in hot oil.
(4) Linen pulp boards are tough, pliable, and show a high electric strength.

Two further important conclusions reached were :—

(1) The electric strength of pressboard is directly proportioned to the density for any class of raw material.
(2) The porosity and ability to absorb liquids also bears a direct relationship to density but is modified by the nature of the finish imparted to the board and by the means used to produce the denser boards.

As a result of these conclusions development proceeded on the lines of mixing various proportions of jute and cotton fibres, in order to combine the strong interlaced structure of the cotton board with the close-knit character of the jute board. A mixture which gave a high electric strength together with mechanical strength and flexibility was adopted, and the resultant pressboards, given the trade name of " Elephantide," were put on the market in various grades. In subsequent developments, it may be noted, the use of jute fibres has been greatly reduced, owing to the poor ageing qualities of these fibres in hot oil.

The co-operation between pressboard makers and electrical

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users has been steadily continued, and the progressive improvement in the material has fully justified the research work involved. Whereas the use of pressboard in its original form was confined to small parts in low voltage insulation, the improved material is now extensively used for general insulation purposes even in large units and, in selected grades, in transformers and other apparatus for the highest voltages of

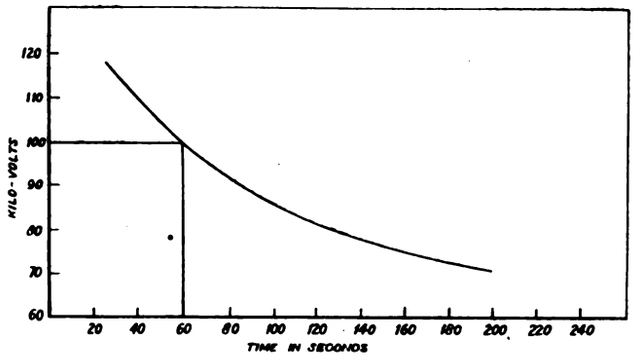

Fig. 3.—Curve showing results of electric strength tests in oil at 90 deg. C. on a special "Elephantide" pressboard ¼-in. thick, dried 48 hours, oil-saturated 48 hours, at 90 deg. C.

transmission systems and testing equipment. Figs. 1 and 2 show striking examples. Fig. 1 illustrates the extensive use of pressboard insulation in a 500 000 V testing transformer, one of two units built by the Metropolitan-Vickers Electrical Co. for use together to give 1 000 000 V. Fig. 2 shows, in course of construction, a 66 000 V shell-type transformer, in which also the use of pressboard is clearly seen. High grade pressboard is also being used to a great extent in the insulation of 132 000 V transformers for the British "grid."

Further Improvements Possible.

That still further improvements may yet be made, as, for instance, by the blending of other fibres, is indicated by the results of tests upon a special board recently produced by Messrs. B. S. and W. Whiteley, Ltd. The actual test results on this board are shown in Fig. 3, from which it will be noted that the material, though only ⅛ in. thick, gave one-minute breakdown voltage values of 100 000 V when tested in oil at 90 deg. C. This value represents a stress of 770 V per mil, probably the highest figure ever obtained with a pressboard of this thickness. The importance of the development is the more marked because the test result was obtained at 90 deg. C. The value should not be confused with results which are often given for tests at 20 deg. C., since there are many materials which appear good when tested at normal temperature, but virtually become conductors at 90 deg. C.

It is gratifying to record that this remarkable material is a British product, and interesting to add that it is produced by hydro-electric plant under almost ideal conditions in the open country of Yorkshire, far from the contamination of smoke or chemical fumes.

As a result of a survey of the materials produced by various manufacturers, a specification (No. 231) has been issued by the B.E.S.A. This specification recognises four grades of pressboard, described as follows:—

GRADE I.—Hard, non-porous, untreated pressboard having a density not less than 1·15 grammes per cu. cm. and not exceeding 1·30 grammes per cu. cm. after 18 hours' drying at 80 deg. C., and characterised by a relatively high electric strength.

GRADE II$_a$—Soft, untreated pressboard having a density less than 1·15 grammes per cu. cm., but not lower than 0·90 grammes per cu. cm. after 18 hours' drying at 80 deg. C., and consequently having a relatively lower electric strength combined with greater absorption than Grade I pressboard.

GRADE IV.—Extra dense, untreated pressboard having a density exceeding 1·3 grammes per cu. cm. after 18 hours' drying at 80 deg. C. and characterised by a higher electric strength than Grade I.

GRADE V.—Thin, untreated pressboard having a density not less than 1·15 grammes per cu. cm. and relatively great flexibility and high tensile strength after 18 hours' drying at 80 deg. C. (This class of pressboard is specially adapted for slot lining and similar purposes.)

NOTE.—In addition to the above, a further grade of pressboard is recognised for electrical purposes, as follows:—
GRADE III.—Pressboard impregnated during manufacture with varnish oil, wax, and the like to improve its electrical properties. This grade is not included in this specification, but a separate specification for impregnated pressboard is under consideration.

The specification gives curves showing the minimum permissible one-minute breakdown voltages for the various grades when tested in air at 90 deg. C. A general impression of the standards set may be given by the following readings taken from the curves:—

1 MIN. BDV—VOLTS-PER-MIL IN AIR AT 90 DEG. C.

	Specimen 1/32 in. thick	⅛ in. thick
Grade I	260	218
,, II	240	204
,, IV	300	255
,, V	270	—

The value for Grade V, which is used in thin sheets, is not given beyond a thickness of 0·04 in., at which it is 260 V per mil.

The best electrical boards conforming with the requirements of the B.E.S.A. Specification are produced from specially selected and blended fibres. The raw material is treated by boiling, beating and straining processes similar to those of paper making, so as to form a highly hydrated cellulose pulp. The "beating" process consists of disintegrating the fibres by the action of blunt knives in a power-driven machine. Many modifications and improvements have been made in this process in order to produce fibres as long as possible, and so obtain maximum flexibility in the finished board.

The prepared pulp is allowed to flow on to running endless belts which pass over vacuum drainage chambers in which as much as possible of the water is drained away. The drained pulp is then carried forward on the belts to the large rotating mandrels of a board machine, such as is illustrated in Fig. 4. Here the fibrous material is built up in a series of layers until a cylinder of the required thickness is produced. The completed cylinder is slit longitudinally to remove it from the mandrel, and then handled as a sheet through the pressing and drying processes.

In the pressing process the sheets are interleaved with several layers of open woven cloth which serve to drain away the water which is pressed out. The impression of the cloth can be seen on the finished pressboard unless it has been highly calendered or planished.

After pressing, the material still has a content of about 30% of free water, and this is finally removed by slow drying in through-type ovens. Fig. 5 shows a press and drying oven in the Pool Mills of Messrs. B. S. and W. Whiteley, Ltd. A stack of unpressed material is seen in the foreground, while

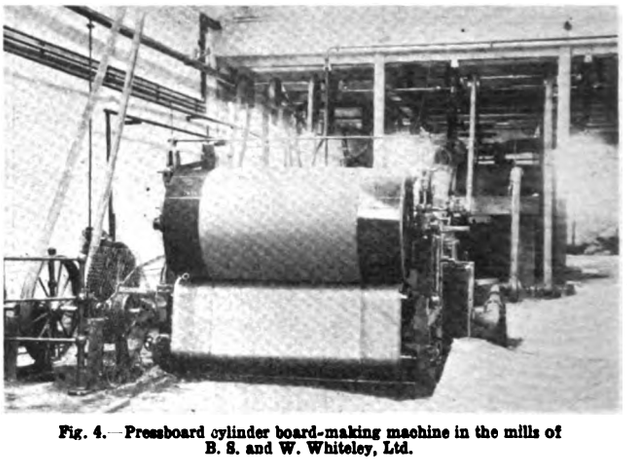

Fig. 4.—Pressboard cylinder board-making machine in the mills of B. S. and W. Whiteley, Ltd.

beyond the press is a quantity of pressed board ready for loading into the conveyor oven.

In the paper mills of Messrs. Mannings, one of the largest American pressboard manufacturers, the boards are made by a similar method, but the drying time has been reduced by subjecting the boards to a tunnel drying process in which the boards pass between rollers which press out the moisture. The development is being watched with interest, as the process is still in the experimental stage and the high quality and reliability of the product has yet to be demonstrated in service.

German manufactured pressboards, still generally known as presspahn, are in most cases characterised by a highly planished surface. This finish, which is also given by British

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makers when called for, gives an attractive appearance which may be desirable in cases where the material is used, chiefly for its mechanical properties in air. It has also the characteristic, desirable in such cases, of taking a better varnish coating, thus decreasing the tendency of the board to absorb moisture. For oil-immersed insulation, however, a planished

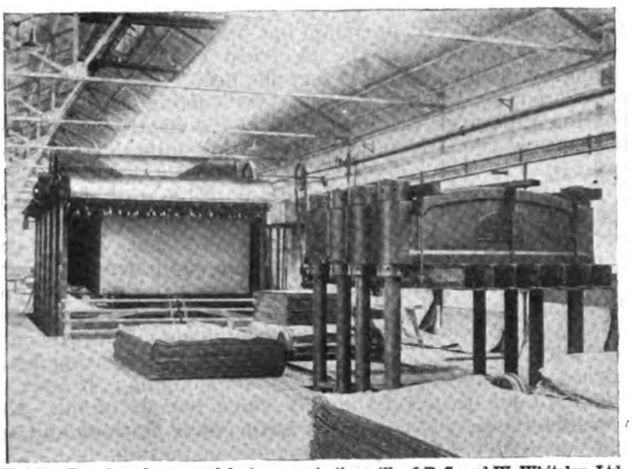

Fig. 5.—Pressboard press and drying oven in the mills of B. S. and W. Whiteley, Ltd.

finish is unnecessary, and is, in fact, undesirable as its lightly reduces the oil-absorptive capacity of the board, and raises the value of its specific inductive capacity. In oil-immersed insulation this causes a departure from the constant voltage gradient which is so important in high voltage design.

(*To be continued.*)

BOOK REVIEWS.

Technical Drawing. By G. E. Draycott. (London Humphrey Milford.) Pp. viii + 232. 6s. net.

The ability to prepare a clean "working drawing" is of vital importance to the student, and therefore he must not only possess a thorough knowledge of the principles of drawing, but also know how to apply them correctly. The object of this book is to set before him, in as simple a manner as possible, these basic principles. A brief description of drawing instruments and the methods of using them is given, following which is a section devoted to plane geometry. Orthographic and isometric projection have been systematically dealt with, and the same remark applies also to both intersection an development of surfaces. Hand sketching, not the least important part of engineering drawing, forms the subject of chapter xi.

The principle feature of this book is its simplicity, and for this reason it should prove useful to both the students of the junior day school and also those of the elementary evening classes.

W. S.

The Case of Benn v. Maxton (being a correspondence on Capitalism and Socialism, to which is appended the report of a Broadcast Debate). (London: Ernest Benn.) Pp. 215. 5s. net.

To those who believe Socialism to be the hope of the world, as well as to those who dread it like a pestilence, not to mention those who, without any strong feeling either way, love to hear two accomplished exponents of opposite systems brilliantly score off each other, this book can be recommended. The duel between these debaters does not end in a verdict or a decisive division; it just comes to a natural end without telling the reader dogmatically which is right. But before it ends it has put the reader through a most stimulating educational course.

The book came into being in this way. Sir Ernest Benn, the Individualist, and Mr. James Maxton, the Chairman of the Independent Labour Party, first debated in public at the London School of Economics. A second contest of the same kind was arranged by the Labour Party, and these discussions were so popular that the B.B.C. secured these two opponents for an hour's debate. The occasion of this debate, simultaneously broadcast from all B.B.C. stations, was the first time effect was given to the removal of the ban on controversial broadcast. Mr. Maxton and Sir Ernest Benn both felt, however, that a viva-voce discussion, limited in time and scope, could be improved upon in correspondence. They therefore exchanged a number of letters in which they debate at greater length the opposing views of Capitalism and Socialism. This vivacious correspondence, in which both men combine the hardest of hitting with the best of good humour, is not designed to convert anybody, but is to be welcomed as the first occasion upon which two opposing and equally authoritative points of view have been brought side by side within the compass of a single volume.

H. C. L.

Der Einfluss des cos ϕ auf die Tarifgestaltung der Elektrizitätswerke. By Hans Nissel, Dr.-Ing. (Berlin: Julius Springer). Pp. 52. Price, 4·5 marks.

Although the study of the effect of power-factor on the economics of electric supply is almost as old as alternating-current distribution, its importance is as great as ever it was. There is still ample room for serious discussion of this question, and much remains to be done in many areas to place electricity charges on an equitable basis. The present study has particular reference to conditions in large towns.

In the first part, the relations between cos ϕ and the capital cost and losses of a supply system are developed. The theoretical tariff based on such results is shown to be impracticable. The second part is devoted to the discussion of some of the tariffs in force. These include (i) the apparent power tariff, in which the charge is based on kVA, (ii) the two-part tariff consisting of a charge for the power or kW component, and a reduction or an increase depending on the amount by which the power factor is above or below a given value—e.g., 0·8; (iii) the mixed cos ϕ—tariff in which the charge is based on kVA plus an extra for reactive power.

These three tariff forms are critically compared respecting relation to generating costs, economical inducement to power-factor improvement by the consumer, measurement and computation, and intelligibility to the consumer. The author shows that with respect to these four considerations the first mode, namely, tariff based on the apparent power or kVA consumption is superior to the other modes of charging. The little book will well repay a careful study.

S. Parker Smith.

Sir Joseph Wilson Swan: A Memoir. By M.E.S. and K.R.S. (London: Ernest Benn.) Pp. 183. 7s. 6d. net.

This delightful memoir, written by a son and a daughter of the late Sir Joseph Swan, comes very opportunely just after the I.E.E. celebration of the jubilee of his invention of the incandescent carbon filament electric lamp, and just before the threatened celebration, by the National Electric Light Association of America, of the self-same invention by Mr. T. A. Edison. Readers of this journal are, of course, aware of the true facts, but the complete story, here set out clearly and concisely, is one that is well worth the reading. Although practical success did not come to Swan's work on incandescent lamps till 1878, he had worked at the problem many years earlier. By 1855, if not before, he was successful in making strong carbon spirals, and five years later he had produced an elementary form of lamp which was rendered ineffective for practical purposes by the inability to get a sufficiently good vacuum in the bulb. With Sprengel's invention of the mercury vacuum pump in 1865 further development was possible, and a workable lamp produced, but the fundamental discovery of a further evacuation of air during incandescence, made in 1878, was the real key to the solution of a problem which had occupied so many years of intermittent experiment.

Swan's claim to remembrance does not by any means rest upon the incandescent lamp alone, but as this was his chief electrical invention, and as such far-reaching developments have arisen from it, electrical men naturally give it pride of place.

Of equal importance in other spheres were some other products of his inventive genius. The bulk of the collodion used for photographic purposes in this country to-day is made according to the formula discovered by Swan over seventy years ago, and he played an outstanding part in the development of the carbon process and bromide printing paper. The half-tone processes for making typographic blocks are largely the outcome of his inventions. The squirted cellulose filaments which he later developed for the incandescent lamp led to an elementary form of artificial silk, and his miners' electric lamp and his development of the Planté storage battery, which gave practicality to the employment of secondary batteries on a large scale, are but a few of his other memorable works.

Of his personal story, of his happy family life, and of his manifold interests and enthusiasms it is impossible to speak here, but we would especially commend these portions of the memoir for the light they shed on the remarkable yet unassuming personality of a great British inventor and scientist.

C. H. B.

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HANDLING AND TREATMENT OF INSULATING OILS.

Report Based on Information Supplied by 57 Supply Undertakings—Tanks and Pipes—Oil Heating Facilities—Use of Filter Presses and Centrifuges.

A REPORT has just been issued by the Electrical Apparatus Committee of the National Electric Light Association of America showing the trend in practice for the storage and treatment of insulating oils, based on information supplied by 57 representative operating companies.

In the section devoted to the design of handling and treating equipment it is stated that permanent facilities for the storage and treatment of insulating oils for electrical equipment are provided by more companies at power stations than at central reconditioning plants, and by considerably less than either at local sub-station reconditioning plants.

Oil Storage Equipment.

The majority of companies provide separate tanks for clean and dirty oil storage at power stations rather than at central reconditioning plants or at sub-stations.

Separate tanks, for transformer and circuit breaker oil respectively, are provided at central reconditioning plants and at local reconditioning plants, by the majority of companies. Companies each having an installed capacity of 100 000 kVA or more, provide separate tanks for transformer and circuit breaker oil, respectively, at all reconditioning plants.

Permanent tanks are installed for clean oil storage, in most cases, at power stations and at central reconditioning plants, but only in a limited number of cases at sub-stations.

Where permanent tanks are not installed for clean oil storage, the majority of companies use drums in preference to portable tanks or tank trucks.

Whereas permanent tanks for dirty oil storage are installed at power stations by slightly more companies than those which use drums, only a few companies report such tanks at central reconditioning plants and at sub-stations.

The majority of permanent clean oil storage tanks are located above ground; and except at sub-stations, where they are usually outdoors, opinion seems to be about equally divided as to whether they should be located outdoors or indoors. The Public Service Co. of Colorado reports that, due to condensation and water leakage during storage, the use of storage tanks placed outdoors and below ground has resulted in a decrease of the dielectric strength.

Permanent clean oil storage tanks are not thermally insulated against atmospheric changes by any reporting company. A few companies report sealing the tanks and using moisture-extracting breathers on clean oil storage tanks at central reconditioning plants. Whenever moisture-extracting breathers are employed, the material used is calcium chloride.

When provided at central reconditioning plants, separate dirty oil storage tanks are usually located above ground and either outdoors or indoors. The Turner Falls Power and Electric Co. has found it advisable to mount its later installations above ground in order to reduce condensation. At power stations the locations for their separate dirty oil storage tanks seem equally divided as to whether they are placed above ground or below ground, and outdoors or indoors. At sub-stations, however, these tanks appear more often to be located outdoors and above ground.

Where separate dirty oil storage tanks are used, it seems that very little effort is made to seal them thoroughly or thermally to insulate them against atmospheric changes.

Most of the companies reporting provide both clean and dirty oil tanks of sufficient capacity to hold the oil from the largest unit.

Independent oil lines are provided for clean and dirty oil respectively in all three types of reconditioning plants, and the same decision appears to hold true in the operation of oil lines for transformer and circuit breaker oil respectively.

In the majority of cases reports indicate that permanent oil piping is located above ground except at sub-stations, where it is buried unprotected in the ground.

Regarding the material used for piping, it is found that wrought iron has been used by the majority of companies for all three locations. At power stations some companies use uncoated steel. Wrought iron and galvanised steel are specified equally for sub-station use.

The great majority of companies report that their piping is permanently connected to the electrical equipment. At the same time, however, provision has been made by most of the companies to connect the electrical equipment to the oil piping by means of flexible metallic hose. Further flexibility is secured by providing means for cutting in portable oil heating apparatus, in the oil lines of the electrical equipment if, upon occasion, the permanent heating units should develop trouble.

The use of different types of non-portable equipment at the central reconditioning plants appears to be equally divided between centrifugal and filter press equipment. A few companies are using both types of treating equipment in order to secure complete reconditioning when treating very dirty oil. The Duquesne Light Co. is the only company reporting the installation of chemical treating equipment. The Rochester Gas and Electric Corporation uses lye when treating badly-burned oil, showing discoloration or sludging; it uses one pound of lye to approximately three barrels of oil. Non-portable equipment is used at both power stations and sub-stations, with the filter press type predominating.

The prevailing rated capacity of non-portable centrifugal apparatus for use in central and local plants is 600 gallons per hour at a temperature of 50 deg. C., the prevailing rated capacity of filter press equipment for use in central and local plants, 1 000 gallons per hour at a temperature of 50 deg. C.

Facilities for heating oils during treating processes include electric heaters in the majority of cases. Very few companies use steam or other facilities for heating. The Detroit Edison Co. has installed 5 kW 220 V heaters under its circuit breaker tanks, for use during severe weather. The Dayton Power and Light Co. employs two immersion heaters rated at 2 kW each. The Duquesne Light Co. reports the installation of steam heating units in their reconditioning plant in order to prevent oxidation of aerated oil produced by the use of electrical heating units which have no adequate temperature control.

For portable equipment at central and local reconditioning plants, the greatest usage seems to lie in filter press apparatus. Two companies use a combination unit consisting of a centrifuge and a filter press mounted on one machine.

For portable apparatus at power stations the rated capacity of centrifugal equipment varies from 100 to 800 gallons per hour at a temperature average of 50 deg. C., and filter press equipment ranges in capacity from 200 to 1 800 gallons per hour at a temperature average of 50 deg. C. The rated capacity of the centrifugal equipment most frequently used is 400 gallons per hour; for the filter press equipment most frequently used the rated capacity is 800 gallons per hour.

Maintenance of Plant.

With regard to the operation and maintenance of handling and treating equipment, only a comparatively few of the fifty-seven reporting companies have found it necessary to apply paint or varnish in order to prevent rusting on interior surfaces of transformers or oil storage tanks and containers. The materials used by these companies include shellac, red metal paint, lacquer, varnish and bakelite varnish. One company uses bakelite varnish and a cork lining on covers, as as well as an external coating of paint and ground cork, in order to prevent internal condensation. Another company applies to the transformer covers, after a thorough cleansing, three coats of shellac.

Many companies have facilities for maintaining during storage an adequate dielectric strength for more than six months, on an average, at their central reconditioning plants and for more than twelve months, on an average, at their power stations. The methods of accomplishing this result are varied. One company keeps the clean oil storage tanks entirely filled up in order to avoid entrapped air spaces and, when necessary, the oil is centrifuged. Another stores the drums with the bungholes pointed down, thereby preventing the collection of water in empty drums. A third company keeps the temperature of the room containing oil tanks at 15 deg. F. above the outside air temperature. The majority of the others maintain the dielectric strength by reconditioning the oil more frequently than condensation can occur in any appreciable quantity; others use small tanks and frequently change their oil. Since the average practice is to filter into and out of

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storage, no appreciable trouble is encountered in maintaining an adequate dielectric strength.

No apparent trouble in maintaining the cleanness of permanent oil storage tanks has been found, due to the methods employed in keeping this equipment clean. Almost all the companies report a periodic cleaning, ranging in time from four to six months, by flushing with clean oil and wiping when empty. The prevailing practice in the cleaning of portable tanks and drums is also to wash with clean oil.

Reports indicate that inspection for rust or sediment in fixed containers is regularly conducted by the majority of companies, the method of inspection usually depending upon visual examination of tank interiors.

Maintenance of Oil Piping.

Considerable trouble in the maintenance of oil piping is due to joint leakage, valve seat leakage and valve packing leakage, the greatest difficulty being experienced with the former. The remedy for joint leakage which has proved most valuable to the Public Service Company of Northern Illinois and the Texas Power and Light Company in the maintenance of oil pipe lines at reconditioning plants is first to cover the threads with white lead and oil, and then to cover them with bakelite varnish and a General Electric compound known as No. 880.

No difficulty has been experienced by any company due to the congealing of oil in buried lines; satisfactory preventive measures having been obtained by burying the pipe to a depth of from two to three feet, by preheating the oil and by running steam lines in the same trench with the oil lines. Thermal insulation is not employed by any reporting company to prevent the congealing of oils.

Corrosion of pipe lines buried in the soil is experienced more at sub-stations than at either central reconditioning plants or local power station reconditioning plants, but the number of replies indicating that any corrosion at all has taken place is relatively few.

At their central reconditioning plants, as well as at their power stations and at their sub-stations, the majority of companies do not permit clean oil to remain in pipe lines not in actual use.

When dehydrating transformer oil at central and local reconditioning plants, more companies use the filter press method than any other, although several companies use a combination centrifuge and filter press at all reconditioning plants. The only additional method employed in dehydrating transformer oil is the use of a filter of Fuller's earth, reported by the Shawinigan Water Power Co.

More circuit breaker oil is successfully dehydrated by filter press than by centrifuge or by a combination of centrifuge and filter press.

Carbon Removal.

The filter press is also accepted as the favourite apparatus for the removal of sediment and sludge from transformer and breaker oil, although the centrifuge and the combination of the two are also used, and even the filter of Fuller's earth has some advocates. The San Diego Consolidated Gas and Electric Co. reports the use of the following unusual formula for the removal of carbon: add one pound of gold dust dissolved in two gallons of water to fifty gallons of oil, heat to 200 deg. F. for half an hour, then agitate with steam jet and run through centrifuge with water seal. The Rochester Gas and Electric Corporation reports that transformer and breaker oils are treated with lye when the presence of acid is noted; for burned oil showing discolouration, one pound of lye is used to three barrels of oil. The Cleveland Electric Illuminating Co. reports that it is unable to remove all traces of carbon from heavily carbonised breaker oil, but that the dielectric test, after one run through the centrifuge at 200 gallons per hour, is better than 25 kV.

Some interesting figures have been obtained in regard to the total volume of transformer oil reconditioned each year by various operating companies. The New York Edison Co. heads the list of companies reporting, with 400 000 gallons per year at its central reconditioning plant. The Alabama Power Co. reports the greatest quantity handled by local reconditioning plants at power stations and at sub-stations, the figures being 306 000 and 432 000 gallons per year respectively.

Figures on the total volume of circuit breaker oil reconditioned per year are also significant. The Philadelphia Electric Co. handled the largest quantity of any central reconditioning plant, viz., 80 892 gallons. The maximum quantity of oil reconditioned by any one company at power stations is 650 000 gallons, the figure submitted by the Duquesne Light Co. The largest quantity reported by any company under any method of reconditioning is the 1 100 000 gallons at the sub-station reconditioning plants of the Southern California Edison Co.

Comparison between the filter press and the centrifuge, in operating experience for one pass of oil, is given in a table. It should be noted that two passes through the oil treating equipment are usually necessary in order to secure the return of a high dielectric strength. The number of hours of continuous operation between changing of blotters or cleaning of equipment depends entirely upon the original condition of the oil. The variation in filter press costs per thousand gallons of oil is so wide that it is omitted from the report. This variation can best be understood by an examination of the methods employed in treating very dirty oil; the companies showing low blotter costs make a practice of running their oil first through the centrifugal apparatus and then through the filter press, and are therefore able to use their blotters over again when handling fairly clean oil.

Many difficulties have been encountered in the operation and maintenance of handling and treating equipment. With regard to design defects, it has been reported that the time required to start and to stop the centrifuge is too great, that a blotter press driven by a repulsion motor constitutes a fire hazard as the result of motor sparking, that oil accumulation on the commutator contributes to dust collection and the motor should therefore be entirely enclosed, that a safety switch should be provided at the motor, and that thermostatic control of blotter press heaters would make operation simpler and safer.

Mechanical Defects.

With regard to mechanical defects, it has been reported that a by-pass relief valve should be placed on the centrifuge, that difficulty is experienced in cleaning centrifuges or certain types, that blotter press bearings require too frequent renewal, that difficulties have been experienced in renovating oil with the filter press in cold weather, although the application of heat to the oil will probably overcome them, and that blotters should be shipped from the factory in sealed packages in order to eliminate the absorption of moisture which would otherwise take place during transportation.

With regard to electrical defects, it has been reported that certain electrical heaters are too small and not sufficiently rugged, that trouble has arisen from the burning out of heating units, that it has been necessary to replace centrifuge switches having insufficient capacity, that centrifuge heaters do not have sufficient capacity, that the electrical connection of heaters under blotters often become damaged because of insufficient flexibility and that heaters for portable presses should be weatherproof.

Numerous companies are experiencing difficulties in the consideration of ratings, it being stated that the rating of equipment depends entirely on the dirtiness of the oil, and that no comparison should be made between the actual rating and the rating given by the manufacturer; centrifugal equipment particularly is reported to be considerably overrated. It is quite obvious that the quality of oil obtained from centrifuge or filter press depends entirely on the dirtiness of the oil; it has been reported that it is sometimes necessary to pass oil once through a press after two or three passes through a centrifuge in order to dehydrate it and that, in a few cases, sludge could not be removed by means of a centrifuge.

In discussing the question of portability, the operating companies seem to feel that portable presses and heaters should be lighter and should be weather-proof, should be arranged for shipment without crating and should be provided with larger wheels, designed for running on cinders and loose dirt, and that containers for storing dry blotters should be added. The general opinion seems to be that the centrifuge requires a more skilled operator than the filter press, particularly on centrifuges necessitating the changing of dams to accomplish dehydrating economically, in which case operators find it difficult to select the proper size of dam. Operators also report difficulty in consistently maintaining the required oil temperature to the centrifuge, and in passing the hot oil to the cold breaker tanks without the occurrence of condensation and the consequent decrease of dielectric strength.

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CENTRAL ELECTRICITY BOARD.

Features of First Annual Report—Details of Accepted Schemes—Tentative Plan of Complete "Grid"—Design of Transforming Stations and Transformers—Work in Progress.

THE Central Electricity Board has just issued its first annual report* covering its operation during the period from the setting up of the Board on March 1st, 1927, to December 31st, 1928.

In the introduction the circumstances which led up to the passing of the Electricity (Supply) Act, 1926, and the objects for which the Board was constituted, are briefly summarised, and it is pointed out that " shortly, the function of the Board is to co-operate with the supply industry in reducing the cost of production to a minimum and concurrently in increasing the availability of supply, thus leading to an acceleration of the growth of output and consumption which of itself is the surest means of bringing about the desired benefits to consumers "

The procedure laid down by the Act for the preparation of schemes and the methods adopted by the Board in considering and adopting schemes are outlined.

Up to December 31st, 1928, the Board had considered five schemes, and adopted four. The salient facts relating to these schemes are as follows :—

Scheme.	Area Square miles.	Population (1921 Census).	Sales of Electricity 1925/26. Millions of Units.
Central Scotland ..	4 980	3 761 200	528
South-East England ..	8 828	11 392 561	1 283
Central England	7 311	5 218 146	715
North-West England and North Wales	9 082	6 980 925	1 214
Total adopted ..	30 201	27 352 832	3 794
† Mid-East England ..	7 455	4 529 880	703
Total	37 656	31 882 712	4 497
Great Britain	88 141	42 769 196	5 606

The details of the Schemes are set out, and maps are given showing the area covered by each, the selected stations, the sub-stations and (diagrammatically) the route of the " grid " lines. There is also a map (p. 13) giving tentatively the complete grid for the whole country.

Grid System.

Pages 13 to 24 give a technical description of the grid, with diagrams of the towers and layout of the sub-stations, as well as five photographs showing towers actually erected, a tower undergoing a test, and a grid circuit breaker.

The grid will consist of some 3 000 miles of overhead lines operating at the standard frequency of 50 cycles per sec. and a pressure of 132 000 V. This system differs from the systems of the Continent and the U.S.A., which have mainly been developed to *transmit* large blocks of power over long distances from localised water power or brown coal areas. " In Great Britain, however, the availability of suitable coal over wide areas and without wide variation of price, coupled with the fact that the country has no large water power resources, calls rather for a system of *interconnection*."

With regard to choice of voltage for primary transmission, the report points out that great diversity exists with regard to the voltage adopted for e.h.t. transmission systems.

The grid voltage had to be determined in the light of the use to which the lines would be put, and the conditions are somewhat special. The generating stations selected for the schemes are either at or near the principal load centres, consequently most of the power, especially during the winter months when the load is heaviest, will be sent out direct from the station busbars for local transmission and distribution without passing over the grid system. Consideration of the loads likely to be met with in these circumstances, and with due regard to emergency requirements, showed that the necessary line capacity should be of the order of 50 000 kW. It follows from the interconnected nature of the system that individual transmission distances are comparatively short; consequently the only remaining factors which had a bearing on the choice of voltage were the degree of security obtainable and the cost. In the preparation of the district schemes, the Electricity Commissioners decided in favour of 132 000 V, being influenced to a certain extent by the possibility that some time in the future short lengths of underground cable might be found to give reliable service at this working pressure where circumstances might warrant the heavy additional capital expenditure involved.

Shortly after the Electricity Commissioners transmitted the first scheme to the Board, the International Electro-Technical Commission, in fixing standards for e.h.t. transmission lines, abandoned 132 000 V as a standard, and now has no intermediate steps between 110 000 and 165 000 V. Investigation of the cost of the various kinds of plant required showed that if the voltage was raised from 132,000 to 165 000 V the capital expenditure on the grid would increase by 12% without making it possible profitably to utilise the increased carrying capacity which would thereby be obtained. On the other hand if the voltage were reduced to 110 000 V the capital cost of the system would be increased by approximately 5% as in many instances lines would have to be duplicated in order to provide the necessary capacity.

After careful consideration of the various arguments for different types of conductor, the Board decided to adopt steel-cored aluminium conductors, so as to secure the largest reasonable spans from tower to tower.

The towers for the primary lines have been designed in consultation with Sir Reginald Blomfield, R.A. The average height will be from 70 to 80 ft., and 16 standard types have been settled. The towers will, as a rule, be galvanised, and there will be roughly six towers per mile.

In certain cases, e.g., where the lines will cross navigable rivers, special towers will be necessary. For the crossing of the Clyde, the Forth and the Cart, towers have been designed varying between 200 and 338 ft. in height.

Switching Arrangements.

Transforming stations giving duplicate supplies will be provided at each grid point. At the most important stations the switching arrangements will be of the conventional type, one circuit breaker being provided for each transmission line and one for each transformer. The busbar sections will be in duplicate, and there will be a circuit breaker for coupling the sections. At less important grid points a specially simple type of sub-station has been devised. In this type of station there will be only three 132 000 V circuit breakers, one between line sections and one on each of the two transformers. This arrangement will reduce to a minimum the capital cost, ground area, and number of vulnerable points. In certain cases special switching arrangements are required, in others the restricted space available makes it necessary to introduce constructional features of particular kinds, and in order to meet such conditions a range of designs has been prepared.

The complete list of sub-station types is as follows :—

Designation.	Description.	Application.
L.N.E. ..	Low Non-Extensible ..	Grid supplies where no extension other than increase of transformer capacity is contemplated.
H.N.E. ..	High Non-Extensible ..	
LE. ..	Low-Extensible	Grid supplies where extensions beyond the capacity of the single 3 switch arrangement will be necessary in the future.
H.E. ..	High-Extensible	
L.D.B. ..	Low Double Busbar ..	Grid supplies at the most important stations.
H.D.B. ..	High Double Busbar ..	
C. ..	Connections only between lines and transformers ..	Used where transformer feeders are applicable or necessary.

Illustrations of typical lay-outs are given in the report.

The " low " type of sub-station is used wherever sufficient ground area is available. In the " low " type stations the amount of structural steel is reduced to a minimum, and the

* Copies are obtainable from the publishers, Whitehead, Morris, Ltd., or through any bookseller at 2s. 6d. (3s. post free.)

† Adopted on March 19th, 1929.

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apparatus is placed as near ground level as safety considerations permit. The arrangement reduces maintenance costs and facilitates inspection and operation. The " high " type sub-stations are more in accordance with existing American and Continental practice. Owing to the disadvantages associated with their maintenance and inspection, they will be used only in cases where ground area is insufficient for " low " type stations.

In all types of sub-stations the arrangements will be such as to allow for overhaul or inspection of any circuit breaker with the rest of the station in service.

All 132 000 V stations will be of the outdoor type. The decision to use outdoor apparatus was reached only after very careful investigation. Very substantial economic advantage is obtained by eliminating buildings; danger from explosion and fire is almost entirely removed and inspection is simplified.

The 66 000 V stations which will be erected in the London area will be of the indoor type.

A uniform standard of rupturing capacity of 1·5 million kW has been adopted for all 66 000 and 132 000 V circuit breakers. Circuit breakers, both of the explosion pot and multibreak type, are being used.

The standard capacities of transformers to cover all grid requirements are 7 500, 10 000, 15 000, 20 000, 30 000, 45 000, 60 000, and 75 000 kVA. The transformer specifications have been drawn up in such a way as to get transformers with minimum light load losses and magnetising currents compatible with reasonable first cost. The preliminary tests which have been carried out indicate that the manufacturers are meeting their guarantees as to losses and efficiency in a very satisfactory way.

All transformers are designed for operating with the neutral points of the 132 000 V windings connected directly to earth. This feature of the design results in greatly reduced first cost as compared with that of transformers designed for operation with insulated neutral points. It also simplifies the design of the apparatus which is required for maintaining constant voltage on the busbars of the undertakers.

Voltage Regulation.

The method of voltage regulation which has been adopted on all transformers, except the least important, is that which employs taps on the higher voltage windings. The transformation ratio can be changed while the transformers are on load. The range of voltage variation which has been provided is ± 10 %.

The voltage regulating methods employed by the different manufacturers differ in detail, some favouring the use of auto-transformer or impedance systems, others resistances, and one uses divided windings, but it has not been deemed expedient to restrict development by standardising any particular design at this stage.

Air cooling is to be used on all transformers. Experience in other countries indicates that the most vulnerable parts of high voltage transformers are the terminal insulators. Two types, oil filled and condenser, are being used, but care has been taken to ensure that the insulators of all types are mechanically interchangeable, The condenser type of bushing has hitherto been largely a foreign product, but British firms are now producing satisfactory insulators of this type.

The decision that lightning arresters will not be used makes it especially important to ensure that the winding insulation will be of the highest grade, and all grid transformers have their windings heavily reinforced at both outgoing and neutral point ends.

Overload and leakage protective devices are to be installed on both higher and lower voltage windings, and, in addition, provision has been made for the installation of Buchholz relays if experience shows that more sensitive protection is required.

Space is available at each sub-station for erecting reconditioning and repair sheds, but it has been decided not to proceed with the erection of these sheds unless experience shows them to be necessary. This decision is contrary to current practice in other countries, but it was arrived at only after consultation with the principal transformer manufacturers.

Dealing with works in progress, the report states that the Board were able to invite tenders for the main transmission lines in Central Scotland (the first scheme) in September, 1927; for the transformers in November, 1927, and for the switchgear in January, 1928. In the second and subsequent schemes they were able to proceed more quickly. By the end of last December contracts had been placed as follows:—

	Central Scotland.	South-East England.	Central England.	North-West England.	Total.
	£	£	£	£	£
Primary transmission lines	439 239	980 084	30 743	—	1 450 066
Secondary transmission lines	—	14 235	—	37 139	51 374
Primary transforming stations	649 685	633 038	—	—	1 282 720
Secondary transforming stations	64 182	32 922	—	13 723	110 827
Totals	1 153 106	1 660 276	30 743	50 862	2 894 987

In Scotland the actual erection of towers is in progress on the routes Greenock–Yoker, Port Dundas–Dalmarnock, and Clyde's Mill–Bonnybridge, which are nearing completion. In South-East England work is in progress on the line from Bedford to Little Barford, 46 towers out of approximately 73 having been completed. In North-West England towers are being erected on the secondary line from Stockport to Macclesfield.

The Wayleave Position.

In regard to wayleaves, the routes of the lines are largely determined by the configuration of the land, and deviations can only be made within small limits, and, generally speaking, at considerable cost. " These factors have added considerably to the difficulty of the Board, whose settled policy it is to reduce to a minimum any action which may spoil the amenities of the countryside, and at the same time to meet as far as possible the reasonable wishes of individual owners as to the exact position of the towers."

The Board have welcomed representations and co-operation from the societies and local authorities concerned in the preservation of amenities, and " acknowledge the helpful and public spirit in which the majority of landowners have recognised the need of facilitating the Board's work, even where it has not been possible to make those minor alterations which the owners desire."

Up to December 31st last the position was as follows:—

	Mileage Surveyed.	No. of towers to be erected.	No. of Wayleaves obtained.
Primary Lines:			
Central Scotland ..	245	1 442	1 158
S.E. England	120¾	730	416
Central England ..	9½	61	12
Secondary Lines:			
N.W. England ..	12	100	100
S.E. England ..	6¾	86	23

The Board recognise that individual undertakers may require additional supplies before the grid would reach them in the normal course. To meet such cases the Board exercise, wherever possible, their powers to make temporary arrangements, and where necessary, construct portions of the grid in advance of programme. " By this means they have already shown the utility of the grid in saving authorised undertakers uneconomical expenditure on the extension of small generating stations, and in making supplies available in new areas."

Arrangements, including the construction of lines, have been made to give supplies: (*a*) At Little Barford for the development of new area in Bedfordshire, Cambridgeshire, and Huntingdon; (*b*) at Worthing, to supplement existing supplies; (*c*) at Aylesbury, to supplement existing supplies and open up rural areas; (*d*) at Macclesfield, Buxton, and the surrounding district. Other arrangements of a similar nature are in negotiation for supplies in and around London; at Kettering and in the Alderley Edge and Wilmslow district.

In order to provide for expenses during the initial period before the disbursements of the Board should become sufficient to justify raising a loan, the Board arranged with the Bank of England, who are the bankers to the Board, for temporary advances, and this arrangement still continues. The total amount of such advances up to December 31st last was £339 000.

There are 7 appendices to the report, the first of which sets out the advantages and economies to be derived from interconnection. The next four give technical details of the grid. Appendix 6 is a progress report, and the final appendix reproduces the Board's standard form of wayleave consent.

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CORRESPONDENCE.

The Editor welcomes the free expression in these columns of genuine opinion on matters of public interest, although he disclaims responsibility alike for the opinions themselves and the manner of their expression.

"The Battersea Problem."

[To the Editor.]

Sir,—With regard to the letter in your issue of May 3rd from Messrs. Siemens Schuckert (Gt. Britain), Ltd., I am of course perfectly well aware that in a number of power stations throughout the world effective methods are being taken to eliminate dust, grit, and other finely divided solid matter from chimney gases, although incidentally even this is a somewhat neglected section of power station operation, especially in London, for example.

What I stated, however, was that no one in the world has yet attempted to tackle the question of the elimination of sulphur in the gases, that is to say sulphurous acid (SO_2) and sulphuric acid (SO_3 combined with water), due to the combustion of the sulphur in the coal, which of course is generally present both in the inorganic and the organic form. Obviously any method of filtration or electrostatic precipitation will not eliminate gas, and the only way to do this is by means of some process or processes involving chemical reaction, of which naturally the simplest, from the theoretical point of view, would be washing by means of dilute alkalis.—I am, etc.,

David Brownlie.

46, Grange Road,
Ealing, W.5.
May 4th.

[To the Editor.]

Sir,—The sulphur and grit problem is a very serious matter when it is considered that in burning a ton of coal there is from 50 to 80 lb. of concentrated sulphuric acid produced. The prevailing idea is that this terrible nuisance cannot be feasibly overcome, which is erroneous, simply because it has been tackled in the wrong way, i.e., after combustion, which is courting failure, instead of before. There are many factors nullifying success after combustion, the very large volume of hot flue gases, and the highly diluted state of the sulphurous oxide, which becomes sulphuric acid on mingling with damp atmosphere.

A striking instance of the damaging effects is to be plainly seen in the eating away of the top portion of the iron chimneys at the Barton generating station, where there are ragged portions from 4 in. to 7 in. completely eaten away. If it will eat through iron in this way, and in a short time, it requires no undue labour of the mind to gauge the pernicious corrosive effects on property, vegetation and lungs.

There is an improved process of fuel utilisation that will not only thoroughly eliminate the sulphur and grit nuisance, but will, at the same time, reduce the fuel costs of any generating station.—I am, etc.,

Chemical Engineer.

Eccles, May 4th.

The Incandescent Lamp Jubilee.

[To the Editor.]

Sir,—With reference to your editorial paragraph, under this heading, in your issue for May 3rd, may I suggest that, as I have shown in my article in the official "Journal of the Institution of Electrical Engineers" for April last, of the three inventors, St. George Lane Fox Pitt, Sir Joseph Swan, and Thomas Alva Edison, the one of the three who made the first and the most fundamental invention is Lane Fox Pitt.

I have just written for the Press a review of Sir Joseph Swan's recently published memoirs, in which I am sure no one will suggest that I have not done him justice as a great and original inventor; but the carbon filament lamps of all these three inventors are now entirely obsolete, while Lane Fox Pitt's fundamental patent for distribution at constant potential, with everything in parallel, not only anticipated both the other inventions, but was at its time an entirely new idea, and still holds the field.

Both Swan and Edison have other great inventions to their credit, and both must have gained considerable wealth; but the debt of science due to Lane Fox Pitt has never been acknowledged, while his inventions never earned him a single penny. He still lives, and all I suggest is that he should have the recognition that is in justice due to him.

By all means let the Institution of Electrical Engineers protest to the American National Electric Light Association that Swan's claims come before those of Edison, but let them at the same time point out that Lane Fox Pitt has clear fundamental patent priority over both of them, as everyone must admit.—I am, etc.,

A. A. Campbell Swinton.

The Athenæum,
Pall Mall, S.W.1.
May 6th, 1929.

[To the Editor.]

Sir,—While I would like to believe your very courteous suggestion about the American plan to celebrate Edison's invention of Swan's lamp, I can hardly imagine that this step has been taken in ignorance of the fact that the jubilee of Swan's great invention was officially celebrated by the Institution of Electrical Engineers last December.

Again, I seem to remember that one of the Smithsonian Institute's publications giving the history of the incandescent lamp gives credit, albeit perfunctorily, to the real inventor.

I agree that a protest should be made to the N.E.L.A., and trust that your efforts to uphold British prestige will not be made in vain.—I am, etc.,

G. H. L. Smethurst.

London, N.8.
April 27th.

North-East Coast Exhibition.

[To the Editor.]

Sir,—Some fears have been expressed that inadequate arrangements have been made for the accommodation of the many thousands of visitors to the great North-East Coast Exhibition at Newcastle-upon-Tyne, which is being formally opened by H.R.H. the Prince of Wales on Tuesday May 14th.

This is not so. Not only have very extensive arrangements been made in the city of Newcastle itself, but the exhibition is situated within extremely easy reach of a large number of the attractive seaside and inland resorts where excellent and extensive accommodation for an enormous number of visitors is available.

There is a well-organised Accommodation Bureau, whose address is 31, Westgate Road, Newcastle-upon-Tyne.—I am, etc.,

P. J. Brown,
Publicity Agent,
North-East Coast Exhibition.

Newcastle-upon-Tyne.
May 4th.

Some Fallacies of Load Factor.

[To the Editor.]

Sir,—I have read with interest the letters of Messrs. Martin, Blaikie, and Brettelle, in The Electrician of January 11th and 25th, and February 1st, commenting on my article in your issue of January 4th, and distance must be my excuse for not replying earlier.

I am sorry the article should be regarded as pouring opprobrium on either municipal or company engineers, or the undertakings they manage. Nothing of the kind was intended; nor was it desired to discuss their relative merits. That the financial aspect of any action is of serious import to a company surely will not be gainsaid, though one may agree fully that financial stability is best secured if one keeps the ideal of service well in the foreground, and that a penny-wise policy may often be pound-foolish. That the financial aspect of an action to a municipal undertaking is much less important also seems quite evident. These facts are, perhaps, seen more clearly in other fields of enterprise than electricity supply and afford one of the strongest reasons for making water supply a municipal affair. Put briefly, I should say that the guiding principle of a municipal undertaking should be service with due regard to the financial position; and of a company the financial position, with due regard to service.

As I have said previously (The Electrician, Vol. XCIX, p. 745), I consider that the published figures of electricity undertakings have had a tremendous influence in stimulating municipal undertakings towards success. But, as at cricket, averages are not the only consideration; and I fear that there are both municipal committees and municipal engineers who would look askance at developments such as those carried out by the Chester Corporation ("J.I.E.E.", December, 1928) on the ground that such must certainly be detrimental to the position on the statistical tables. Granted that there have been many difficulties placed in the way of expansion of area of municipal,

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as of company, supplies in Great Britain, there are, nevertheless some municipalities which have shown that such expansion is not impossible ; and the skill displayed by so many municipal engineers in the intensive development of their restricted areas suggests that vast extensive development might also have taken place with financial justification, had service, in its wider sense, been kept more in the foreground. To this extent, I am ready to criticise municipal engineers and undertakings alike ; but I cannot agree that to criticise is necessarily to pour opprobrium.

Mr. Martin, I think, has failed to read my article carefully. There is no contradiction between the statement that " better load-factors will permit of lower *average* costs of electricity," and my subsequent argument ; but apparently the importance of the word " average," now italicised, has been overlooked. Nor, had he followed my argument, would he have suggested that the sale of a large number of extra units at a negligible margin over their extra cost would enable other units to be sold at a lower figure than before. This seems to be a very common fallacy ; but as soon as the proposition is put into figures, however rough, its absurdity is seen. There is no question of the selection of figures to give the result aimed at, as appears to be suggested. Any other figures with the same premiss will give the same result.

Mr. Martin, with Mr. Brettelle's support, questions my contention that diversity factor is insufficiently regarded, and load factor too much, on the ground that they are too closely interwoven to be easily considered apart. I agree that diversity factor cannot be considered without load factor ; but the converse is certainly not the case ; and I think that a study of tariffs in force in Great Britain and elsewhere would speedily show that there are many undertakings, both company and municipal, which do not realise that, owing to diversity factor, water heaters with a 30% load factor, operated by time switches or the equivalent, deserve in most cases a lower tariff than those permanently in circuit, or operated by means of a load levelling switch.

Australian Practice.

Mr. Blaikie will find from the article above quoted that I am well acquainted with the rateable value tariff. In Australia the most favoured tariff of this nature bases the annual charge on floor space. The extended areas of supply and large gardens surrounding many quite small houses probably account for this. A tariff of this kind is an empirical one, which aims at giving due weight to load factor, diversity factor, and density of load, for normal domestic supplies ; but the fact that it is purely empirical prevents it from being suitable for universal application, as most undertakings recognise.

For example, Dr. S. Parker Smith (" An All Electric House," " J.I.E.E.," No. 351), though taking the bulk of his energy on a tariff with a running charge of ½d. per unit, nevertheless is given by Glasgow Corporation the benefit of a flat rate of ⅜d. for energy for night water heating. Again, Sydney (N.S.W.) with a tariff based on floor space, prohibits the use of large geysers, and requires current for the lighting of private tennis courts to be metered separately. Tariffs of this kind aim at encouraging consumers to take increased supplies of electricity at reduced rates, and I should expect them to have more influence on the statistical figures than on the financial position of the undertakings adopting them. This may or may not afford an explanation of the fact stated by Mr. Blaikie, and suggested in my article above referred to, that they are much more popular with municipal than with company engineers.

I do not follow Mr. Blaikie's suggestion of the proper tariff for bulk supplies from the " grid." I should say that those distributing authorities who take all their supplies from the grid will probably have quite a low diversity factor, of the order of 1·25 to 1·5 ; and that, consequently, for these a tariff of a Hopkinson type will be quite appropriate. On the other hand, if sundry of the larger distributors are encouraged to retain unselected stations of moderate efficiency to assist in carrying their peak loads, these particular authorities will contribute largely to the diversity factor, and therefore to the load factor of the grid ; and will be entitled to correspondingly better terms, irrespective both of the magnitude and of the load factor of their own demands from the grid.

I readily agree with Mr. Brettelle's contention that a company must be prepared to take risks ; but subject to the qualification that the reasonable expectation of profit must be commensurate with the risks incurred. However, his statement that 0·115d. is the approximate extra cost of additional units in a modern station with coal at 12s. 6d. per ton seems to indicate that his views and mine are not so far apart as at first sight would appear. On this basis, the " relatively small " municipal undertaking in London which he cites as selling current for night water heating at 0·33d. would incur an extra cost of about 0·23d. per unit, thus showing some 40% margin between selling price and cost ; and this is quite in accordance with the opinion I expressed that where extra cost is 0·35d. a selling price of 0·5d. is much more rational than 0·375d.

Mr. Martin questions my economics ; and on that point I think we must agree to differ. In my opinion, lavish expenditure during the post-war years, by governments and individuals alike, is the prime cause of the financial stringency and dearth of employment in both England and Australia to-day. And this being so, I cannot subscribe to the doctrine that a reduction in price which causes a marked increase of expenditure on a luxury is bound to be permanently beneficial to the community.—I am, etc.,

EDWARD V. CLARK.

Adelaide.
April 4th.

Two-Part Tariffs.

[TO THE EDITOR.]

SIR,—In a leaderette in your current issue you refer very kindly to an article which appeared under my name in a previous issue in which mention was made of a three-part tariff. As you remarked that it may well be that the best approach to the nearly ideal method of charging may eventually be evolved along these lines, may I point out that in the course of that article I actually did mention a finding which holds out some promise of being useful.

Statistics obtained from the working of the three-factor tariff show that a curve given by a sliding-percentage of rateable value, varying, say, from 18½% on rateable values of £15, down to 12½% on rateable values of £75 and over, conforms very closely to the curve resulting from the fixed charges based on the three-factor tariff.

May I here say that I did not, and do not, advocate a three-factor tariff if there is something simpler to hand combined with reasonable equity.

As regards a sliding-percentage of rateable value, or, if you will, a sliding rateable value tariff, such as indicated, naturally the anomalies inherent in a single-basis tariff would still exist, but the broad conformity referred to is much in its favour, for the reason that the results obtained from a three-factor basis must be about the fairest it is possible to produce, owing to the smoothing-out of the anomalies of the separate factors.

A hope was expressed that the new rating reassessments under the Rating and Valuation Act, 1925, would be on more equitable lines than formerly, thus providing a reasonably practicable basis on the above lines for a two-part tariff. These new assessments are now available, and the effect of applying them is at the moment being investigated.—I am, etc.,

C. F. MOUNSDON.

Sevenoaks.
May 6th.

MINING TYPE TRANSFORMERS.

First of a New Series of Specifications.

THE British Engineering Standards Association has issued a British Standard Specification for mining type transformers, this being the first of a series of specifications that are in the course of preparation for mining electrical apparatus by the Colliery Section. The specification applies to oil-immersed naturally cooled transformers primarily for use underground in collieries, and, whilst no stipulation is made on flameproofness as an essential requirement, it includes the necessary constructional provisions to satisfy the requirements of the Coal Mines Acts underground in collieries. The Colliery Electrical Section has also in the course of preparation specifications for mining type motors and generators, flameproof switches and circuit breakers, miners' hand lamp bulbs, underground lighting fittings and cable glands and sealing boxes.

Copies of the new Specification (No. 355–1929) can be obtained from the British Engineering Standards Association, Publications Department, 28, Victoria Street, London, S.W.1. price 2s. 2d. post free.

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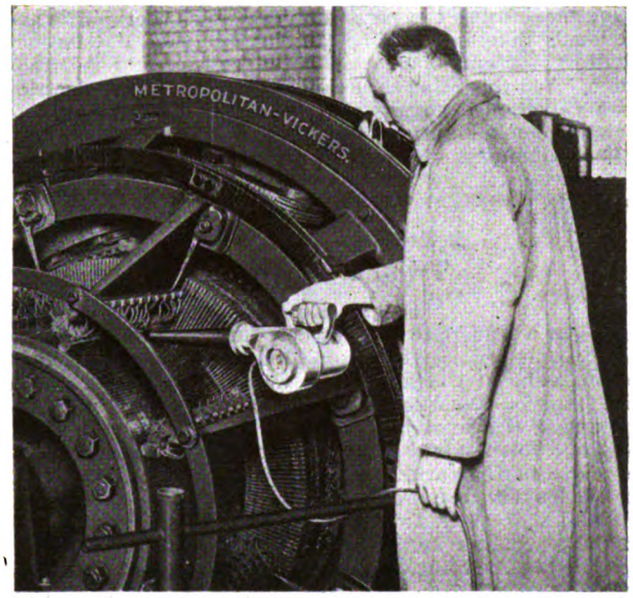
MANUFACTURERS' EQUIPMENT.

A Blower for Motor Windings—New Range of Squirrel Cage Motors—Electric Lamps for Face Working in Fiery Mines—Cable-Braiding Machines.

ONE of the most important functions of the "Cadillac" portable blower, supplied by METRO-VICK SUPPLIES, of 155, Charing Cross Road, London, W.C.2, is the cleaning of electric motor windings and housings. It is claimed that for this purpose the blower is better than compressed air on account of



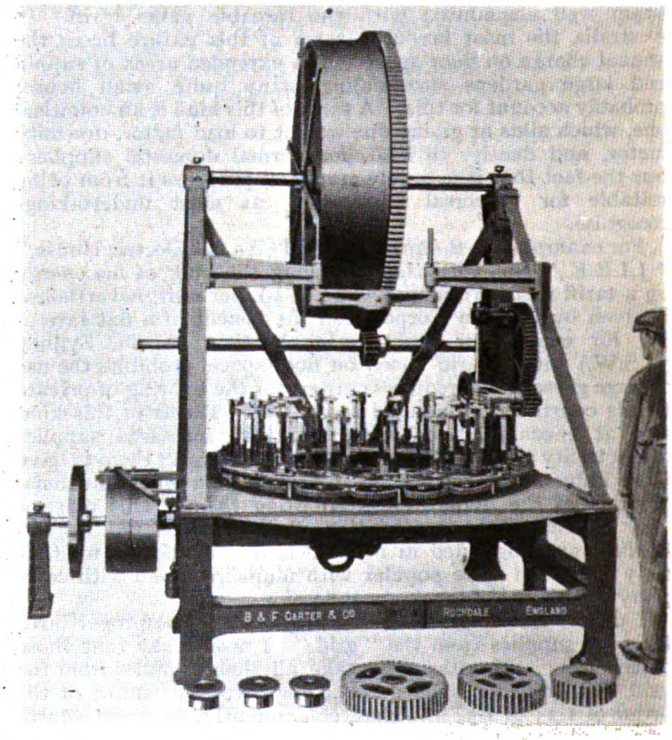
Illustrating the "Cadillac" blower of Metro-Vick Supplies.

convenience in moving, absence of the moisture due to condensation in compressor tanks, freedom from the danger of injuring windings with excessive pressure, the superiority of a continuous high-velocity blast of air at relatively low pressure to the quickly-expended force of a compressor, and low cost. Special attachments enable the blower to be used in various circumstances such as are to be met in textile and flour mills, printing works, theatres and hotels, telephone and telegraph works, cable companies, tobacco manufacturers, engineering firms and power stations.

We have received from JOHN DAVIS AND SON (DERBY), LTD., of All Saints' Works, Derby, particulars of the type K 60 M-L pneumatic electric lamp for use at the working face of a fiery mine. The lamp is a self-contained unit which can be coupled up to any compressed air main. It consists of a metal casing containing a generator driven by a compressed air turbine. The interior of the lamp, both generator and protecting glass, is in communication with the exhaust side of the turbine and a pressure of about 2 lb. per square inch is maintained in the interior by means of a spring loaded exhaust valve. As an additional precaution a safety device is incorporated which cuts off the current in the event either of the air supply failing, or the lamp glass being damaged or removed. This device consists of a spring loaded diaphragm, one side of which is in connection with the outside air, the other side exposed to the excess pressure in the interior of the lamp. The diaphragm carries a contact, which normally engages with a fixed contact and short circuits the generator. When the lamp is working, the excess pressure in the interior holds the contacts apart and permits the lamp to light. Failure of this pressure from any cause permits the contacts to close and makes the whole system dead. A system of small holes is provided in the lamp, so that a scavenging stream of air flows through it during working. Consequently, any gas which may have penetrated in during the time the lamp has been standing out of use, is driven out before the lamp lights up. The turbine and generator rotors are carried on a short steel spindle. An extension of the shaft carries a centrifugal governor to prevent racing. The turbine is of the radial two-stage type, air passing in through a tangential nozzle, traversing the vanes first in an inwards direction, then through a transfer port, and secondly in an outwards direction. In order to make the lamp independent of the air pressure, and to permit its being used on air supply systems in which wide variations of pressures occur, a reducing valve is incorporated in the lamp, which reduces the pressure to 40 lb. per square inch at the nozzle, so that the lamp can run at any pressure desired above this figure. In special cases, where the pressure in service falls lower than 40 lb. per square inch, a special setting can be given to cover any reasonable requirements of pressure variation. The generator has an output of 60 W at 25 V. A standard 25 V 60 W bulb is used in a special resilient mounting. The bulb is protected by a stout glass dome secured in place by a gunmetal locking ring fitted with a magnetic lock, and a steel guard is provided to prevent the dome being accidentally damaged or broken.

B. and F. CARTER AND CO., of Lark Works, Hare Street, Rochdale, have sent us details of their 36-spindle cable-braiding machine for covering electric cable up to diameters of 3 inches. The machine is arranged with a haul-off capstan of 5 ft. diameter which is sufficiently wide to take three turns of the largest size cable that is to be braided. The machine is fitted with what are known as "Speedway" carriers, which, it is claimed, give an increased speed of between 20% and 100% greater than the ordinary "weight-and-dropper" type of carrier, and being built up practically of steel throughout are free from breakages. This machine is fitted with machine-cut gearing. The same firm advise us that they have just completed a similar machine, but arranged for dealing with lead covered cable up to 5 in. diameter. The haul-off capstan of this machine is 8 ft. in diameter, which is the smallest diameter that this size of cable will give to. This machine is also fitted with "Speedway" carriers. We understand that it is the largest braiding machine made in this country for this class of work.

A new range of protected squirrel cage induction motors (known as type K) in sizes from 1 to 25 H.P., 400/440 V, three-phase, 50 cycles, is manufactured by the BRITISH THOMSON-



A 36-spindle cable-braiding machine for diameters up to 3 in., by B. and F. Carter and Co.

HOUSTON CO., LTD., Rugby. Their type K motors comply with B.S.S. 168, have high power factor, give maximum starting and overload torque, and take low starting current. Ball and roller bearings are fitted. The rotor has aluminium bars and end rings cast in one piece by a special process and is claimed to be practically indestructible under service conditions. The core is ground on the periphery to ensure true running. The stator windings are specially dried and impregnated under vacuum.

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ADVERTISING ABUSES.

Methods of Blackmailing the British Electrical Manufacturer.

FOLLOWING our recent reference to the exposure of practices which can only be described as blackmail in advertising, made by Mr. C. Pinkham in a recent lecture to the Glasgow Publicity Club, we have received numerous requests for details of the abuses referred to. As it is apparent that Mr. Pinkham's experiences in this field are not merely isolated examples we print below some extracts from his paper in the hope that this publicity will lead other victims to ventilate the abuses to which they have been subjected, and to a general stiffening of resistance to proposals which are regrettably prevalent in the electrical industry to-day :—

During the last few years I have been impressed by the rapid growth of the number of advertising propositions, which do not, and cannot, stand on their own feet, i.e, on their merits as advertising schemes. There are many forms of this phenomenon, but they all come down in some degree to a species of blackmail, or highway robbery—if you don't pay up and take space your firm will be looked on with severe disfavour, will lose an order, or will even be struck off the list of suppliers to the firm for whom the proposition is being promoted.

Let me take you through one or two forms of it. A favourite one, of which I have had dozens, in the last two years, takes this form. A firm of publicity agents goes to a municipal authority or a large firm and says in effect—you would like a brochure describing your municipality or your firm, as the case may be—all right, we will produce it for you and it won't cost you anything—(or perhaps a slight charge may be made). Just give us a list of your suppliers, *they will be only too pleased* to take advertising space. In some cases the agents even get a supply of letter-headings from their clients and write in the client's name.

Let me quote a paragraph from a letter I received in reply to a refusal to go into such a production :

" It will interest you to hear that a number of the chief nationa advertisers are supporting this booklet, not because they will probably secure much benefit from the advertisement from the general point of view, but in consideration of the amount of business which will ultimately accrue from the———Co."

After I had replied in suitable terms to their letter, they wrote an explanatory note in which they said :

" Of course it would be impossible for us to approach anv firm for a book of this kind unless a certain amount of business was done with the company."

There you have the whole matter in a nutshell.

Then there is the house organ bearing many pages of ads. ; in most cases inserted by suppliers who, whether the advertising value be great or be nil, feel that they have not the chance of weighing these considerations against the price charged, but that they *must* go in in order to preserve their business relations with the firm producing it.

Then there is the person who openly demands that you should take space you do not want, because he has bought your products, or has an order to place, or because it is a necessary qualification if you wish to get on his list for inquiries. The medium in question may be a time-table or programme, a poster site, or what not, but my point is, it is not a proposition which stands or falls by its advertising value, but is something approaching, as I said, blackmail. I have even had a man walk into my office with an order in his hand, and offer it to me if I purchased it with advertising space.

Then there are the editorial pages devoted to some big firm in, I regret to say, some national papers, which other firms who supply the said firm with material are expected to pay for, often at fancy rates. Here, again, use is sometimes made of the firm's letter-heading when writing to suppliers. There is, of course, a certain amount of advertising value here, but the rates are usually high, the money could be used to better advantage, and the underlying principle is coercion.

Now let us see what it all means. It means, of course, intense irritation to the victim. It also means, of course, the expenditure of a considerable sum of money in a year which we grudge, which we feel is wasted ; for none of us is able to withstand all these attacks.

Important as these aspects are to the individuals concerned, I feel there are other aspects which are really far more important. In the first place, every pound we spend on propositions of this type reduces the amount of our appropriation which is available for ordinary publicity expenditure at commercial rates. This, of course, not only reduces the income of those principals and agents who have *sound* publicity to sell, but, in wasting part of our allocation, it makes the average return per pound spent over our whole appropriation less, and therefore tends to give *our* principals, who have spent the money, a poorer impression of the efficiency of advertising.

I am not suggesting that there can be no such thing as some legitimate reciprocal trading in this matter. For instance, if I decide to go in for railway advertising, as long as I get value for money, I am naturally going to show preference for taking space with those railways who are good friends to my firm on the other side of the business ; that is only right and fair. Similiarly, if my firm is approaching another who is in the market for motors, I can see no reason why we should not ask for special consideration, price and quality being equal, on the ground that we buy some product extensively from this firm.

On the other hand, we should not be justified in going to such a firm who are using steam drive, and saying to them, in effect, however much you may be convinced that steam drive is the best for your job, you have got to put in some of our electric motors or lose all our business. There *can* be legitimate reciprocity, but what I inveigh against are attempts to force advertisers to spend money on types of publicity they do not favour, to force advertisers to take space of some value at uncommercial rates, or more often than not, to take space of no advertising value at all, by means of threats more or less veiled, sometimes baldly stated, sometimes implied.

I.E.E. GOLF.

Details of the North-Western and Mersey and North Wales Centres Competition.

THE golf competition of the North-Western and Mersey and North Wales (Liverpool) centres of the Institution of Electrical Engineers, in aid of the Institution Benevolent Fund, will be held on May 29th, on the links of the Hesketh Golf Club, Cambridge Road, Southport.

The tournament will be a bogey competition under handicap, and will be open to members and their friends. The player, being a member of the I.E.E., returning the best net score against bogey, will receive the G.P. Dennis trophy and replica, the trophy to be held by the winner for one year. If the best net score is returned by a non-member of the Institution, he will be awarded one of four prizes under medal play rules. There will be an optional sweepstake of 2s. 6d., divided so that three-sixths will be awarded to the competitor who returns the best card, two-sixths to the second best card, and one-sixth to the third best card. A two-ball foursome competition which will be open to ladies will be played for four prizes under medal play rules. Members of the home club will be penalised two strokes off their full handicap for local knowledge. A putting competition will be arranged, and a fee of one shilling will be charged on each card taken out. The prize will be awarded for the best score returned on the first card, and the sweepstake will be awarded, proportioned as above, to the best score on any card. Competitors may arrange their own partners and may start from 10 a.m. onwards, all cards to be returned by 5.30 p.m. The net proceeds will be handed over to the I.E.E. Benevolent Fund. The prizes have been presented by British Insulated Cables, Ltd., the British Thomson-Houston Co., Ltd., Callender's Cable and Construction Co., Ltd., the English Electric Co., Ltd., the General Electric Co., Ltd., Metropolitan-Vickers Electrical Co., Ltd., and other friends.

THE ROYAL INSTITUTION.

The annual meeting of the Royal Institution was held on May 1st, Sir Arthur Keith in the chair. Sixty new members were elected in 1928, and 64 lectures and 19 evening discourses were delivered. Officers for the ensuing year are :—PRESIDENT, The Duke of Northumberland ; TREASURER, Sir R. Robertson ; SECRETARY, Major C. E. S. Phillips ; MANAGERS, Lord Blanesburgh, Sir James Crichton-Browne, Sir Arthur Keith, Sir Richard Paget, Messrs. E. Clarke, F. G. Donnan, W. H. Eccles, W. Vaux Graham, J. S. Highfield, V. Warren Low, C. H. Merz, R. Mond, C. C. Paterson, G. C. Simpson, and W. J. Tennant. VISITORS, Messrs. M. A. Adam, E. N. da C. Andrade, J. H. Batty, F. H. Berryman, M. Ellis, K. R. Hay, D. Heron, G. W. C. Kaye, W. Macnab, E. S. Mond, H. M. Ross, W. S. Rowntree, S. Skinner, H. R. D. Spitta, and A. E. Western.

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NEWS IN BRIEF.

New Telephones for the Post Office—Bombay and Electric Water-Heaters—Fares to the N.E. Coast Exhibition—The E.T.U. and Unemployment.

RIPON Electricity Committee is considering plans for electricity showrooms.

It has been decided to light the Parish Church of Albury (Surrey) electrically.

The Henley-on-Thames Charity Trustees propose to light the almshouses electrically.

Birmingham Salvage Committee is to erect and equip an electric vehicle garage at the Lifford depot, at a cost of £6 430.

Bangor (co. Down) Corporation requires an electrical engineer and manager.

Barnstaple Lighting Committee is preparing a scheme for an electrical showroom.

Ballot papers for committee vacancies, session 1929–30, of the Western Centre, I.E.E., should be returned to-day (Friday).

At a meeting of the Overhead Lines Association on May 15th, Lt.-Col. W. A. Vignoles will give an address entitled "Getting Consumers in Rural Areas."

Members of the Association of Mining Electrical Engineers (South Wales Branch) visited the works of the Electrical Construction Co., Wolverhampton, on Thursday.

The annual dinner of the Bradford Engineering Society was held at the Great Northern Victoria Hotel, on May 3rd. Those present included Mr. H. Unwin, president; the Lord Mayor of Bradford, Prof. F. C. Lea, guest of honour; Messrs. R. A. S. Thwaites, Thos. Roles, and W. Kirby.

Mr. J. Rowan, general secretary of the Electrical Trades Union states, in his monthly report, that so far as the E.T.U. is concerned, there is no complaint, except in one or two isolated areas, of any scarcity of employment. In most areas there is an acute demand for the Union's members.

Bombay Corporation has amended the water by-laws so as to admit of electric water heaters being connected to the direct water supply pipe.

The Women's section of the Eastbourne local Labour Party has suggested the provision of electrically fitted public washhouses at the Victoria Drive and Martello housing sites.

The 1928 edition of the annual volume of "Regulations and Orders relating to Mines under the Coal Mines Act, 1911," has been published by H.M. Stationery Office (price 1s.; post free 1s. 4d.)

Torquay Electricity Committee has decided to continue negotiations with the contractors in the town with regard to the sale of fittings and apparatus, before coming to any decision regarding the purchase of new premises for electricity showrooms.

At the Wednesday's meeting at the annual conference for the National Association of Goldsmiths, at Weston-super-Mare, Mr. F. Hope-Jones delivered an address entitled "Britain's Supremacy in Time-Keeping." Mr. R. P. Howgrave-Graham also spoke at the same meeting.

On May 2nd members of Preston Corporation visited the Crown Street electricity works, Messrs. Hawkins' Green Bank Mill, where a modern electrical plant is installed, and the joint sub-station of the English Electric Co.'s works, Strand Road; they also inspected the new Preston-Blackpool transmission line.

Hett P.C. is to borrow £200 for electric street lighting.

Manchester Education Committee has decided to adopt electric lighting at Mobberley open-air school.

Birkenhead Electricity Committee is to consider a scheme for providing wiring installations through automatic meters.

Eastbourne Corporation has informed the Ministry of Health that, if required, an undertaking will be given that no one shall have an electric light ray bath, when these are provided at the Devonshire Baths, without medical sanction.

The Walsall telephone service was changed over to the automatic system on May 4th.

The Postmaster-General has ordered 60 000 telephone transmitters and receivers of British manufacture. (See page 569.)

A sum of £1 000 is to be expended by the Aberdeen Tramways Committee for providing music at the Sea Beach and Hazlehead from July 15th to August 3rd.

The annual meeting of the contributors to the Benevolent Fund of the I.E.E. was held yesterday, when a statement of accounts and balance sheet to December 31st last was presented.

The question of the pay of blind ex-Service men employed as telephonists in Government Departments has been considered by a committee of the National Whitley Council for the Civil Service. An advance of 3s. a week basic has been offered and has been accepted by the staff side.

The London and North Eastern Railway Co. announces that during the North East Coast Exhibition, day excursion tickets, available by the 1.10 a.m. train from King's Cross, London, and for return by 11.13 p.m. train from Newcastle, will be issued on the opening day (May 14th) and every Saturday from May 25th onwards.

A scheme of improved lighting for the sea front at Tower Gardens is being made by Herne Bay U.D.C., at an estimated cost of £225.

Plans of the Beauharnois Light, Heat and Power Co. for power development in the St. Lawrence, have been approved by the Canadian Government.

Work is being commenced on a new training school at Lambeth North (London) station for the drivers, guards, signalmen and other grades concerned in the operation of the Underground Railways.

The Hull Medical Officer of Health describes in his annual report an experiment carried out in connection with the artificial lighting of schools. Several firms installed electric lighting in different rooms and the efficiency of the installations was measured in candle power at various points.

The Post Office announces a list of places in the Home Counties which will in future be served by the London Toll Exchange instead of the Trunk Exchange. These include towns as far distant as Clacton-on-Sea, Eastbourne, Littlehampton, Bletchley, etc.

Watt-hour meters recently approved by the Electricity Commissioners include the "Ferranti" type F.C.C. single phase, rated sizes 10, 12½, 20, 25, 40 and 50A, 200 to 250 V, at 50 cycles, and "Korting and Mathiesen" type WZ.5° single phase, rated sizes 1·5, 3, 5, 10, 15, 20 and 30A, 100, 110, 200, 210, 220, 230, 240, and 250 V, at 50 cycles.

LOOKING BACKWARD.

FIFTY years ago THE ELECTRICIAN *of May 10th, 1879, recorded that :—*

The s.s. "Seine" was able to sail to complete the submarine cable between Mozambique and Natal.

A correspondent expressed the view that "as the telephone becomes better known . . . it will largely supersede the telegraph for many purposes."

Mr. W. H. Preece, in an inaugural lecture at the opening of the Albert Hall Exhibition of Electric Light Apparatus, said that "the electric lamp of the future remains to be invented," and that ideas as to its distribution were "as futile as those regarding the philosopher's stone and perpetual motion."

* * *

TWENTY-FIVE years ago, according to THE ELECTRICIAN *dated May 13th, 1904 :—*

Recommendations on the construction of underground sub-stations were issued by the Home Office.

The Institution of Electrical Engineers was holding a meeting to alter its Articles of Association so as to permit the creation of the new office of "President Elect." The National Electrical Manufacturers' Association had a membership of 64.

An L.C.C. return showed that 15 local authorities and 14 companies possessed statutory supply powers within the County of London. Average load factors were 16·05 for local authorities and 13·75 for companies.

* * *

TEN years ago, as reported in THE ELECTRICIAN *of May 9th, 1919 :—*

A reduction of the Excess Profits Duty to 40 per cent. was a "welcome" Budget provision.

All restrictions on lighting were to be suspended for four days to permit of the illumination of buildings during the peace celebrations.

Mr. William Noble was appointed engineer-in-chief of the G.P.O. in succession to Mr. William Slingo.

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PERSONAL.

IT is reported that Mr. H. Sewell, late of the Macintosh Cable Co., will be general manager of Derby Cables, Ltd. See page 573.

Mr. D. Williams, of the Leicester Corporation Electricity Department, has been appointed consumers' engineer at the Rugby electricity works.

Amongst the presentations at the Levee at St. James's Palace, on Tuesday, was that of Mr. E. G. Benn, who was presented by his father, Sir Ernest Benn.

A portrait of Sir Hugo Hirst, painted by Mr. Richard Jack, R.A., is included in the Royal Academy Summer Exhibition, which opened on Monday.

Sir J. A. Ewing, F.R.S., has been appointed a member of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research in place of the late Mr. R. W. Reid.

Personal estate in Great Britain to the value of £71 657 was left by the late Dr. C. Scheibner du Riche Preller, who was for many years engaged on electric railway undertakings in Central Europe and was formerly chairman of the Dimmat Valley Electric Railway Co.

Torquay Electricity Committee has recommended the payment to Mr. H. F. G. Woods of 500 guineas for the special services he has rendered as consulting engineer in connection with the extension of the generating station at Newton Abbot and the installation of additional plant.

Mr. A. C. Morgan, secretary to the technical management at the Belvedere works of Callender's Cable and Construction Co., Ltd., who is taking up a position in London, has been presented by his colleagues with an inscribed gold watch. Mr. Morgan has been on the staff for 22 years.

Contributions to the National Radium Fund, which has been established as part of the Thank-offering for the King's convalescence, include :—Lord Weir, £250 ; Western Union Telegraph Co., £10 10s. ; General Electric Co., Ltd., £500 ; Mr. Sydney Evershed, £52 10s. ; Underground Electric Railways Co. of London, Ltd., £500 ; and Mr. F. A. B. Lord, £5 5s.

Mr. Arthur E. Apps was presented on Tuesday with a silver cigarette box by the staff and employees of the London and South of England branch of Simplex Conduits, Ltd., on his retiring from the post of sales representative after 18 years. Mr. Apps is a Batti-Wallah of long standing, and is taking up an engagement with the Millars Machinery Co., Ltd.

Obituary.

SIR PERCY KENDALL STOTHERT, on Monday, aged 65 years. He was chairman of Stothert and Pitt, crane makers, of Bath.

OVERHEAD LINES ASSOCIATION.

Preliminary Details of the Summer Meeting to be held in July.

THE summer meeting of the Overhead Lines Association will be held in Cheshire very early in July by invitation of the directors of the Mid-Cheshire Electricity Supply Co., Ltd., and of the President of the Association. The local arrangements will be made by the President as time and circumstances may permit, and will be notified to members later. They will include inspection of the new designs of sub-stations for bulk supply for small towns, suburbs and villages, from the 33 kV main system ; also representative country lines, including some on native timber treated on the Cobra process, single phase, 3 300 V, with special guarding and compound lines 3 300 V and 220 V, on the same poles. The route will include many of the beauty spots of mid-Cheshire and, by way of contrast, the salt district near Brunner Mond's Works ; also an inspection of subsiduary areas. The special type of lifting building will be inspected. It is hoped to assemble at Crewe at about midday, and to end at 6 p.m. at the same centre.

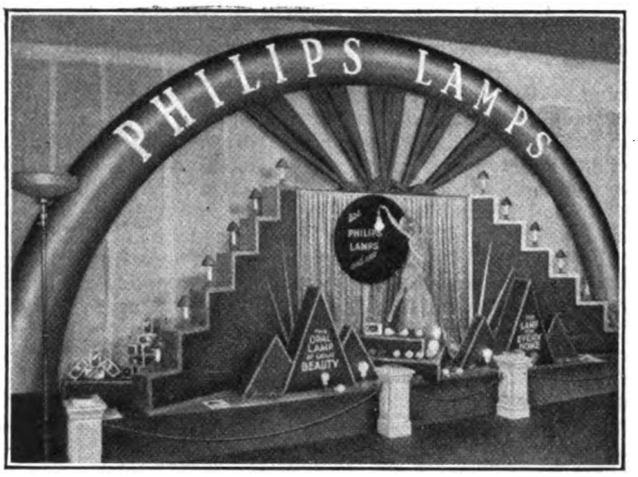
It is hoped that this visit, being held in the North Midlands, within easy reach of North Wales, Lancashire, Yorkshire and the South Midlands, will be attended by members from all parts. In the case of London members, a train, with restaurant car, will leave Euston at 8.30 a.m., stopping at Rugby and arriving Crewe at 11.36. Returning at 6.14 p.m., reaching London at 9.5.

In order to complete arrangements and to fix a date, members are asked to notify the Honorary Secretary before June 1st, giving him a list of the dates they have free during the first ten days of July.

BUSINESS ITEMS.

Messrs. SHIRLEY, electrical and wireless dealers, have opened a new showroom at 130, Cowley Road, Oxford.

T. BEADLE AND CO., LTD., of 3, 4, and 5, Castle Street, Hull, in addition to branches at Grimsby, Leicester and Liverpool, have opened a trade branch at 96, Hamilton Street, Birkenhead.



A special display of Philips lamps at the premises of Messrs. Lewis's of Liverpool.

The Ipswich branch of the GENERAL ELECTRIC CO., LTD., is moving, as from Monday, May 13th, from Commercial Union Buildings, Princes Street, to premises in Westgate Chambers, 40B, Westgate Street.

SIEMENS ELECTRIC LAMPS AND SUPPLIES, LTD., 38–39, Upper Thames Street, London, E.C.4, point out that each of the 11 new cars of the Swansea and Mumbles Railway has been equipped with "" Silvalux " gasfilled opal traction lamps.

The ELECTRIC FURNACE CO., LTD., 17, Victoria Street, London, S.W.1, has recently received a number of orders for furnaces in foreign countries, in some cases in spite of heavy import duties. These include two Héroult furnaces for India and Brazil, four Ajax-Wyatt furnaces, each of 600 lb. capacity, and four Ajax-Northrup high frequency furnaces varying from 15 cwt. to 2 cwt. capacity for France. A one ton Ajax-Northrup furnace will shortly be put into operation in France. This furnace, of which the output is equivalent to a four-ton arc furnace or an eight ton open hearth furnace, is claimed to be the largest high-frequency furnace yet constructed, and has been designed and built in Great Britain. Three 5-cwt. Ajax-Northrup furnaces will shortly be started in France, the order having been received last year.

BIRMINGHAM ELECTRIC FURNACES, LTD., 55, George Street, Birmingham, inform us that they have received an order from Moss Gears Co., Ltd., Tyburn, Birmingham, for an electric re-heating furnace. This firm has already three furnaces of the same make in operation. These comprise a large box type furnace for carburising ; a continuous rotating annular hearth furnace ; and a small box type furnace for re-heating purposes. Included among other recent contracts are a box type electric furnace for carburising, for the Alvis Car and Engineering Co., Ltd., Coventry ; an electric re-heating furnace for the same firm ; and three electric re-heating furnaces for David Brown and Sons, Ltd., Park Works, Lockwood, Huddersfield.

PROPOSED DOMESTIC APPLIANCES EXHIBITION.

A conference to discuss the possibilities of a periodical exhibition for household appliances was held recently under the auspices of the Household Appliances Section of the London Chamber of Commerce, among those present being Mr. T. G. Leith, of the G.E.C., and Mr. V. W. Dale, of the E.D.A. Mr. L. J. Hydle, chairman, said that he felt that the ironmongery and allied trades were now of sufficient importance to warrant their organising an exhibition of their own. Mr. L. Leith said that his company was of the opinion that more co-ordination could exist between manufacturers and ironmongers' in the sale and display of electrical appliances. It was decided that the Ironmongers Federated Association should be asked to approve the suggestion and to encourage manufacturers to support such an exhibition.

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LEGAL INTELLIGENCE.

Hearing of Evidence in Respect of Extension of B.T.-H. Lamp Patent.

IN the Chancery Division, on Monday, Mr. Justice Luxmoore had before him an application of the British Thomson-Houston Co., Ltd., for an extension of their patent No. 10 918, dated May 8th, 1913, relating to gasfilled incandescent electric lamps. Applicants asked for an extension for five years, on the ground that they had suffered loss or damage owing to the war.

Sir A. Colefax, K.C., for the applicants, said the application was made under sub-section 6 of section 18 of the relevant Act. The patent had been the subject of litigation in this country, and its validity had been upheld by the House of Lords. The invention was made in the United States by a gentleman in the employ of the General Electric Co. of America. When war broke out considerable work had been done in this country by the British Thomson-Houston Co., who were the grantees and registered owners of the patent in the application of the invention to large-sized lamps, suitable for voltages generally obtaining here, and progress had been made in their manufacture. Since tungsten was not made in this country, filaments were made here from imported tungsten. When war broke out the applicants had to make suitable tungsten. Further, the gas essential for our voltages was argon for the smaller lamps, mixed with another gas in the larger sizes.

Lamp Sales.

His case was that in respect of the large lamps their manufacture was seriously interfered with, while application of the invention to smaller sized lamps would find the greatest use. In fact, it constituted to-day 70% of the actual sales in this country of lamps made in accordance with the invention. So far as the British Thomson-Houston Co. and their licensees were concerned, the company became a controlled establishment in 1915 and remained so till the middle of 1919. The lamp department was largely occupied in making wireless valves and special lamps required for military purposes. Their licensees were also controlled establishments.

His case was that the applicants had lost for four years the life of a valuable patent. The few lamps made in this country during the war were supplied to the Government, and in 1918 there was an importation of these lamps for Government purposes from Holland.

Notice of objection to the extension had been given by Mr. Claude H. Morrell and by Mr. A. H. Gower. An objection by Lissen, Ltd., was, he understood, withdrawn. There were objections by a union of French lamp manufacturers. The Nox Electric Lamp Co., who were represented by Sir Duncan Kerly, wanted a licence, which applicants were not indisposed to grant on certain terms and subject to royalties. Applicants had not refused a licence, except in one case for good reasons. The other objectors were Tungstalite, Ltd., the Nye Electric Co., Ltd., and the Nelson Electric Co., Ltd. They said that if applicants had suffered loss by reason of the war, they had more than recouped their losses since. They also said that prices were too high, but as last year 17 million of these lamps were sold in this country it did not look as if this were the case or as if the public were suffering. Another objection was that large dealers had been given the option that if they would take other lamps of the applicants they would receive a bigger discount on the patented lamps. The patent was in force, and had been extended in the principal European countries, with the exception of France, where it had been held invalid on the ground of alleged prior publication. The decision was to be the subject of appeal.

Affidavit evidence having been read, Sir Duncan Kerly said he was not there to oppose on behalf of the Nox Co., but his contention was that he had a concluded agreement for the grant of a licence, and he would ask his Lordship not to grant an extension unless he had a licence according to the agreement.

The hearing was continued on Wednesday and further adjourned.

Marconi Royalties.

The appeal by Marconi's Wireless Telegraph Co., Ltd., from a decision of Mr. W. S. Jarratt, Comptroller-General of the Patent Office, and Mr. H. C. Haycroft, his assistant, was again before Mr. Justice Luxmoore, in the Chancery Division, last week.

Sir Duncan Kerly, resuming his speech for the appellant, said the Marconi Co. had granted 2 200 licences and had never yet refused a licence to what might be described as a solid applicant. The Comptroller's decision was that the 12s. 6d. royalty was too high and that there was reason to believe it might exclude a body of possible buyers. There was no evidence to support that view.

Mr. Trevor Watson also addressed his Lordship in support of the appeal.

Mr. Moritz, for respondents, said this case affected a large body of traders and a trade of national importance, but there were no novel principles involved. Compulsory licences had been part of the law of this country for nearly fifty years and scores had been granted. The Marconi Co. never had manufactured broadcast receiving apparatus, but had a subsidiary company, the Marconiphone Co., to which it granted a licence to make apparatus. Dealing with his submission that there had been a refusal to grant a licence to the Brownie Co. on reasonable grounds, Mr. Moritz said there was a concealment of the fact that all licensees were not treated alike. Certain firms who could manufacture by mass production were granted special licence terms, while at the same time the other licensees were told that everybody was being granted licences on the same terms. It had come to the information of the respondents that the British Thomson-Houston Co. had never paid the scale of royalties suggested in the evidence, and that they had paid at the rate of 2s. 6d. per valve holder.

Sir Duncan Kerly said the British Thomson-Houston paid a 10s. royalty, and they continued to pay 10s. royalty down to just before the hearing of the case before the Comptroller. On the eve of the hearing they did not make their payment, and, in fact, they had made no payment since in this matter. They had not been pressed to make it, nor had any agreement been made. The matter was merely standing over, and no doubt it would be affected by the result of these proceedings. As regards the other licensees, until the Brownie application was made they continued to pay, but some of them, on that application being made, were allowed to let the matter stand over.

Mr. Moritz said he could not accept the evidence. Within the last twenty-four hours they had discovered that 10s. was not the rate at which the B.T.-H. Co. paid.

Mr. Shelley, for the Brownie Co., argued that any manufacturer must get a licence from the Marconi Co. or go out of business, but it did not follow that the licence was a reasonable one.

At the resumed hearing on Wednesday, the Attorney-General, Sir T. Inskip, gave the case for the Crown, after which Mr. Justice Luxmoore reserved judgment.

Marconi v. Langham Radio.

In the Official Referees Court of the High Courts on Monday, Sir Francis Newbolt, K.C., had before him an action brought by Marconi's Wireless Telegraph Co., Ltd., against Langham Radio, of 96, Regent Street, W., in which plaintiffs claimed a declaration that they were entitled to inspect the defendants books and accounts relative to certain licenses granted by the plaintiffs to defendants under a contract of May 6th, 1926, to ascertain the amount due and payment of the same. The matter came before Mr. Justice McCardie on January 23rd last, who sent it to the Referee, as the defendants submitted to judgment.

Mr. Samuels, for the plaintiffs, said the auditors found that there was due to the plaintiffs £11 066.

Mr. Gardiner, for the defendants, did not contest this, and the Official Referee entered judgment for plaintiffs for the amount stated, with costs.

FIBRE CONDUIT.

We have received from H. D. DOUGLAS AND CO., LTD., of 7, Victoria Street, London, S.W.1, particulars of "Bermico" multiple conduit, for the laying of underground cables. This conduit is made of fibre with sleeve joints, and, it is claimed, is immune from the action of those acids and alkalis commonly found in soil. The makers state that the dielectric strength when the conduit is dry is approximately 50 000 V, and is at present in use with cables carrying voltages of from 2 300 to 132 000. Several ducts of this material may be bound with iron bands, and in order to overcome the possibility of setting up an induced current in the bands when used for high tension work, they are fitted with fibre insulators.

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IN PARLIAMENT.

London Passenger Traffic Bills Passed by House of Commons Committee.

THE L.C.C. (Co-ordination of Passenger Traffic) Bill, as amended by the Select Committee was discussed in the House of Commons last week.

Mr. G. M. Gillett moved to amend clause 2 so as to provide that a " reasonable return " on capital should not exceed 5% per annum or 1% in excess of the average Bank rate during the preceding year, whichever was the lower.

Sir H. Jackson opposed the amendment. The Committee had decided that the return must be such as would enable additional capital to be raised at above par. The amendment was rejected.

An amendment to leave out certain provisions in clause 3 relating to payments into a common fund was also defeated, as was an amendment proposed by Mr. E. Thurtle to limit the capital admissible as ranking capital. The Bill was passed for third reading.

In the discussion on the London Electric Railways Bill, Sir Henry Jackson said immediately after the passage of the Bill work would be begun on the extension of the Piccadilly tube from Finsbury Park (to Southgate). The third reading of this Bill was also agreed to.

Grampian Electricity Bill.

In consequence of the death of Viscount Younger, chairman of the House of Lords Committee which has been considering the Grampian Electricity Supply Co.'s Bill, and of the failure of the parties concerned to agree to the appointment of a new chairman, the Committee has been discharged, and if the measure is to be proceeded with, it will be necessary for it to be re-introduced and re-committed.

Mansfield Co.'s Trolley Vehicles Bill.

The Bill promoted by the Mansfield and District Light Railway Co. seeking powers to convert the existing tramway system to a trolley vehicle system, etc., came before the Local Legislation Committee of the House of Commons recently.

Mr. F. Wrottesley, K.C., for the promoters, said Mansfield Corporation had carried on a policy of incredible and reckless granting of licences for omnibuses. Unless protection was given to the statutory undertaking there must be an end of the system. The directors had decided that the tramways should go, as the streets of Mansfield were very narrow. The alternative was the trolley vehicle system. The promoters also sought power to construct as trolley vehicle routes, two authorised but as yet unconstructed tramway routes.

Sir Joseph Nall, chairman of the company, gave evidence in support of the Bill. He maintained that on established routes the trolley vehicle had every advantage over the petrol bus. He described the bus conditions in Mansfield as chaotic.

Mr. W. G. Marks, manager of Nottingham Corporation tramways, gave evidence as to the suitability of the trolley vehicle system for the proposed routes.

Mr. Arthur Collins, financial expert, said the gross cost of the proposed conversion would be £49 015, including £13 333 for the renewal of the tramway tracks.

Mr. Craig Henderson, for the Trent Motor Traction Co., Ltd., said it would be unjust to grant the monopoly.

Mr. James Haller, county surveyor for Nottinghamshire, said the proposed trolley vehicle route from Mansfield to Blidworth was unsuitable.

Alderman Beck, Mayor of Mansfield, said a conference of local authorities had decided that it would be to the general interest of the inhabitants to oppose the proposals.

The Committee approved the Bill, and decided to include the monopoly powers, and to introduce a clause protecting the interests of existing holders of omnibus licences on the specified routes. All new licences to ply for hire on the specified routes would be issued only to the promoters. The slight extension to the specified routes would be allowed, but the proposed trolley vehicle routes to Clipstone and Blidworth would not be sanctioned.

Derbyshire and Nottinghamshire Power Bill.

On April 25th the Unopposed Bills Committee of the House of Commons passed for third reading the Bill promoted by the Derbyshire and Nottinghamshire Electric Power Co. for new capital powers. The principal object of the Bill is to seek authority to raise further capital to the extent of £500 000 and to increase the borrowing powers by half that amount.

"JUBILEE OF LIGHT."

American Claims for Invention of the Incandescent Lamp.

FOR the information of readers who have not seen the full details of the American plans to honour Mr. Edison for the discovery of the electric incandescent lamp (actually invented by the late Sir Joseph Swan), we reprint below extracts from the N.E.L.A. " Bulletin " for April, which give some idea of the scale on which the celebrations are being organised :—

" The international celebration of the Golden Jubilee of Light—marking the fiftieth anniversary of the invention of the incandescent light bulb by Thomas Edison—will be inaugurated in Atlantic City, beginning on the evening of Friday, May 31, the inauguration festivities to continue throughout the fifty-second convention and exhibition of the N.E.L.A.

" In addition to opening the world-wide festival of light, the event will initiate a brilliant light display throughout the entire resort and approaching highways, to last until October 21st, the anniversary date.

"Fifty Golden Years."

" This year marks the fiftieth of fifty golden years of lighting and electrical progress. And October 21st, 1929, will mark the fiftieth anniversary of Thomas A. Edison's invention of the first practical incandescent lamp, the very corner-stone over which the electrical industry has raised itself.

" This golden year, then, and that golden day offer not only the vast lighting industry, but the entire civilised world, that long-waited-for opportunity to pay a fitting personal tribute to the master inventor for the greatest of all his gifts to mankind, and that opportunity to celebrate fittingly the fiftieth birthday of the incandescent lamp, both with Light's Golden Jubilee.

" According to extensive plans already taking shape, Light's Golden Jubilee will be just as much an occasion for serious retrospect, profound appreciation and genuine inspiration as it will be a celebration, gala, festive and jubilant. It will be a celebration exclusive to no one company, to no one industry, nor will it be limited to any single nation. It is upon the people of the world, upon a grateful people, that the blessings of Edison have been showered. Light's Golden Jubilee offers the electrical trade a golden opportunity to join hands with the world at large in standing beside the man who gave the world light without flame, the man whose life is an inspiration to all, the man who stands for all that is American and good. Individually and collectively the men of the electrical industry owe it to themselves to make Light's Golden Jubilee the greatest tribute ever paid a living man.

" Light's Golden Jubilee sponsoring committee, which is now being formed, will have at its disposal an adequate organisation to plan, to direct, and to co-ordinate the many events and activities of the jubilee. It is expected that the time between now and the National Electric Light Association convention at Atlantic City in June will be devoted to crystallising and perfecting plans and organisations, and preparing essential literature. It is the general plan to start the first of a great series of events relatively early, with the thought of leading up to a tremendous climax on October 21st —the fiftieth birthday of the incandescent lamp; October 21st will be ' The Night of Light,' and will be the occasion of a celebration and tribute to Thomas Edison which will encircle the globe and echo through the years that follow.

" Light's Golden Jubilee should be the occasion for jubilee lighting festivals all over the nation. It will call upon all branches of the industry to promote the movement nationally and locally. Every retailer, wholesaler, central station and manufacturer will have a twofold opportunity—first, of active direct participation, and, second, of encouraging others to participate.

" The jubilee will be magnificently supported by Henry Ford, Edison Pioneers, and close personal friends of Thomas Edison. All of Edison's original laboratories and machines are being moved to Dearborn, Mich., where Menlo Park will live again and through the years as part of the great Ford Museum of American Industry.

Following publication of the American proposals, we have received numerous protests from British electrical engineers against the action of the N.E.L.A., and there is increasingly strong support for the suggestion, made in our columns last week, that a formal letter of protest should be sent by the Institution of Electrical Engineers to the American organisations concerned.

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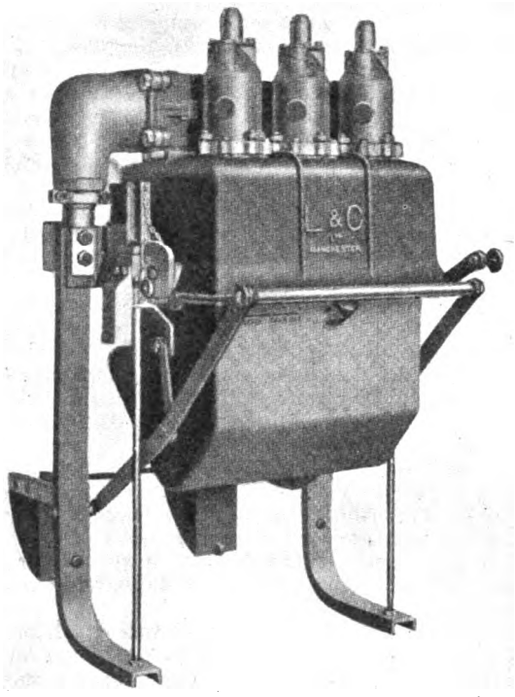
ISOLATING SWITCH FUSES.

WE have received from LONG AND CRAWFORD, LTD., 2, Gorton Road, Manchester, S.E., particulars of a self-isolating oil-immersed switch-fuse arranged for various types of line and cable terminal connections and designed for use on 3 300, 6 600, 12 500 and 33 000 V single and three-phase systems. The gear is equally suitable for mounting on overhead line pole cross arms, on a frame structure, or for kiosk and cubicle fitment.



One of the service type self-isolating oil immersed switch-fuses by Long and Crawford, Ltd.

The oil switch fuse unit is constructed in two main parts. The top or fixed portion carrying the through insulators and terminals for connections to the line and transformer on branch circuit, and the lower part containing the switch with its operating gear, replaceable fuses, and oil tank. The electrical connection between the two parts is made through concentric plugs and sockets forming the isolating feature of the gear, the latter being operated by the movement of a lever, which lowers the oil tank for fuse replacement by an extension of the same movement. Both plugs and sockets are completely shrouded and encased within the unit, and when opened are separated by a wide gap. No extraneous isolators are required. The switch, which functions under an adequate head of oil, has an independent operating handle so interlocked with the isolating gear that a mistake in the sequence of operations cannot occur. The fuses are of a replaceable type engaged in suitable carriers and forming the switch arm. They are always immersed in and freely open to the oil in the switch tank, and rupture the circuit under a good head. Access to the fuses can only be obtained when the switch has been opened, the isolators separated and the oil tank lowered.

INDUSTRIAL COUNCIL FOR WEST MIDLANDS.

The annual meeting of the District Industrial Council for the Electricity Supply Industry, in the West Midlands area, which deals with wages and conditions of service in the counties of Warwickshire, Staffordshire, Worcestershire and Shropshire, was held at the Chamber of Commerce, Birmingham, on April 22nd. The Council consists of an equal number of employer and trade union representatives. Coun. R. F. Dempster presided. During the year the West Midlands Joint Electricity Authority and Cannock U.D.C. Electricity Department became affiliated to the Council. It was reported that the number of men employed by undertakings affiliated to the Council totalled 3 400, while the weekly wages bill amounted to approximately £11 000. Special investigations with regard to various classes of labour have been carried out with every hope of settlements satisfactory to both sides. General wages rates as stabilised by the agreement made in December, 1927, have been continued and renewed to December 31st, 1929.

The Council expressed thanks to the chairman, Coun. R. F. Dempster (Amalgamated Engineering Union), to Mr. G. R. J. Parkinson (Midland Electric Corporation), vice-chairman, and to Mr. C. Heathcock, hon. secretary and treasurer.

WINDOW DISPLAY.

Interesting Competition Open to London Electrical Showrooms.

THE annual competition for challenge cups organised by the London "Evening News" and the British Association of Display Men, with gold, silver and bronze medals presented by the British Empire Union, and diplomas by the British Association of Display Men, will be held in the London Postal Area, during the period May 23rd to 30th, inclusive, concurrently with the Empire Marketing Board competitions.

That section of the competition which is of most interest to the electrical trade falls under Class 3, which is confined to displays of "Things to Use," which includes domestic electrical appliances. This class offers gold, silver and bronze medals, as well as diplomas.

The competitions are open to all retail shops and stores in the London Postal Area. Windows must be entirely dressed with merchandise produced in the United Kingdom (Great Britain, Northern Ireland and any other part of the Empire). The inclusion of goods produced in foreign countries, even though packed in Great Britain or Northern Ireland, will disqualify an entry.

Entry forms may be obtained from the Secretary, the British Association of Display Men, 11, Berkeley Street, London, W.1, and must reach that address not later than May 13th. On receipt of entry form, each competitor will have posted to him a special window strip and card, and no display will be eligible for the competition which fails to show the card in a prominent position. Windows must be dressed for the period May 23rd to 30th, inclusive. The preliminary judging will be carried out by a personal visit of judges appointed by the British Association of Display Men, and a card will be handed to the competitor when his displays have been judged. The judges, during the preliminary test, will select in each district the two best competitors in each class for consideration by the central committee of judges for the challenge cups. Each competitor successful in this preliminary test will be asked to have a photograph of his window, as dressed for the judging, sent to the Secretary of the British Association of Display Men. Such photographs to reach him by June 5th, with the class and grade written on the back of the photograph with name and address. Any competitor failing to submit a photograph by that date will be disqualified. The arrangement of grades is:—Grade "A"—shops and showrooms employing 11 or more assistants; Grade "B"—6 to 10 shop assistants; Grade "C"—5 or less assistants. Points will be allotted by the judges on the following basis:—capacity of the display to sell merchandise, 20 points; originality of design or arrangement, 20 points; general attractiveness and neatness, 20 points; simplicity, 10 points; workmanship, 10 points; inexpensiveness of display and use of least accessories, apart from goods, 10 points; neatness in displaying price tickets and advertising matter, 10 points.

ELECTRICAL WOMEN.

Details of the Summer Outing—The Annual Conference—The Birmingham Branch.

THE summer outing of the Electrical Association for Women will be held on June 12th, when a visit to Ashford will be made by the invitation of the Ashford District Branch. The party will travel by motor coach via Maidstone and members will be received at Ashford by the chairman of the Urban District Council, to be followed by a visit to the electricity works. Tea will be served and a garden party held at "Gleniffer Brae," the home of Mr. and Mrs. H. Wilson, members returning to London at 10 p.m. Those intending to be present should notify the Director by June 3rd.

The conference and annual general meeting will be held at Newcastle-on-Tyne, on July 10th, 11th and 12th, by the invitation of the N.E. Coast Branch.

Members of the Birmingham and Midlands Branch paid a visit on April 25th to the needle factory of Henry Milward and Sons, Redditch, about 70 forming the party. The factory is entirely electrically equipped. At the conclusion of the visit, every member was presented with a souvenir of the visit in the form of a needle case. Mrs. H. K. Beale, president, delivered a vote of thanks to the firm and staff for all they had done.

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BUSINESS OPENINGS.

Latest Particulars of Electrical Engineering and Wiring Installation Contracts for which Tenders are being Invited at Home and Abroad.

WE give below the latest particulars of contracts for which tenders are invited. The closing date is given, when available.

AYR DISTRICT COMMITTEE.—Electric light wiring in District Fever Hospital, Old Cumnock. Specification from Mr. J. E. MacEwan, 62, Robertson Street, Glasgow, C.2.

CARDIFF CORPORATION.—Electric lighting of High School, Girls' Extension, The Parade, Cardiff. Specifications from the City Electrical Engineer.

MELTON MOWBRAY URBAN DISTRICT COUNCIL.—Electric light wiring of Egerton Lodge, Melton Mowbray. Forms of tender from the surveyor, Mr. W. H. Jarvis, Corn Exchange, Melton Mowbray.

ST. PANCRAS (LONDON) BOROUGH COUNCIL.—Electric motor driven pump. Specification, etc., from Electricity Department, 57, Pratt Street, Camden Town, N.W.; deposit £1.

WEST MIDLANDS JOINT ELECTRICITY AUTHORITY, May 10th.—(a) Main 33 000 V switchgear, each circuit breaker having rupturing capacity of not less than 1 500 000 kVA; (b) auxiliary 33 000 V switchgear, each circuit breaker having rupturing capacity of not less than 500 000 kVA, with group feeder reactors, for Ironbridge power station. Specification (No. 4) and form of tender from Mr. E. F. Hetherington, chief engineer and manager, Phœnix Buildings, Dudley Road, Wolverhampton; deposit £2 2s.

WEST MIDLANDS JOINT ELECTRICITY AUTHORITY, May 10th.—(1) One 50 000 kW turbo-alternator, with step-up transformers, etc.; (2) condensing plant, boiler-feed pumps, evaporators, etc.; (3) circulating water pumps, etc., for Ironbridge power station. Specification (No. 2) and form of tender from Mr. E. F. Hetherington, chief engineer and manager, Phœnix Buildings, Dudley Road, Wolverhampton; deposit £2 2s.

BLACKBURN CORPORATION, May 11th.—Supply of 10 drums of l.t. cable. Further particulars from the Electrical Engineer, Town Hall, Blackburn.

SOWERBY EDUCATION DEPT., May 11th.—Electric light installation in Heptonstall Council School and head teacher's house. Specifications from Mr. A. Beilby. Education Offices Sowerby Bridge.

STOCKPORT CORPORATION, May 11th.—Supply of two wireless sets for elementary schools. Specification can be seen at the Education Offices, Town Hall, Stockport.

WEST RIDING EDUCATION COMMITTEE, May 11th.—Electric light installation in South Crosland Netherton Council School Specifications from Mr. W. Heeley, 4, Macaulay Street, Huddersfield.

LONG ASHTON RURAL DISTRICT COUNCIL, May 13th.—Electric light installation in Council houses at Fenswood, Long Ashton. Particulars from Mr. A. E. Hicks, clerk, Flax Bourton, Bristol.

GLASGOW CORPORATION, May 14th.—Electric lighting installation at Haghill No. 2 housing scheme (tenement section), intermediate type. Specifications, etc., from the General Manager, Electricity Department, 75, Waterloo Street, Glasgow.

Electric Trolley Wire.

MANCHESTER CORPORATION, May 14th.—Cadmium copper trolley wire, and copper bands for tramway rails. Specifications, etc., from the General Manager, Corporation Tramways, 55, Piccadilly, Manchester.

WEST RIDING EDUCATION COMMITTEE, May 14th.—Electric light installation in mixed and infants' departments of Robin Hood School, Rothwell. Specification, etc., from Mr. Percy Beaumont, Education Offices, 8, St. John's North, Wakefield.

WOOLWICH GUARDIANS, May 15th.—Supply of electrical refrigerator, for use at the Institution, Plumstead High Street, London, S.E.18. Specification from the Clerk, Union Offices, 99, Rectory Place, Woolwich, S.E.18.

GLASGOW CORPORATION, May 16th.—Supply of (2) l.t., paper insulated, one, two, three and four core and e.h.t. cables; (3) small i.r. insulated cables and flexibles; (4) electric cookers; (5) meters; (6) arc lamp carbons; (12) electric kettles, for 12 months. Specifications from the General Manager, Electricity Department, 75, Waterloo Street, Glasgow, C.2. State whether cable schedule (2) or (3) is required.

HULL CORPORATION, May 16th.—Supply and laying of underground cables. Specifications, etc., from Mr. J. N. Waite, city electrical engineer and manager, Electricity Works, Sculcoates Lane, Hull; deposit £2 2s.

CHERTSEY GUARDIANS, May 18th.—Electric lighting installation at the Institution, Ottershaw, near Chertsey. Specifications from Mr. F. J. Wareham, clerk, Council Offices, West Byfleet, Surrey.

PANNAL (YORKS) PARISH COUNCIL, May 20th.—Electric or gas lighting, from October 1st to March 31st, for three years. Further particulars from Mr. J. H. Brooksbank, clerk, Lund House Green, Harrogate.

BELFAST CORPORATION, May 21st.—Manufacture, supply and erection of (*a*) h.t. armour-clad switchgear (specification No. W. 80), and (*b*) air preheaters for boilers (No. W.81); also for manufacture and supply of (*c*) 22 000 V, three phase transformers (No. W.82), and (*d*) cable drum trailer and tractor (No. W.83). Specification, etc., from Mr. F. H. Whysall, city electrical engineer, East Bridge Street, Belfast; deposit £2 2s. each for items (*a*), (*b*) and (*c*).

Overhead Lines.

BELFAST CORPORATION, May 21st.—Manufacture, supply and erection of 22 000 V, 3-phase overhead transmission line. Specification (No. W.84), etc., from Mr. F. H. Whysall, city electrical engineer and general manager, East Bridge Street, Belfast; deposit £2 2s.

BETHNAL GREEN (LONDON) BOROUGH COUNCIL, May 22nd.—Electric lighting installations in two blocks of tenement buildings. Specification, etc., from Mr. H. W. Couzens, 9, Old Queen Street, London, S.W.1; deposit £2 2s.

LARNE GUARDIANS, May 22nd.—Electric light installation in connection with conversion of workhouse buildings into a district hospital. Specifications can be seen and forms of tender obtained at the office of Mr. W. Pleasance, 44, Wellington Place, Belfast, or at the Union Offices, Larne.

RICHMOND (SURREY) GUARDIANS, May 22nd.—Re-wiring for electric lighting of certain buildings at Grove Road Institution, Richmond. Particulars from Mr. C. L. Fenn, Guardians Offices, Parkshot, Richmond, Surrey; deposit £1.

WEST LANCASHIRE RURAL DISTRICT COUNCIL, May 23rd.—Electric lighting scheme for parish of Aughton. Specifications, etc., from Mr. James Scott, 358, Royal Liver Building, Liverpool; deposit £2 2s.

BOOTLE CORPORATION, May 24th.—Electrician's work in connection with erection of 122 houses, under the Northfield Road housing scheme. Specifications from the Borough Engineer, Town Hall, Bootle; deposit £2 2s.

CENTRAL ELECTRICITY BOARD, May 25th.—Supply and erection of 33 000 V metal clad switchgear, in connection with South-East England Electricity Scheme. Specification (No. S.E.E.—G.S.1) from Mr. Richard H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

EPSOM URBAN DISTRICT COUNCIL, May 25th.—Supply and erection of l.t., d.c. switchboard, with the changing over of connections, with certain instruments and gear from the existing switchboard. Specification, etc., from the Resident Electrical Engineer, Electricity Works, Depot Road, Epsom; deposit £3 3s.

GEORGE HERIOT'S SCHOOL, EDINBURGH, May 30th.—Electrical installation. Specification, etc., from Mr. John Anderson, superintendent of works, 20, York Place, Edinburgh.

SUTTON AND CHEAM URBAN DISTRICT COUNCIL, June 7th.—Installation of fire alarm system, connected with the fire station. Plans showing positions of fire alarm boxes, etc., from the Engineer and Surveyor.

CROYDON CORPORATION, June 3rd.—Supply and erection of (*a*) one 20/25 000 kW turbo-alternator, with condensing plant, pumps, etc.; (*b*) boiler house extensions, with two 100 000 lb. per hour boilers, stand-by coal conveyor from siding, coal-handling plant at siding, steam piping and receiver, etc.; (*c*) engine room extension, switch house, bridges, and pump house; (*d*) 6 600 V switchgear, transformers, etc. Specifications, etc., from the Engineer and Manager, "Electric

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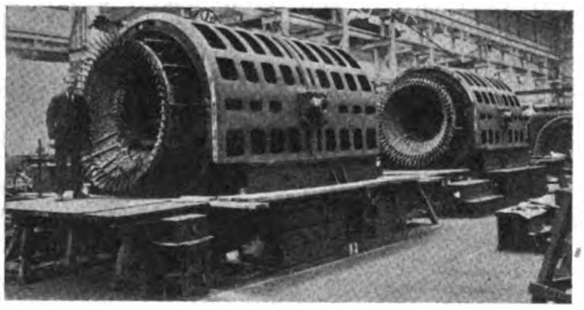
House," 38, High Street, Croydon; deposit £1 1s. for each section.

EAST HAM EDUCATION COMMITTEE, June 12th.—Electric lighting installation at the Salisbury School. Specification, etc., from the Secretary, Education Office, Town Hall, East Ham, London, E.6; deposit 10s. 6d.



ALTERNATOR stators for 3 000 r.p.m. steam turbine and alternator sets in course of manufacture at the works of the English Electric Co., Ltd. The stator in the foreground is for a 37 500 kVA set being constructed for West Ham. The turbine will have a h.p. cylinder and two l.p. cylinders exhausting into a single-body condenser, which will be the largest of its type so far produced at Rugby, with a weight of some 100 tons. The second stator is for the 31 250 kVA turbo set under construction by the same company for Leicester Corporation. Readers may recall that a set practically identical with the latter was recently ordered by Sheffield Corporation.

Overseas.

UNLESS otherwise stated, particulars of overseas contracts are to be had from the Department of Overseas Trade (Room 52), 35, Old Queen Street, Westminster, London, S.W.1. *Note.—An asterisk denotes that local representation is, in practice, essential.*

NEW SOUTH WALES PUBLIC WORKS DEPARTMENT, May 13th.—Supply and erection of synchronous condenser (contract 257, 28). (Reference B.X. 5 205.)

POSTMASTER GENERAL'S DEPARTMENT, MELBOURNE, May 14th.—Loading coil pots (schedule C. 433). (Reference B.X. 5 284).

EGYPTIAN MINISTRY OF PUBLIC WORKS, May 15th.—Supply and erection at Government Printing Office, Cairo, of 120 kW d.c. Diesel electric generating set, with foundations, artesian well, electrically-driven water cooling pump, etc. Forms of tender, etc. (10s. 6d.) from Chief Inspecting Engineer, 41, Tothill Street, London, S.W.1.

MELBOURNE AND METROPOLITAN TRAMWAYS BOARD, May 15th.—Supply of 500 kW sub-station rectifier unit, arranged for automatic control, with necessary switchgear (contract 677). (Reference B.X. 5 206.)

MELBOURNE AND METROPOLITAN TRAMWAYS BOARD, May 15th.—Supply of sub-station units for automatic control, comprising two rotary converters of 1 000 kW and one of 500 kW (contract No. 678). (Reference B.X. 5 210.)

PRETORIA MUNICIPALITY, May 20th (extended from May 6th).—Supply of cables, switchgear and transformers. (Reference B.X. 5 245.)

SOUTH AFRICAN POSTS AND TELEGRAPHS, May 23rd.—Supply of rubber covered wire and telephone cable (contract No. 153). (Reference B.X. 5 229.)

INDIAN STORES DEPARTMENT, May 27th.—Supply of 500 kW, 6-phase rotary convertor, starting panel, etc. (order No. N./9 736). (Reference B.X. 5 279.)

VALPARAISO PORT ADMINISTRATION, June 1st.—Four electric travelling cranes of portal type (capacity 3 metric tons each). (Reference A.X. 7 892.)

AUCKLAND ELECTRIC POWER BOARD, June 3rd.—Supply of cables and accessories. (Reference B.X. 5 248.)

NEW SOUTH WALES PUBLIC WORKS DEPARTMENT, June 4th.—Supply of 18 electrically operated water level indicators (contract No. 61/1928–29 W.S. and S.). (Reference B.X. 5 233).

VICTORIAN ELECTRICITY COMMISSION, June 4th.—Supply of 22 000 V transformers and spares (specification No. 29/36). (Reference B.X. 5 216.)

NEW ZEALAND POSTS AND TELEGRAPHS, June 18th.—Supply of telephone cords (No. P. and T. 151/1425). (Reference B.X. 5 251.)

VICTORIAN RAILWAY COMMISSION, June 26th (extended from May 15th).—Supply of geared, three-phase, electric winding engine. (Reference A. 7 630.)

SOUTH AFRICAN POSTS AND TELEGRAPHS, June 27th.—Automatic wall and table pattern telephones (tender No. 158). (Reference B.X. 5 273.)

STATE ELECTRICITY WORKS, MONTEVIDEO, July 8th.—Construction and equipment of 50 000 kW power station.

POSTMASTER GENERAL'S DEPARTMENT, MELBOURNE, July 9th.—Resistances and reactances (schedule C. 426). (Reference B.X. 5 281.)

NEW SOUTH WALES GOVERNMENT RAILWAYS, July 10th.—One 750 kW turbo-alternator; 2 200 V ironclad switchgear; two switch operating batteries; and two motor generator sets. Specifications from the Chief Electrical Engineer, 61, Hunter Street, Sydney.

NEW ZEALAND POSTS AND TELEGRAPHS, July 16th.—Telephone bells (P. and T. No. 151/1 444). (Reference B.X. 5 272.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, August 6th.—Supply of 120-ton, four-motor, overhead travelling crane and runway (specification No. S.M. 358). (Reference A.X. 7 810.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, August 13th.—Water turbine driven generating sets and switchgear, for Waitaki power development (section 2). (Reference B.X. 5 278.)

Tenders Accepted.

GENERAL POST OFFICE.—Edison Swan Electric Co., Ltd., charging tablets.

MERSEY DOCKS AND HARBOUR BOARD.—Callender's Cable and Construction Co., Ltd., electric cables.

HULL CORPORATION.—Siemens-Schuckert, supply of cables to telephones department, £279 9s. 3d. (Recommended.)

SHEFFIELD CORPORATION.—Rees Roturbo Manufacturing Co., Ltd., motors and pumps for Rivelin water pumping station, £1 055 15s.

MALVERN URBAN DISTRICT COUNCIL.—Pirelli-General Cable Works, Ltd., about 1 000 yards of h.t. concentric cable, class 3, £550 per 1 000 yards.

SOUTHEND CORPORATION.—General Electric Co., Ltd., h.t. switchgear and transformers, £5 220 2s. 10d.; Union Cable Co., Ltd., l.t., a.c. cable, £9 501 7s.

LEICESTER CORPORATION.—Hayward-Tyler and Co., Ltd., supply of three electrically-driven pumps for Belgrave pumping station, £4 097. (Recommended.)

LIVERPOOL CORPORATION.—Mather and Platt, supply, erection and maintenance of electrically operated pumping machinery at Aubrey St. Station, £2 840.

METROPOLITAN ASYLUMS BOARD.—Alpha Mfg. and Electrical Co., Ltd., installation of automatic telephone system at North Western Hospital. (Recommended.)

BRISTOL DOCKS COMMITTEE.—English Electric Co., Ltd., eight spare electric motors, for use in connection with grain elevators at Royal Edward Dock extension.

FULHAM (LONDON) BOROUGH COUNCIL.—S. Smith and Son, £20, five "Wootton" electric safety lamps, with charging apparatus, for use in sewers, £20. (Recommended.)

GLASGOW CORPORATION.—W. F. Dennis and Co. (for Felten and Guilleaume), copper trolley wire (German manufacture), £1 260. (Recommended.) Lowest British offer for same quality, £1 372.

GLOUCESTER CORPORATION.—General Electric Co., Ltd., supply and erection at the electricity works of two 1 000 kW motor generators for conversion of 11 000 V, 50-cycle, a.c. to 460/500 V d.c.

LIVERPOOL CORPORATION.—Annual supplies: Alternating current motors and starting gear, Crompton Parkinson, Ltd., English Electric Co., Ltd., British Thomson-Houston Co., Ltd., and Airedale Electrical and Manufacturing Co., Ltd.; insulated cables, Mersey Cable Works, Ltd., Geipel and Co., Ltd., and Edison Swan Electric Co., Ltd.; electricity meters, Ferranti, Ltd.; incandescent lamps, Tungstalite, Ltd.

ST. PANCRAS (LONDON) BOROUGH COUNCIL.—Electric Construction Co., Ltd., supply and erection of kiosk type sub-station and switchgear, £388. (Recommended.) Other tenderers: Johnson and Phillips, Ltd., £436 and £491; General Electric Co., Ltd., £513; Ferguson, Pailin, Ltd., £513 19s.; British Thomson-Houston Co., Ltd., £541; Park Royal Engineering Co., Ltd., £565; Crompton, Parkinson, Ltd., £574 (plus rough labour); New Switchgear Construction Co., Ltd., £669; Switchgear and Cowans, Ltd., £675; Whipp and Bourne, Ltd., £887 10s.; J. G. Statter and Co., £895.

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WIRELESS NOTES.

Advance Particulars Concerning the National Radio Exhibition of 1929.

THIS year's National Radio Exhibition will be held at the New Hall, Olympia, London, from September 23rd to October 3rd, the promoters being the Radio Manufacturers' Association. The positions of applicants for space will, as in former years, be made by ballots, one being for members of the R.M.A., and another for non-member applicants, so long as application is made by May 31st. After that date applications will be dealt with in order of date and space allotted accordingly, if available. All exhibits must be of British manufacture.

The conditions of the exhibition are the same as in previous years, except that this year special arrangements have been made whereby loud speakers, whether independent units or incorporated in receivers, may be demonstrated at certain times of each day of the show. The input for these demonstrations will be common and will be supplied by the organisers, local amplification or demonstrations of reception are, however, prohibited. The use of accumulators or batteries for lighting and power will not be allowed and the organisers have arranged to carry out all wiring requirements of exhibitors both as regards loud speaker demonstrations and stand lighting.

The layout of the ground floor of the exhibition is the same as last year with the exception that a double staircase will be provided for admittance to the gallery. The latter will this year be devoted to exhibitors' stands to the exclusion of the dance floor and the large space occupied in previous years by the B.B.C. Some of the additional space thus gained will accommodate twenty-five specially constructed cabinets or rooms, wherein loud speaker demonstrations may be conducted from the common input or from gramophone records.

Radio Wholesalers' Federation.

At a meeting of the new Council of the Radio Wholesalers' Federation, held on May 1st, Messrs. C. H. G. Hobday, of Hobday Brothers, Ltd., and W. A. Hunt, of the London Electric Stores, Ltd. were co-opted members. The officers for the year were elected as follows:—CHAIRMAN, Mr. E. W. Houghton, Houghton-Butcher (G. B.), Ltd.; VICE-CHAIRMAN, Mr. B. R. Banks, Brown Brothers, Ltd.; HON. TREASURER, Mr. A. G. Beaver, the Sun Electrical Co., Ltd. The above gentlemen, with Mr. T. Beadle, T. Beadle and Co., Ltd., again constitute the Federation's Liaison Committee.

A "Fultograph" photo-electric transmitter has been installed at Hilversum, and experimental broadcasts of still pictures will commence this month. The present stations offering "Fultograph" service are 5XX, 5GB, 2LO, and Vienna. Radio-Paris will shortly be added to the list.

Mr. W. H. J. Ryder, of North Shields, has presented the Tynemouth Jubilee Infirmary with a "Met-Vick" all-electric 5-valve wireless set. The apparatus is fitted with volume controls where required, and operates off a 240 V 40 cycle supply, for 70 headphones and six loud speakers.

THE NATIONAL REGISTER.

Executive Committee Approves Seventeen Applications from Contractors.

AT the May meeting of the Executive Committee of the National Register of Electrical Installation Contractors, held at the Institution of Electrical Engineers on May 3rd, twenty-eight applications from electrical contractors for admission to the National Register came up for consideration. Of these ten were declined and one was withdrawn.

The names and addresses of the seventeen successful applicants are given below:—

Belshaw and Co., Ltd., 68, Victoria Street, Westminster, London, S.W.1.

Burrell, R. C., 1, Back James Street, Harrogate.

Bush, E., and Co., 26, Sunbridge Road, Bradford.

Collins, C., 32, Denbigh Place, London, S.W.1.

Forrest and Webb, 12, Elmhurst Road, Handsworth, Birmingham.

Girdler, Edward, 131B, Streatham Road, Mitcham, London, S.W.16.

Holt, Allan, Electrical and Sanitary Engineering Co., 2, College Square East, Belfast.

Law and Carruthers, 1A, Cross Street, Bury, Lancs.

McMaster, Malcolm, Kerrsland Drive, Upper Newtownards Road, Belfast.

Maddocks, E. S., 6B, Flixton Road, Urmston, near Manchester.

Nicholson and Ade, 31-35, South Street, Eastbourne.

Podmore, Colin, J., 41, High Street, Longton, Stoke-on-Trent.

Shrosbery, Bakewell and Co., Ltd., 69, Crouch Street, Colchester.

Sothers, C. A., Ltd., 156, Hockley Hill, Birmingham.

Taylor, Percy, 98, Station Road, Taunton.

Troy, F., and Co., Ltd., 194-6, Finchley Road, Hampstead, London, N.W.3.

York, William, H., 11, Alcester Road, South, King's Heath, Birmingham.

ELECTRIC TRACTION.

Scottish Tramway Orders Inquiry—Applications for Restriction of Competition.

A COMMISSION, presided over by Lord Lamington, held an inquiry last week into applications by owners of tramway undertakings for Provisional Orders.

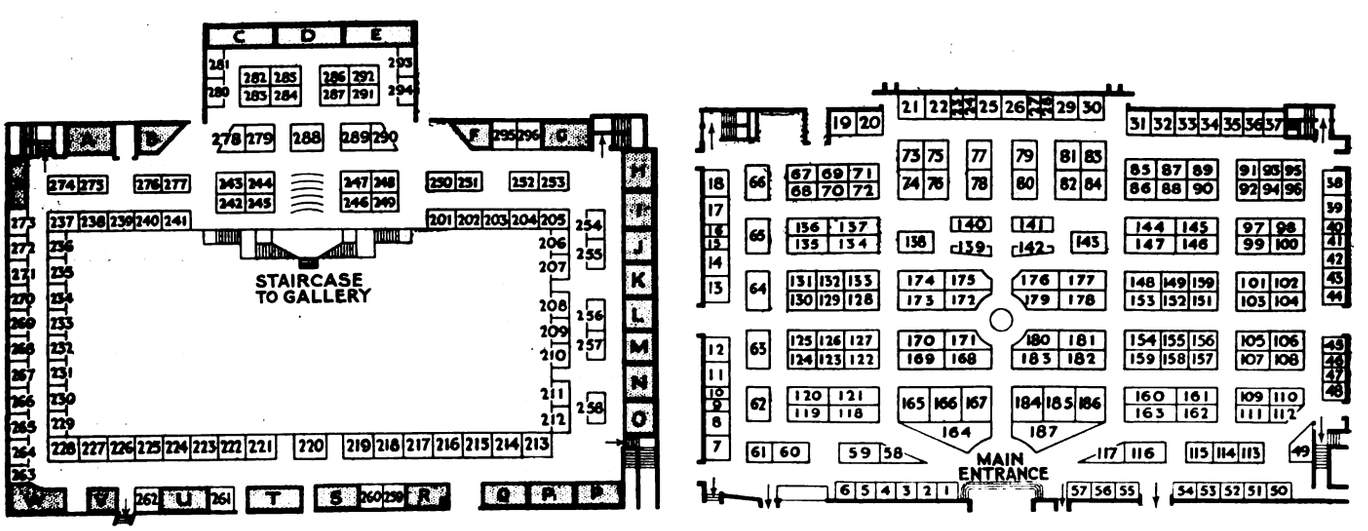
Ayr T.C. asked for power to run omnibuses in the burgh and five miles from the burgh boundary, and for protection from competition along the existing tramway route.

Mr. T. A. Gentles, K.C., for the Corporation, said the loss on the tramway undertaking last year was £1 849.

Mr. Wm. Grant, manager of the undertaking, said if the powers asked for were not granted he saw no hope of being able to run the tramways without a loss.

The Commission found the preamble of the Order not proved.

[Details of the other applications are unavoidably held over.]



A plan of the gallery on the left, with the ground floor on the right, showing the stand arrangements for the National Radio Exhibition, to be held in the New Hall, Olympia, London, in September. The shaded portions indicate the special loud speaker demonstration cabinets, all of which have already been allotted to R.M.A. members.

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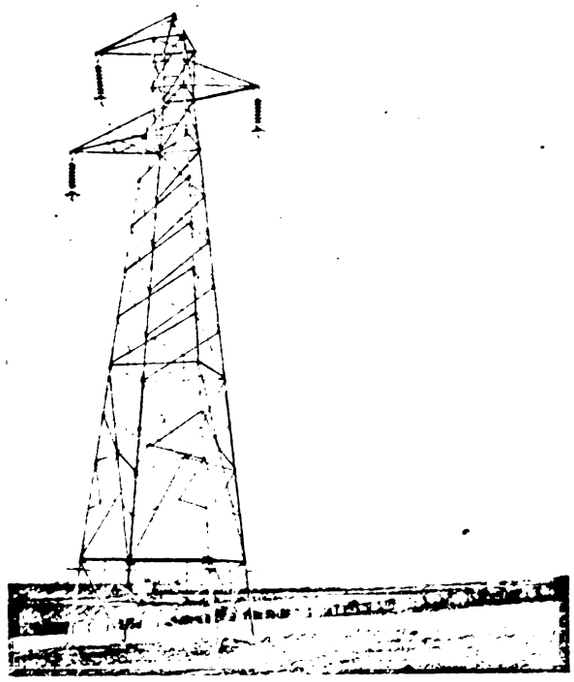
ELECTRICITY SUPPLY.

Additional Plant for Aldershot—Chester Extensions—Assisted Wiring at Bolton—Porthcawl Loan Refused—Loans for Cables, etc., at Marylebone.

WALSALL Electricity Committee is to extend mains at a cost of £7 000.

Aldershot T.C. has applied for a loan of £4 560 for an additional 1 000 kW set.



THE switching in, at full pressure, this week of the first 20 miles of overhead lines in connection with the Central Scotland Electricity Scheme, marks another milestone on the path of electrical progress. It is worth recording that this is the first transmission at 132 000 V in Great Britain. The section referred to will supply power from Dalmarnock sub-station, Glasgow, to Bonnybridge. A short section of line erected by the same contractors, British Insulated Cables Ltd., of Prescot, but situated in England, between Bedford and Little Barford, was made alive last week and is in commission at 33 kV. The latter voltage will be raised to 132 kV as soon as the rest of this scheme is completed.

Hornsey electricity department is to supply St. Luke's Hospital, Muswell Hill.

All lamps in the main roads of Conway have been converted from gas to electric lighting.

Coventry Electricity Committee seeks sanction to borrow £7 621 for extensions of mains.

Croydon Electricity Committee has accepted tenders for the erection of four sub-stations.

Heston and Isleworth Electricity Committee is to carry out mains extensions to cost £13 566 10s.

Formby U.D.C. has applied for a loan of £6 500 for electricity purposes for the next three years.

Nottingham Corporation has applied for a loan of £150 000 for extensions of mains and transformers.

Stoke Newington (London) B.C. has obtained sanction for a loan of £3 000 for free wiring installations.

Forres T.C. has concluded an agreement with the Grampian Electric Supply Co. for lighting in the town.

Wimbledon Finance Committee has received sanction to borrow £3 428 for a sub-station site and buildings.

Chailey R.D.C. has decided not to object to the construction of an overhead 11 000 V line between Haywards Heath and Uckfield.

Torquay Corporation has obtained an Order to supply the premises of the Co-operative Wholesale Society in Buckfastleigh U.D.C.

Barnstaple Lighting Committee is to apply to the Commissioners for sanction to a loan of £6 750 for a 300 kW Diesel generating set.

Plans for the erection of two sub-stations at Butterhill Triangle and Beacon Hill have been approved by Torquay Electricity Committee.

Tilbury U.D.C. has applied for loans of £5 000 for mains and services, £750 for plant, £4 200 for domestic apparatus, and £2 350 for wiring installations.

The Commissioners have sanctioned loans of £6 260 for the construction of stores for Burnley electricity department and £35 000 for mains extensions during the next three years.

The Whitehall Securities Corporation, which holds the whole of the shares in the Wellington District Electricity Co., proposes to take electricity in bulk to Wellington (Somerset) from Exeter.

Chester City Council has received sanction to a loan of £18 000 for overhead mains and £2 000 for outdoor sub-stations and equipment in connection with the supply to Kelsall, in the area of Northwich R.D.C.

Bolton Electricity Committee has adopted a scheme of assisted wiring. The Water Committee has made tentative arrangements with the Lancashire Electric Power Co. for a supply in connection with the Bromiley Well.

By the reductions in the charges approved of by Liverpool City Council last week, the drop in the revenue from Liverpool and Bootle will amount to about £21 000. The reduction in the other areas will bring the total decrease to £34 499.

Porthcawl U.D.C., having failed to obtain from the Electricity Commissioners sanction to a loan of £23 000 for electricity supply purposes, has decided to open negotiations with companies, individuals, and other authorities with regard to a supply.

Marylebone B.C. electricity department is to lay cable and put in electric lighting equipment at the chapel at East Finchley cemetery.—The Electricity Committee has received sanction to borrow £115 652 for electricity cables, switchgear, and transformers.

The Exe Power Experiment Association has been informed that the Board of Trade will grant permission to moor two pontoons in the Exe estuary, for the purpose of ascertaining what power can be obtained from the tidal waters, in connection with the scheme for harnessing the Exe for electrical purposes.

In submitting the 1929-30 estimates to Edinburgh T.C. last week, Treasurer Harvey said for electricity the estimate was nearly £400 000. The reason for that figure was the desire to complete as rapidly as possible Portobello station, which was becoming a generating station for Scottish national purposes.

The Irish Free State Electricity Supply Board has notified the Mayor of Limerick that the Board has placed the contract, for the distribution system for the city, valued at about £32 000. The work will commence in about a month's time, and is due for completion by mid-September. The network, when completed, will be fed from the temporary station at Ardnacrusha, pending Shannon supply. When Shannon supply is available in Limerick, the existing station will be shut down and dismantled.

Lancaster T.C. has applied for a Special Order to increase its area of supply so as to include (inter alia) the township of Heaton-with-Oxcliffe. Morecambe T.C. has notified Lancaster Council of a desire to take over the White Lund factory and the immediately adjoining area as part of its supply district, and that no objection will be raised to Lancaster Council's application, subject to this area being transferred to the Morecambe undertaking.—Lancaster Electricity Committee proposes to borrow £27 000 for two new boilers for the Caton Road station.

Mr. F. Gordon Tucker, on May 1st, held an inquiry into the application of the Maidstone T. C. to take an overhead 6 000 V cable to Aylesford, Ditton, and East Malling. Mr. E. E. Hoadley said the Corporation wanted to supply the Empire Marketing Board fruit preservation station, and the East Malling research station, and continue to West Malling, where the Corporation had already contracted for street lighting. There were objections on the grounds of alleged disfigurement of the countryside by the poles and inadequacy of the offer of 2s. per pole. The inspector said if electricity was to go into rural areas it had, in the main, to go overhead at the cheapest possible rate.

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ELECTRICAL NEWS OF THE WEEK IN PICTURES.

A new electrically-operated flashing sign which has been installed on the London-Southend road.

A group taken during the recent Salesmen's Conference of the Chloride Electrical Storage Co., Ltd., at Clifton Junction. Many, if not all, of the faces will be familiar to the trade, in spite of our reduction of the photograph for reproducing purposes.

Visitors and officials, taken outside the new Colchester automatic telephone exchange, on the occasion of the recent inspection by the Mayor, Coun. John Russell, and members of the Council.

The "Relay" private automatic branch telephone exchange of Cardiff Corporation was opened on Wednesday, by the Lord Mayor, Ald. W. R. Williams. The system includes four switchboards, connecting the City Hall, the Law Courts, and the Electricity Departments at the Hayes and Ninian Park Road. The police charge room is shown above.

A substantial order has been placed by the Post Office with a London manufacturer for a new type of telephone receiver, an illustration of which is given above. The instrument is intended as an alternative to the type at present in use, and, designed by the Post Office Engineering Department, may be adapted for automatic or manual exchanges.

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COMPANY NEWS.

Quiet Market for Electrical Shares—Anchor Cable Co.'s Increased Dividend—Shanghai Electric Construction's Improved Position—Expansion of Richmond Co.'s Undertaking—Associated Electrical Industries' Meeting.

THE market for the shares of electrical undertakings—supply, transportation, equipment and telegraph—has been quiet during the past week, and changes in our list of price quotations are few and far between. Two outstanding features call for notice. Shropshire, Worcestershire and Staffordshire Power "B" shares have risen a further 3s. 9d. above £2; and British Insulated Cables ordinary shares, which for a long while past have been creeping up, have been marked down 25s. after deduction of the share bonus. For the first time for a long while, the telegraph section, including Eastern and Marconi issues, is without change.

Last Annl. Divd.	Description	This Week.	Last Week.	1926 to 1928. Highest.	Lowest
%	**Electricity Supply.**				
(*d*)	Brompton & Kensington Ord. ..	26/-	26/-	35/6	23/9
4	Central Elec. Sup. 4% Deb. ..	94	94	95½	88½
(*a*)	Charing Cross Elec. Ord. (£1) ..	26/-	26/-	51/-	24/3
4½	" " " 4½% C.P. (£1)	17/6	17/6	18/3	16/6
(*b*)	Chelsea Elec. Sup. Ord.	26/-	26/-	45/3	24/-
10	City of Lond. Elec. L'ting Ord. ..	33/1½	33/1½	52/10½	26/-
6	" " " " 6% C.P.	23/-	23/-	24/3	21/6
10	County Lon. Elec. Sup. Ord. ..	54/-	55/-	68/6	25/9
6	" " " " 6% C.P.	23/-	23/-	24/-	21/3
(*c*)	Kensington & K'bridge Ord. (£1)	26/6	26/6	27/6	23/9
1/9⅝	Lon. Elec. Sup. Ord. (£1) ..	27/6	27/-	37/6	23/-
1/9⅝	Metro. Elec. Sup. Ord.	41/3	41/3	53/-	24/9
4½	" " " 4½% C.P. ..	17/6	17/6	18/3	16/3
7½	N'castle & Dis. Elec. Ltg. Ord. ..	27/6	27/6	31/9	17/6
1/25	N'castle-upon-Tyne Elec. Sup. Ord.	25/-	25/-	30/3	19/3
6	N Metro. Elec. 6% C.P.	23/-	23/-	23/9	20/10
6	Notting Hill 6% C.P. (£10) ..	10½	10½	11½	9½
(*c*)	St. James & P.M. Ord (£1) ..	27/6	27/6	28/6	23/6
1/4½	Shrops. Worcs. & Staffs. Power B. Ord.	43/9	40/-	37/6	21/4
1/9½	W'minster Elec. Sup. Ord. (£1) ..	26/-	26/-	52/9	24/-
4½	" " " 4½% C.P. (£1)	17/6	17/6	17/10½	16/7½
8	Yorks. Elec. Power Ord.	34/-	34/-	38/9	24/6
6	" " " 6% C.P. ..	24/-	24/-	26/9	20/7
	Railways and Tramways.				
8	Brit. Elec. Trac. Pfd. Ord. Stk. ..	128	128	152	117
6	" " " 6% Pf. Stk.	127½	127½	133	103½
4	Cent. Lon. Ry. Ord. Stk. (asstd.)	72	72	72	54
4	" " " 4% Deb.	80	80	83	77½
4	City & S. Lon. 4% Perp. Deb. ..	78½*	78½	81	76½
5	Lon. Elec. Rly. Cons. Ord. Stk. ..	73½	73½	75½	42½
4	" " " " 4% Pf. Stk.	73	73	77	68
4	" " " " 4% Deb. ..	80	80	83	76½
5	Lon. & Sub. Trac. 'A' Deb. ..	95½	95½	97½	74
4	Lon. Un. Trams. 1st Deb.	62	62	63	39
4½	Met. Elec. Trams, 4½% Deb. ..	72	72	73½	62
5	" " " 5% Deb. ..	67½	67½	70½	65½
3½	Met. Rly. Cons. Ord. Stk.	59½	60	81	54½
3½	" " " 3½% Pf. Stk. ..	63	63	67	60½
3½	" " " 3½% Deb. ..	70	70	73½	67½
5	Met. Dis. Rly. Ord. Stk.	75½	76	77½	52½
4½	" " " 4½% 1st Pref. ..	81½	81½	84	74½
6	" " " 6% Perp. Deb. ..	110½	110½	118½	110
4	S. Met. Elec. Trams, 4% Deb. ..	70	70	70	64½
7	Underground Electric Rlys. Ord.	23/6	23/6	28/2	11/-
—	Yorks. (W.R.) Trams, Ord. ..	5/-	5/-	16/-	3/-
4½	" " " 1st Deb. ..	59	59	78	60
	Electrical Manufacturing.				
7	Brit. Elec. Transformer 7% C.P. ..	15/-	15/-	19/10	4/6
15	Brit. Insulated Cables Ord. ..	67/6†	92/6	80/3	56/-
6	" " " 6% C.P. ..	22/6	22/6	23/10	21/-
7	British Thomson-Houston Pref. ..	23/9	23/9	24/9	19/7
7	" " " 7% Deb.	103½	103½	109½	102½
10	Brush Electrical Ord.	28/9	28/1½	30/9	24/-
15	Callender's Cable Ord.	87/6	87/6	91/3	66/-
6½	" " 6½% C.P. ..	25/-	25/-	25/9	22/-
7½	" " 7½% B. Pref. ..	27/6	27/6	28/3	25/-
8	Crompton-Parkinson 8% Cum. Pf.	25/-	25/-	27/-	14/-
6	" " 6% Cum. 2nd Pf.	17/6	18/-	19/6	9/7
7½	Edison Swan Elec. 1st Pref. ..	25/7½	25/7½	13/-	7/4½
5	" " " 1st Deb. Stk.	86½	86½	92	81½
7½	Elec. Construction Ord.	20/-	20/-	32/6	23/6
7	" " 7% C.P. ..	22/6	22/6	22/9	21/-
—	English Elec. Ord.	6/3	6/3	15/9	5/-
—	" " 6% C.P. ..	8/1½	8/1½	18/9	7/-
7	Ericsson Telephones 7% Pref. ..	20/-	20/-	22/7½	17/6
35	Ever Ready (Gt. Britain) Ord. ..	23/-	23/6	92/3	18/1
6	Ferranti 6% Pref.	18/-	18/-	19/4½	16/9
7	" 7% 2nd Pref.	21/3	21/3	19/3	13/9
10	General Elec. Ord.	60/-	60/-	46/6	26/6
‡25	W. T. Henley's Ord.	120/-	120/-	120/-	69/3
12½	Johnson & Phillips Ord.	36/3	36/3	67/11	34/-
7½	Lon. Elec. Wire & Smith's Pref. ..	23/9	23/9	25/-	22/3
7½	Siemens Bros. & Co. Ord. ..	27/6	27/6	36/6	24/9
10	Telegraph Const. Ord. (£12) ..	24½	24½	30½	20
	Telegraph.				
3½	Anglo-Am. Tele. Ord. Stk. ..	61½	61½	63½	56½
10	Eastern Ord. Stk.	280	280	273	135
3½	" 3½% Pref. Stk.	67½	67½	70½	59
4	" 4% Deb.	79½	79½	81½	74
10	Eastern Extension Ord. (£10) ..	28	28	27½	14
22	Gt. Northern Telegraph (£10) ..	33	33	43½	26
10	Indo-European (£25)	54½	54½	48½	30
20	Marconi's Wireless T. Ord. ..	85/-	85/-	84/4	12/-
15	" Int. Mar.	65/-	65/-	90/-	16/6
10	Western Tel. Ord. (£1)	28	27½	27½	12½

(*a*) 19.9d. per share. (*b*) 1s. 9·3d. per share. (*c*) 1s. 6·949d. per share.
(*d*) 1s. 8·700d. per share. (*e*) 1s. 7·181d. per share. ‡ Including 1s. bonus.
* Ex dividend. † Ex share bonus.

YOUNG ACCUMULATOR CO. (1929), LTD.—This co. has invited, during the present week, subscriptns. for 300 000 10s. ord. shs.

CABLE, TELEPHONE AND GENERAL TRUST.—Net rev., £26 202, plus £984 brt. in. After paying divs. on 6% pref. and 7% pref. shs., a div. of 4%, less tax, on ord. shs. is recommended. Fwd. £1 050.

WESTON-SUPER-MARE AND DISTRICT ELECTRICITY SUPPLY CO., LTD.—Credit blce. £32 089, plus £4 959 brt. in. To res., £17 500; 6% pref. div. for year, £2 400; ord. div. of 10% for year, £11 000. Fwd. £6 149.

SHANGHAI ELECTRIC CONSTRUCTION CO., LTD.—Pft. for 1928, £165 171, agst. £96 571, plus £11 656 brt. in. To renewals, £50 000; taxatn., £25 000; to res., £25 000. Fin. div. 7½%, tax free, makg. 12½% for year, agst. 12%. Fwd. £12 028.

PROVINCIAL TRAMWAYS CO., LTD.—Credit blce. on rev. acct., £16 749, plus £3 139 brt. in. Deb. int., £4 408; sinkg. fund for deb. stk., £801. Directors propose div. for year 1926 on pref. shs., leavg. 2 years' arrears. To res., £5 000. Fwd. £3 679.

SWANSEA IMPROVEMENTS AND TRAMWAYS CO.—After provisn. of £20 000 for renewals, surplus for 1928 was £11 101, agst. £14 749, plus £6 481 brt. in. Ord. div. for year 6%. To res. £2 000, agst. £3 000. After paymt. of pref. divs., carry fwd. is £5 185.

GREENWICH CABLE WORKS, LTD.—Net pft. for 1928, £3 008. Div. declared on 7% 1st pref. shs. for year 1926. Fwd. £3 976. A further year's div. on 1st pref. shs. was paid on Jan. 1, 1929. It is proposed to change name to Croydon Cable Works, Ltd.

MERTHYR ELECTRIC TRACTION AND LIGHTING CO., LTD.—Net rev. for 1928, £23 868, agst. £25 896. After provisn. for exes., income tax, int. and renewals (£7 000), surplus is £3 072, agst. £3 683, plus £3 706 brt. in. Div. on ord. shs. 2½%. Fwd. £3 653.

ANCHOR CABLE CO., LTD.—Pft. for 1928, £84 973, agst. £64 748. Int. on deb. stk., £2 250, leaving £82 723, plus £113 836 brt. in. It is proposed to transfer to res. for income tax £10 000, agst. £15 000, to pay div. of 20%, agst. 15%, and carry fwd. £147 560.

URBAN ELECTRIC SUPPLY CO., LTD.—Net pft. for 1928, £100 832, agst. £98 749. Fin. div., 4% on ord. shs., makg. 7% for year. To depreciatn. res., £30 000; to gen. res., £15 000; to staff benevolent fund, £2 000; written off exes. of increased cap., £1 741. Fwd. £22 953, agst. £22 219.

MADRAS ELECTRIC TRAMWAYS (1904), LTD.—Gross pft. for 1928, £29 099, plus £2 191 brt. in. After provisn. for int., London office exes., depreciatn. and renewals (£7 500), divs. on pref. shs. to Mar., 1929 (£6 000), and writing off blce. of cost of issue of 5½% debs. (£6 700), the amt. carried fwd. is £1 703.

ORIENTAL TELEPHONE AND ELECTRIC CO., LTD.—Net rev. for 1928, £89 551, plus £25 243 brt. in. Deductg. intm. divs. paid on Nov. 1 leaves £91 029. Fin. div. for year of 3½%, less tax on pref. shs.; fin. div. of 8% for year, tax free, on ord. shs.; to gen. res., £15 680; fwd. £34 425. New automatic exchange in Singapore is well in hand. A contract for installation of automatic exchanges for the Hongkong Telephone Co. was placed last year.

JOHNSON AND PHILLIPS, LTD.—Pft. for 1928, after provisn. for bad debts and charging to rev. £15 911 for maintenance of bldgs., plant, etc., was £106 417, plus £115 072, less div. paid on May 17, 1928, £30 000. After providg. for directors' auditors' and trustees' fees, int. on deb. stk. to Dec., 1928, res. re. 6% deb. sinkg. fund (£15 217), depreciatn. on machy. and plant (£17 929), and intm. div. paid Nov. 23, 1928, blce. is £110 903. Fin. div. at rate of 5%, less tax, on ord. shs. recommended, makg. 10% for year. Fwd. £80 903.

ANGLO-AMERICAN TELEGRAPH CO., LTD.—Accts. for year ended March 28, 1929, show that three qrtrly. intm. divs. of 15s.% on ord. stk. and £1 10s.% on pfd. stk. were paid on May 1, Aug. 1 and Nov. 1, 1928, and the fin. divs. for year ended Dec. 31, 1928, of £1 10s.% on ord., £1 10s.% on pfd. and £1 10s.% on dfd. stk. were paid on Feb. 1 last. These payments, with £52 500 income tax, absorbed £262 500, being the rent paid by the Western Union Telegraph Co. for the year, equal to 3½% on ord., 6% on pfd. and 1½% on dfd.

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stk. Blce. at credit of rev. acct., £65 625, is available for paymt. of divs. for qrtr. to March, 1929.

BRUSH ELECTRICAL ENGINEERING CO., LTD.—Accts. for 1928 show that, after provg. for gen. charges, maintenance of plant and bldgs., int. on deb. stks., income tax, and £16 681 for depreciatn. of bldgs .and plant, net pft. is £67 406. To gen. res., £6 010; div. (10%), £47 640; further 4% int. on prior lien participatg. 2nd deb. stk, £2 044; to surplus acct. for apportionmt. btwn. shhldrs and co-partners, £11 711. This surplus is allocated as to £1 873 to shhldrs. and £9 839 to co-partners. The shhldrs' proportion has been added to undivided pfts. acct., which now stands at £82 817, from which it is proposed to distribute 1% on the shs, tax free, in cash or shs. as shhldrs. may desire.

OFFICIAL QUOTATIONS.—The following securities have been granted quotations in the official list: 1 225 000 £1, fully paid, ord. shs. of Associated Electrical Industries, Ltd.; 210 £1, fully paid, ord. shs. of the Brompton and Kensington Electric Supply Co., Ltd.; 925 000 £1, fully paid, ord. shs. and 1 400 £1 fully paid, 5% pref. (non-cum. and participatg.) shs. of the Newcastle-upon-Tyne Electric Supply Co., Ltd.; $2 004 200 cap. stk. of the American Telephone and Telegraph Co.; 2 069 934 10s., fully paid, ord. shs. of Pinchin, Johnson and Co., Ltd.; 600 000 £1, fully paid, ord. shs. of the Scottish Power Co., and 12 393 £1 fully paid, ord. shs. of the Underground Electric Railways Co. of London, Ltd.

MARCONI'S WIRELESS TELEGRAPH CO., LTD., in an announcemt. to the shhldrs., the directors state that they anticipate that on or about May 18th, the shhldrs. will receive from the Bank of England, which is actg. on behalf of Cables and Wireless Ltd., the necy. documts. settg. out in detail the terms and conditns. of the offer made to the shhldrs. of the Cable and Wireless Cos. to exchange their stk. and shs. in those cos. for shs. in Cables and Wireless, Ltd. and fully explaing. the steps to be taken by those who decide to accept the offer. After careful consideratn. and consultatn. with the directors of Cables and Wireless, Ltd., the directors have decided to pay an intm. div. of 20%(actual), less tax, on the ord. shs., and an additnl. 10% (actual), less tax, on the 7% cum. participatg. pref. shs., out of pfts. available for distributn. in respect of the year 1928. This div. will be payable on May 18. The available profits will not permit of any further distributn. in respect of 1928. The Cable Cos. have already paid their usual divs. for 1928. Mtgs. of shhldrs. of the Cable Cos. and of Marconi's Wireless Telegraph Co., Ltd., will be held on May 29 to consider and approve certain alteratns. in the articles of associatn. of the several Cos., to come into force when the merger proposals become operative. At the meeting of Marconi's Wireless Telegraph Co., Ltd., the shhldrs. will also be asked to approve the accts. for 1927.

Company Meetings.

SHANGHAI ELECTRIC CONSTRUCTION CO., LTD.—At the meeting on May 1st, Mr. J. S. Haskell, chairman, said the balance sheet showed a remarkable recovery from the difficult and uncertain conditions which characterised the period of civil war and general disturbance in China. Their traffic receipts, at £370 274, showed an increase of 30·9%. Operating profit was £167 232. By transferring £25 000 to general reserve they had raised that account to £135 000. The report and accounts were adopted, and resolutions were passed authorising the creation of 200 000 new £1 shares and the issue, by way of capitalisation of profits, of 100 000 new shares in the ratio of one for every five held.

ANGLO-PORTUGUESE TELEPHONE CO., LTD.—Sir Alexander Roger, presiding at the meeting last week, said they had increased the reserve for renewals by £14 580, and this now stood at £68 722. In addition, they had created a general reserve of £25 000. Net profit was £42 886, compared with £31 412 for 1927. The number of telephone stations at the end of December showed an increase of 1889, or approximately 9%. The new rates came into force on September 1st, 1928. It was their intention to replace the manual equipment with automatic equipment as and when it became economical to do so, and they had several small automatic stations in course of erection. The telephone business in Portugal undoubtedly had a prosperous future. That country was now in telephone communication with most of the European countries. The report and the dividends proposed therein were approved.

WEST LONDON AND PROVINCIAL ELECTRIC AND GENERAL TRUST, LTD.—Mr. Harry Kahn, presiding at the recent meeting, said the net profit, £25 206, was £9 870 higher than for the previous twelve months. They had disposed of a further part of their holding in the Chiswick Electricity Supply Corporation. Investments, at £383 856, were £126 080 higher than last year. The net profit of the Chiswick Corporation for 1928 was £7 254 higher than for 1927. It paid the same dividend as in the preceding year, namely 16%, on a larger capital, and the amount allocated to depreciation was £2 000 greater. The position of the Trust was a very sound one. They had a capital reserve of £35 000 and a general reserve of £12 500, besides the large surplus over book values which the valuation of the investments showed. The report and accounts were adopted.

RICHMOND (SURREY) ELECTRIC LIGHT AND POWER CO., LTD.—At the meeting on May 3rd Sir Thomas Bethell read the speech prepared by Sir Harry Renwick (who was unavoidably absent), in which it was stated that the total receipts for the past year were £75 065, an increase of £5 767. Profit on working was £46 486, increase £6 564. After provision for sinking fund, depreciation, reserves, etc., the balance available for distribution was £26 281. The directors proposed to pay a final dividend of 7% on the ordinary shares, making 11% for the year, leaving £4 281 to carry forward. They were changing over from direct to alternating current. Since the close of the year, 591 kW of new business had been obtained, and output had increased by 20% over the corresponding period of last year. The report and accounts were adopted.

BOURNEMOUTH AND POOLE ELECTRICITY SUPPLY CO., LTD.—Lord Erskine, presiding at the meeting on May 3rd, in the unavoidable absence of Sir Harry Renwick, read the speech in which the latter dealt with the figures in the report (abstracted in our issue of May 3rd) and added: We propose to declare a dividend final of 9% on the 720 000 £1 ordinary shares, making 15% for the year. This will leave £6 268 to be carried forward. We will now pass on to matters of general interest affecting your company. Regarding the negotiations with the local authorities for extension of tenure of the company's undertaking, a number of meetings have taken place, but settlement has not yet been arrived at. I am hopeful that at no very distant date a settlement will take place, and I believe, when reached, it will not be unsatisfactory to you as shareholders. The company has acquired controlling interests in other supply undertakings, and has two Orders pending for Wimborne and district. The company purchased some time ago a site at Hamworthy, in the Poole area, and application is being made to the Electricity Commissioners for sanction to erect a new capital generating station on that site. For the first three months of this year there is an increase of 637 kW in the supplies applied for, compared with the corresponding period last year, there is an increase of over 18% in the electricity sold, and unless any unforeseen circumstances arise I think you may look forward to another successful year. The report and accounts were unanimously adopted.

ASSOCIATED ELECTRICAL INDUSTRIES, LTD.—Mr. H. C. Levis, presiding at the meeting on Tuesday, said reference was made at the last ordinary general meeting to negotiations with the British Thomson-Houston Co., Ltd., the Edison Swan Electric Co., Ltd., and Ferguson, Pailin, Ltd., with regard to co-operation with a view to eliminating unnecessary duplication of effort and expenditure and effecting economies in various directions. The plans had been brought to a successful conclusion. The plan finally adopted involved the use of that company as a holding company. To preserve the goodwill connected with the name of Metropolitan-Vickers Electrical Co., Ltd., it was intended to change the name of an existing subsidiary company to Metro-Vick Electrical Products, Ltd., but later it was decided to change the name of this subsidiary to the old name of that company—namely, Metropolitan-Vickers Electrical Co., Ltd., and that was its name to-day. The chairman next gave particulars of the operations involved in the transfers of the shares and the changes of and additions to the boards of directors. The whole group of companies, he said, employed nearly 30 000 people in England, and they possessed manufacturing facilities in Australia. The report, which covered the work of the Metropolitan-Vickers Co., showed that during the year the intake of business increased about 16 per cent. in money value, representing in volume of material a greater increase, while the output constituted a record. As regarded the group as a whole, for the first four months of this year the volume of business had increased. There had been a substantial increase in the number and volume of orders for the smaller class of apparatus, rather than an increase in contracts of considerable magnitude. The report and accounts were adopted and the dividends of 8 per cent. on the preference and 6 per cent. on the ordinary shares for the year 1928 were approved.

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COMMERCIAL INFORMATION.

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debt. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

BINGHAM, Mr., Woodmancey, electrical factor. £11 2s. 6d. April 3rd.

BISSETT AND WOOD, 44, Hawkesley Drive, Northfield, electrical engineers. £22 16s. 6d. March 22nd.

BROWN, Mr. R. J. W., 151, Gray's Inn Road, W.C., radio engineer. £12 18s. 6d. March 6th.

EARLSDOWN RADIO SUPPLIES, LTD., 44, Albert Street, Newark. £21 3s. 2d. April 4th.

PHILLIPS (FRED) AND CO., 32, Mount Stuart Square, Cardiff, electrical engineers. £17 2s. 10d. March 5th.

RED TRIANGLE ELECTRIC CO., LTD., 37, Tothill Street, Westminster, manufacturers and importers of electrical goods. £49 1s. 4d. February 28th.

"S" MOTORS, Lenham, motor and electrical engineers. £16 8s. 9d. April 4th.

Deed of Arrangement.

THORNTON, William Haigh, 25, Bridge Street, and 78, Albion Street, Burnley, electrical and wireless engineer. Dated April 26th, filed May 3rd. Trustee, J. H. Worsley, 42, St. James Street, Burnley, I.A. Liabilities unsecured, £721; assets, less secured claims, £162.

Receiverships.

HENDON ELECTRIC LAMP CO., LTD.—Harold Bell, chartered accountant, 18, Bedford Row, W.C.1, was appointed receiver and manager for the debenture holder on May 2nd.

KEMP (J. T.), LTD. R. B. Baggaley, C.A., of Commerce Chambers, Parliament Street, Nottingham, was appointed receiver on April 23rd, 1929, under powers contained in debentures authorised September 23rd, 1927.

PROSSER (G. D.) AND CO., LTD. J. Dawson, of 261, Goldhawk Road, W.12, was appointed receiver on April 18th, 1929, under powers contained in debenture dated March 1st, 1928.

Mortgages.

[NOTE.—*The Companies Act of* 1908 *provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—allowed by the date of the Summary, but such total may have been reduced.*]

ACME ELECTRIC WIRE AND CABLE CO., LTD., Shardlow. Registered April 19th, £500 debentures, to H. L. L. Greaves, Elmdene, South View, Letchworth; general charge. *Nil. May 22nd, 1927.

RADIO ELECTRIC CO. (BOURNEMOUTH) LTD.—Registered April 26th, £400 debenture, to A. G. Smith, 10, Rushton Crescent, Bournemouth, and another; general charge. *Nil. May 21st, 1928.

Private Meetings, etc.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

LYONS, Herbert, trading as J. LYONS, electrical and wireless engineer, 300, Willesden Lane, London, N.W.2. In response to a circular letter issued by Messrs. Phillip L. Causley and Co., accountants, of 70, Hatchard Road, London, N., a meeting of the creditors of the above was held on May 6th, at Winchester House, Old Broad Street, E.C. The statement of affairs as at April 30th last showed liabilities of £577, made up as follows: Trade creditors, £208; preferential claims, £64; cash creditors, £170; bank overdraft, £60; law costs, £25; and capital accounts, £50. The assets consisted of stock, £124; book debts, £33; fixtures and fittings, £30; debit balances, £5; J. Lyons, Ltd., £28; and work in hand, £25; making a total of £246, or a deficiency of £331. It was stated that the debtor was previously in a partnership and then started trading on his own account. There were various contracts and other work which it was thought would be profitable, and the business, it was believed, could be carried on successfully in the future. On May 2nd last a company called J. Lyons, Ltd., was formed to take over the assets as a going concern. Certain of the cash creditors were taking shares in the company, which was willing to make arrangements to pay the other creditors in full.

Mr. D. Weller, of the Palatine Trade Protection Office, said he understood that the assets had been transferred to the company, and he enquired where the money for the assets had gone. The debtor's accountant replied that no money had passed, but the debtor was being allotted fully paid shares in the company. The latter was willing to offer deferred notes to the creditors which would be redeemable over 12 months, with a reasonable rate of interest.

A resolution was passed in favour of the matter being dealt with n bankruptcy.

London Gazette, etc.

Company Winding-up Voluntarily.

SUPER ELECTRIC HEATERS, LTD. By reason of its liabilities, April 25th. F. E. Bendall, Midland Chambers, Warwick Passage, Birmingham, accountant, appointed as liquidator. Meeting of creditors at the offices of Poppleton and Appleby, Midland Chambers, Warwick Passage, Birmingham, on May 13th, at 12 noon.

Bankruptcy Information.

McBEAN, John Horace, 29, Bradford Road, Batley Carr, Yorks, electrical engineer. Receiving order, May 3rd. Debtor's petition.

MILLWARD, Eric Rodney, trading as WEST OF ENGLAND RADIO, at 67, High Street, Barnstaple, wireless engineer. Receiving order, April 29th. Debtor's petition First meeting, May 14th, 11.30 a.m. Official Receiver's Offices, Exeter Bank Chambers, Broadgate, Exeter. Public examination, June 4th, 2.30 p.m., Guildhall, Barnstaple.

STIRZAKER, John, Tanyfynwent, Llanfairfechan, Carnarvon, lately Wen Roe, Llanfairfechan, electrical engineer. Receiving order, May 1st. Debtor's petition.

Notices of Intended Dividends.

CRUMP, Augustus Henry, lately 202, Walworth Road, S.E.17, trading as SELWYN ELECTRICAL ENGINEERING CO. electrical engineer. Last day for receiving proofs, May 18th Trustee, W. Boyle, Bankruptcy Buildings, Carey Street, London, W.C.2, Senior Official Receiver.

WHITE, William Reginald James, Golden House, 29, Great Pulteney Street, London, electrical agent. Last day for receiving proofs, May 28th. Trustee, D. Williams, Bankruptcy Buildings, Carey Street, London, W.C.2, official receiver.

Order Made on Application for Discharge.

GREGORY, Albert Butterworth, 29, St. Alban's Road, Seven Kings, Essex. Wireless expert. Discharge suspended for six months, until September 18th.

Partnerships Dissolved.

CROFTS AND SMITH (John Frederick CROFTS and Edward William SMITH) Queen Street, Deal, Kent, electrical, mechanical and radio engineers, by mutual consent, April 24th, 1929. The business will be carried on by E. W. Smith.

MACKAY AND ORR (John Holmes ORR and William A., SMALL). electrical engineers and agents, 7, Ann Street, Glasgow, as at December 31st, 1928, by mutual consent. The business will be carried on by J. H. Orr on his own account, under the old name.

W. G. PYE AND CO. (William George PYE, Thomas Allen White ROBINSON and Harold John PYE), manufacturers and sellers of (*a*) wireless transmitting and receiving sets and apparatus used in connection therewith, and (*b*) scientific instruments and apparatus, physical and electrical apparatus and instruments of precision of all kinds, Granta Works, Cambridge, by mutual consent, March 26th, 1929. Debts received and paid by W. G. Pye and H. J. Pye, who will continue the businesses specified in paragraph (*b*) above, under the old style.

W. S. WATSON (Walter Samuel Watson and John Stuart DENHOLM), electrical engineer and contractor, 267, Langside Road, Glasgow, as at March 31st, 1929, by mutual consent. The business will be carried on by W. S. Watson on his own account, under the same firm name.

Bankruptcy Proceedings.

BALL, Walter Reginald (trading in partnership with another, and described in the receiving order as R. Ball and Co.), electrical engineer, 287, Upper Street, Islington, London, N. The affairs of this firm came before Mr. Registrar Warmington in the London Bankruptcy Court last week, on the hearing of an application for discharge by the debtor Ball. The Official Receiver said that the adjudication in bankruptcy took place in May, 1925, the ranking liabilities being £2 230 as far as the joint estate was concerned. Proofs of debt had been lodged for sums amounting to £1 029. The assets were £20. According to the separate estate of the applicant he owed £160 and no assets were disclosed. In January, 1922, with a capital of £100, the applicant began business as an electrical and mechanical engineer in Upper Street, N., and in

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March of the following year he was joined in partnership by the debtor Leech. They traded under the above style. In September, 1924 they entered into a contract to supply The X.L.O. Co. with 15 000 pairs of wireless headphones at the rate of 500 a week between September, 1924 and April, 1925. At the time the date of the delivery of the first consignment was not specified, but they afterwards agreed to urge delivery for October 17th, 1924. Owing, however, to late delivery by the manufacturers of certain of the materials required for the contract, delivery was not made by that date and in consequence the contract was cancelled on the following day. In February, 1925, the firm was sued for breach of contract and judgment was given against it for £369, of which £70 was paid. The debtors continued their business until March, 1925, when their stock, machinery, and effects were sold under an execution levied by another creditor. The applicant was without regular occupation and dependent from March, 1925, for six months on relatives, but he was afterwards employed as a traveller on a commission basis. The debtors had attributed their insolvency to the loss of business owing to the failure of the manufacturers to supply goods on order, to their liability under the judgment obtained against them in February, 1925, and to loss sustained on the sale of their stock-in-trade by the sheriff. They had explained that the goods supplied by their sub-contractors for the contract entered into with the X.L.O. Co. were marked with the latter's trade mark and consequently were worthless for realisation purposes after the contract was cancelled. No trading or profit and loss accounts or balance sheets were ever prepared and the debtors added that they first realised insolvency in October, 1924, up to which date they had had a surplus of £800. The Official Receiver opposed the application on the grounds that the applicant's assets were not of a value equal to 10s. in the £ and that he had omitted to keep proper books of account, and his Honour suspended the discharge for 3 months.

HELIKON WIRELESS CO., LTD., 6, Park Royal, North Acton, Middlesex. The winding-up order herein was made in December last. According to the statement of affairs there are liabilities amounting to £1 188, against assets of £51, less preferential claims of £27, a deficiency of £1 164. The issued capital of the company was £197. It was registered in November, 1925, and was formed for the purpose of carrying on business as merchants and dealers in wireless accessories. The company commenced business at an office and warehouse in Camomile Street, London, E.C. In May, 1928, a factory was acquired and the company began to manufacture electric lamps. Balance sheets and trading and profit and loss accounts were made out for the year ending November 30th, 1926, and these show a trading loss of £392, and for the year ending November 30th, 1928, a further loss of £392.

METAL AND CHEMICAL PRICES.

TUESDAY, May 7th.

		Price.	Inc.	Dec.
Copper—				
Best Selected ..	per ton	£80 10 0	£2 5 0	—
Electro Wirebars	,,	£84 15 0	15s. 0d.	—
H.C. Wires, basis	per lb.	11 11/16d.	1/16d.	—
Sheet	,,	1s. 0d.	—	—
Phosphor Bronze—				
Wire (Telephone) basis	per lb.	1s. 2 11/16d.	1/16d.	—
Brass 60/40—				
Rod, basis ..	per lb.	9d.	—	—
Sheet ,, ..	,,	10 1/4d.	—	—
Wire ,, ..	,,	11 1/8d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£3 11 0	—	—
Galvanised Steel Wire, basis 8.S.W.G. ..	,,	£14 15 0	—	—
Lead Pig—				
English	per ton	£26 0 0	—	—
Foreign or Colonial	,,	£24 10 0	2s. 6d.	—
Tin—				
Ingot	per ton	£197 12 6	—	£1 2 6
Wire, basis ..	per lb.	2s. 7 1/2d.	—	—
Aluminium Ingots	per ton	£95 0 0	—	—
Spelter	,,	£26 10 0	—	5s. 0d.
Mercury	per bottle	£22 5 0	—	—

Sulphur—Flowers, Ton £12 0 0 *Sulphuric Acid*—
,, Roll ,, £10 10 0 (Pyrites, 168°) Ton £6 15 0
Copper Sulphate ,, £25 to £25 10 0 *Sodium Chlorate* per lb. 2 1/4d.
Boric Acid (Crystals),, £30 0 0 *Sodium Bichromate* per lb. 3 1/2d.
Rubber—Para fine, 11d.; plantation, 1st latex, 10d.

∴ The metal prices are supplied by British Insulated Cables Ltd., and the rubber prices by W. T. Henley's Telegraph Works Co., Ltd.

THE LEAD MARKET.

A firmer tone was apparent in the lead market last week, and according to James Forster and Co., prices opened steady on Monday and slightly advanced until Friday, when there was a small setback. The American market is steady with the price unchanged at 7 cents.

Closing prices on May 3rd were £24 8s. 9d. for May, £24 6s. 3d. for June, £24 3s. 9d. for July, and £24 1s. 3d. for August, or about 5s. per ton higher on the week.

NEW COMPANIES.

ASSOCIATED ENGINEERING AND METAL SUPPLY CO., LTD.—Cap., £500. Manufacturers of and dealers in steel and other metals, electrical and other machinery, etc. Reg. Office: 16, Deansgate, Manchester.

WIRELESS-ELECTRIC (WHOLESALE), LTD.—Cap., £1 650. To acquire business of wireless factor and electrical supplier now carried on by C. E. Coulson, at 23, North Street, (City), Bristol, as "Wireless Electric Wholesale."

ROBINSON, NELSON AND CO., LTD.—Cap., £4 000. Manufacturers of and dealers in physical, electrical and scientific instruments and apparatus, laboratory equipment, etc. Solicitors: Forsyth, Bettinson and Co., 36, Cannon Street, Birmingham.

SPHINX ELECTRIC, LTD.—Cap., £300. To acquire registered trade mark "Sphinx" from Auto-Bulbs, Ltd., and to carry on business of manufacturers of and dealers in electric lamps, fuses and signs, etc. Reg. Office: Sphinx House, Hatton Garden, London, E.C.1.

VENRECO, LTD.—Cap., £8 000. To adopt an agreement with Reandco, Ltd., and W. S. Veness, and to carry on business of manufacturers of and dealers in electrical fittings, appliances and component parts. Reg. Office: 55, Neal Street, Long Acre, London, W.C.

ZIRKO, LTD.—Cap., £1 500. Experimenters with, workers in, manufacturers of and agents for vulcanite, ebonite, rubber, rubber substitutes, compositions and insulating materials of all kinds, etc. A permanent director: A. W. Wright, Melverne, Gorden Lane, Moor Park, Fazackerley.

BROADCASTING LAMPSHADES, LTD.—Cap., £200. Manufacturers of and dealers in lamp shades, lamps, lighting apparatus, loud speakers, wireless receivers and components, electrical instruments and apparatus, etc. A director: J. Phillips, 146, Broadhurst Gardens, West Hampstead, London, N.W.

TRUPHONIC RADIO, LTD.—Cap., £75 000. To acquire undertaking of Truphonic, Ltd., and to carry on the business of manufacturers of and dealers in radio, television, electrical apparatus, manufacturers, importers and exporters, electrical engineers, etc. Solicitors: Ashurst Morris Crisp and Co., 17, Throgmorton Avenue, London, E.C.2. (Public Co.)

DERBY CABLES, LTD.—Cap., £100 000. To carry on the business of electrical engineers and contractors, manufacturers of and dealers in cables, insulating materials, lifting appliances, etc. Directors: C. A. Newton (chairman), J. H. Lord, H. Newton, H. B. Potter, and F. Newton (managing director). Secretary: E. A. Swindall, Solicitors: Flint, Marsden and Bishop, Derby.

ELECTRICAL TRADE MARKS.

This list has been specially compiled for us from official sources by GEE AND CO. *Patent and Trade Marks Agents, 51 and 54, Chancery Lane, London, W.C.2, from whom further information may be obtained.*

ALLSCOTT.—495 953. Class 8. Wireless telephonic apparatus and parts therof James Scott, trading as James Scott and Co., 56, Inglis Street, Dunfermline, Scotland engineer. October 15th, 1928. User claimed from December 5th, 1924.

UNIVISAPHON.—496 376. Class 8. Philosophical and scientific instruments and apparatus. John Good, 173-174, Finsbury Pavement House, Moorgate, London, E.C.2; manufacturer. October 26th, 1928.

THERMAG.—499 090. Class 8. Automatic electrical overload switches. Allen West and Co., Ltd., Engineering Works, Lewes Road, Brighton, Sussex; electrical engineers and manufacturers. January 16th, 1929.

FARADEX.—499 506. Class 8. Philosophical and scientific instruments and apparatus. Rooke Brothers, Ltd., 55, Cardington Street, London, N.W.1; radio manufacturers. January 29th, 1929.

ADZCOPE.—498 684. Class 8. Electrically illuminated advertising and display signs. Messrs. George Alfred Woodman, Richard Tudor Rees, Trevor George Edwards, and Emil Rudolph Alexander, trading in co-partnership, 120, Westbourne Road, Penarth, Glamorganshire; manufacturers. January 4th, 1929.

CONVOLUXE.—499 817. Class 8. Gramophones, wireless telephonic instruments, and gramophone records. Celebritone, Ltd., Commerce House, 72, Oxford Street, London, W.1; manufacturers. February 7th, 1929.

EQUIFLEXIAL.—499 824. Class 8. Sound-reproducing instruments. Celestion, Ltd. London Works, London Road, Kingston-on-Thames, Surrey; manufacturers. February 7th, 1929.

H.U. (sign).—498 480. Class 8. Electrical batteries (not for medical purposes) and electrical transformers. Charles Reginald Francis Hanson, trading as Hanson and Co., Building 191, Trading Estate, Slough, Buckinghamshire; electrical engineer. December 27th, 1928.

MICROFICIENT.—500 220. Class 8. Philosophical, scientific instruments and apparatus. Graham Farish, Ltd., 17, Masons Hill, Bromley, Kent; instrument makers. February 20th, 1929.

Opposition to the registration of the following trade marks can be lodged up to May 17th.

491 639. Class 8. Wireless telegraphic and telephonic instruments and apparatus, and sound producing, reproducing, transmitting and recording instruments and apparatus, and parts, all being goods included in Class 8. The Ormond Engineering Co., Ltd., 199, 201, 203 and 205, Pentonville Road, London, N.1; manufacturers. August 31st, 1928.

AEONIC.—496 367. Class 8. Wireless telephone apparatus. J. L. Gotlieb and Co., Ltd., 15, Cromer Street, London, W.C.1; manufacturers. October 26th, 1928. (By consent.)

VIVA-TONIC.—500 527. Class 8. Philosophical and scientific instruments. The Columbia Graphophone Co., Ltd., 102 to 108, Clerkenwell Road, London, E.C.1; manufacturers. February 28th, 1929. To be associated with No. 471 115 (2 52 5).

Opposition to the registration of the following trade marks can be lodged up to May 24th.

GLOVERS CABLES.—497 090. Class 8. Electric cables. W. T. Glover and Co., Ltd. Trafford Park, Manchester; manufacturers of electric cables. November 15t , 1928. To be associated with No. 387 907 (2 139) and another. Advertised before acceptance, the applicants alleging distinctiveness.

GINNIPORTO.—497 737. Class 8. Philosophical and scientific instruments. David Lannon and Phillip Lannon, trading in co-partnership, 18, Savile Row, London, W.1; merchants. December 4th, 1928.

AUDIOGRAPHOPHONE.—499 582. Class 8. Philosophical and scientific instruments. The Columbia Graphophone Co., Ltd., 102 to 108, Clerkenwell Road, London, E.C.1; manufacturers. January 31st, 1929. To be associated with No. 219 222 (1 102) and others.

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PATENT RECORD.

The following information is prepared from the Illustrated Official Journal (Patents) by permission of the Controller of H.M. Stationery Office. Printed copies of full Patent Specifications, when accepted, may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at 1s. each.

Specifications Accepted.

307 989 A. E. Watkins. Radio telegraph, telephone, and like signalling circuit and apparatus. (21/12/27.)
307 994 S. G. S. Dicker (N. V. Philips' Gloeilampenfabrieken). Sealing or joining of glass and quartz. (22/12/27.)
307 995 Johnson and Phillips, Ltd., and D. M. Broughton. Electrical relays. (23/12/27.)
308 002 R. Brooks and Metropolitan-Vickers Electrical Co., Ltd. Electric vehicles. (5/1/28.)
308 009 Birmingham Electric Furnaces, Ltd., and A. G. Lobley. Electric resistance furnaces. (11/1/28.)
308 021 H. Heath and R. W. Bill. Boxes or cases for electrical apparatus. (26/1/28.)
308 037 F. O. Seyd. Electric gas-lighters. (7/2/28.)
308 041 J. C. Macfarlane and W. A. Macfarlane. Electric rotary convertors. (9/2/28.)
308 052 General Electric Co., Ltd., and A. Wardle. Terminal arrangements for electrical devices. (18/2/28.)
308 056 General Electric Co., Ltd., and E. H. Croft. Electric motor control systems. (22/2/28.)
287 048 Siemens and Halske Akt.-Ges. Duplex signalling systems. (12/3/27.)
286 737 G. Mombur. Electric speed-indicators. (10/3/27.)
308 085 S. G. S. Dicker (N. V. Philips' Gloeilampenfabrieken). Thermionic generators and the like. (19/3/28.)
292 903 Siemens and Halske Akt.-Ges. Telephone sets. (25/6/27.)
291 032 I.G. Farbenindustrie Akt.-Ges. Process for preparing lead electrode for electric storage batteries. (24/5/27.)
308 118 J. Downs and Watts, Fincham, and Co., Ltd. Portable electric lamps. (25/5/28.)
292 474 Westinghouse Electric and Manufacturing Co. Apparatus for sorting or classifying articles by means of light. (16/6/27.)
293 796 E. Pohl. Supporting-frames for Rontgen-ray photographic apparatus. (12/7/27.)
308 131 W. Petri. Process and mould for casting accumulator grids. (6/7/28.)
294 618 Associated Telephone and Telegraph Co. Telephone systems. (7/1/27.)
308 144 J. C. Macfarlane and W A. Macfarlane. Electric rotary convertors. (9/2/28.)
297 825 Ateliers J. Carpentier. Telegraphic printing systems. (30/9/27.)
297 117 J. Seegmuller. Electric meat and like roaster. (16/9/27.)
308 156 L. Thurm. Electromechanical amplifier. (4/10/28.)
307 730 K. Kaisser. Starting-device for electromoters equipped with a clutch. (12/10/27.)
304 702 Associated Telephone and Telegraph Co. Telephone systems. (7/1/27.)
308 283 D. P. Battery Co., Ltd., and J. Waddell. Negative secondary battery plates. (21/9/27.)
308 183 C. A. Turner. Rotary electric switches. (15/11/27.)
308 286 A. Muriel [legal representative of G. Fornaca, (deceased)]. Means for regulating the supply of current from dynamos having a third brush for use in power-driven vehicles. (8/12/27.)
308 288 S. G. S. Dicker (Naamlooze Vennootschaap Philips' Gloeilampenfabrieken). Circuit arrangements embodying discharge tubes. (16/12/27.)
308 184 P. McDermid and P. S. McDermid. Means for controlling electric hoists and elevators. (19/12/27.)
308 185 Walsall Hardware Manufacturing Co., Ltd., and A. E. Read. Junction boxes for metal-sheathed electric cables. (19/12/27.)
308 186 A. Reyrolle and Co., Ltd., and J. Mirrey. Electric switchgear. (19/12/27.)
308 188 L. H. Peter and Westinghouse Brake and Saxby Signal Co., Ltd. Apparatus for rectifying alternating electric currents. (19/12/27.)
308 189 L. H. Peter and Westinghouse Brake and Saxby Signal Co., Ltd. Apparatus for rectifying alternating electric currents. (19/12/27.)
308 190 L. H. Peter and Westinghouse Brake and Saxby Signal Co., Ltd. Apparatus for rectifying alternating electric currents. (19/12/27.)
282 676 International General Electric Co., Inc. Regulating devices. (24/12/26.)
308 192 K. Younghusband, J. Summers and Sons, Ltd., and English Electric Co., Ltd. Heating of the rolls of metal-rolling mills. (19/12/27.)
308 239 Creed and Co., Ltd., F. G. Creed and A. Orling. Electric contact making and breaking devices and associated controlling and controlled means. (20/12/27.)
308 335 English Electric Co., Ltd., and R. D. Ball. Alternating current electric machines. (22/12/27.)
308 336 W. S. Smith and N. W. McLachlan. Two-way telephone and the like systems. (22/12/27.)
308 337 W. S. Smith and N. W. McLachlan. Thermionic and the like amplifiers. (22/12/27.)
308 334 A. Reyrolle and Co., Ltd., and B. H. Leeson. Electric protective arrangements. (28/12/27.)
308 378 A. Reyrolle and Co., Ltd., B. H. Leeson, and E. W. M. Scott. Electric protective arrangements. (28/12/27.)
308 380 Harland Engineering Co., Ltd., and F. G. Warburton. Driving mechanism of electrically driven paper machines and the like. (28/12/27.)
308 381 T. Yamanouchi. Electric cable joint. (29/12/27.)
308 382 F. Von Brunner. Means for generating electricity by evaporating liquids. (29/12/27.)
282 831 Akt.-Ges. Brown, Boverie, et Cie. Electric time relays. (30/12/26.)
308 384 Sachsenwerk Licht-und Kraft Akt.-Ges., and T. Schmitz. Alternating current dynamo-electric machines. (31/12/27.)

Applications for Patents.

February 25th.

6 141 Callenders' Cable and Construction Co., Ltd., and P. V. Hunter. Electric cables.
6 074 C. Cremer. Electric cables. (20/9/28, Germany.)
6 216 F. G. G. Davey and Wireless Music, Ltd. Sound producing devices.
6 217 F. G. G. Davey and Wireless Music, Ltd. Electromagnetic vibratory devices.
6 133 W. H. Dearden, G. Lawton and Standard Telephones and Cables, Ltd. Continuous loading for signalling conductors.
6 082 W. Donegani. Electric signs.
6 136 Dubilier Condenser Co. (1925), Ltd. Radio receiver, etc. (24/2/28, Germany.)
6 129 Grierson, Ltd. and R. Grierson. Electric heating of buildings, etc.
6 072 E. H. Hill. Turntable for portable wireless sets, etc.
6 087 A. Lederer. Electric discharge tubes. (24/2/28, Austria.)
6 213 Lichtenberg and Jones, Ltd., and J. A. Szabadi. Protective arrangements for thermionic valve circuits.
6 076 J. McCallum. Connections for cables, etc.
6 077 B. L. Myer and Power Electric Co., Ltd. Electric radiators.
6 185, 6 186 N. Petersen and J. Sinclair Ross. Electric motors.
6 124 E. W. C. Russell (B. Kjellgren). Production of crystals for piezo-electric devices.
6 148, 6 149 B. Schwarz. Alternating current induction motors. (29/11/26, Austria.)
6 146 Siemens and Halske A.G. Telegraphic installations. (6/7/28, Germany.)
6 158 J. A. Smale. Telegraph instruments.
6 192 C. G. Smith. Secondary batteries.
6 170 C. Stille. Transmission of wireless telegraphy, etc.
6 171 C. Stille. Electromagnetic talking machine.
6 172 C. Stille. Recording sound by electromagnetic means.
6 145 B. H. Stone. Electric stoves.
6 132 West Manufacturing Co. Test sets for locating faults in transmission lines. (5/7/27, U.S.)
6 185, 6 186 J. Zetsche. Electric motors.

February 26th.

6 353 C. R. Altenheim (K. Spieckermann). Electric conductor rail.
6 236 J. H. Asdell and G. W. Ingram. Automatic controlling means for electric currents.
6 296 British Electric Transformer Co., Ltd. Measurement of thermal conditions in electrical apparatus.
6 300 British Thomson-Houston Co., Ltd., and F. H. Harris. Systems of electric control.
6 301 British Thomson-Houston Co., Ltd., and C. J. Morton. Rotary switches.
6 302 British Thomson-Houston Co., Ltd., and C. J. Morton. Ignition equipment for motor cycles.
6 256 W. H. Bulpitt and Bulpitt and Sons, Ltd. Safety appliance for electrically heated apparatus.
6 262 L. A. Catlin and Electro-Mechanical Brake Co., Ltd. Tramway brakes, etc.
6 329 G. Eaton. Electric toaster.
6 326 Ferranti, Ltd., and S. Z. de Ferranti. Electric fires.
6 331 A. E. Honey and J. Stone and Co., Ltd. Electric lighting installations for railway vehicles, etc.
6 254 Lane and Girvan, Ltd., and A. R. Wood. Electric fires.
6 241 C. Miles. Aerial systems for wireless telegraphy, etc.
6 325 N. V. Philips' Gloeilampenfabrieken. Photoelectric cells. (25/9/28, Holland.)
6 316 H. A. Whitehorn (Bell Telephone Laboratories, Inc.). Electric conductors.

February 27th.

6 389 H. Antranikian and U. A. Thuau. Distant transmission, etc., of images. (29/2/28, U.S.)
6 416 Automatic Coil Winder and Electrical Equipment Co., Ltd. Coil winding machines, etc.
6 357 H. G. Baggs and R. A. Smith. Electric fuses, etc.
6 359 C. Coppock. Means for regulating electric current.
6 455, 6 456 J. Cruwys, J. P. Keith, Power Equipment Co., Ltd., and G. Richardson. Electric circuits.
6 457 L. J. Francis. Telephone instruments.
6 439 H. J. Garnett, J. A. Holden and W. S. Smith. Manufacture of loaded signalling conductors.
6 408 General Electric Co., Ltd., and R. Orsettich. Dynamo-electric machines.
6 381 R. E. Hopkins. Dynamo-electric machinery.
6 437 Lignes Telegraphiques et Telephoniques. Coupling transformer arrangements. (9/3/28, France.)
6 366 B. Loewe. Manufacture of high emission cathodes. (28/2/28, Germany.)

COMING EVENTS.

Friday, May 10th.

Institution of Mechanical Engineers.—Storey's Gate, St. James's Park, London. Special general meeting. 6 *p.m.*

Monday, May 13th.

Electrical Contractors' Association (Liverpool Branch).—Ordinary meeting. 3 *p.m.*

Tuesday, May 14th.

Electrical Contractors' Association (Leicester Branch).—Corridor Chambers Ordinary meeting.
Electrical Contractors' Association (Swansea Branch).—Ordinary meeting.
Institution of Civil Engineers.—Great George Street, Westminster. Annual general meeting. 6 *p.m.*
Illuminating Engineering Society.—Home Office Industrial Museum, Horseferry Road, Westminster. Paper reviewing the proceedings at the meetings of the International Commission on Illumination, and on the International Congress held in the United States in 1928, by Mr. G. H. Wilson, followed by a discussion. 6.45 *p.m.*
Electrical Contractors' Association (Bournemouth Branch).—Ordinary meeting. 7.30 *p.m.*

Wednesday, May 15th.

Electrical Contractors' Association (Sussex Branch).—Midland Bank Chambers, Brighton. Ordinary meeting.
Overhead Lines Association.—Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London. Paper by Col. W. A. Vignoles, on "Getting Consumers in Rural Areas." 5.30 *p.m.*
Polytechnic Engineering Department.—307–311, Regent Street, London. Lecture II (Course of six lectures) by Mr. W. H. Date on "Thermionic Valves." 6.30 *p.m.*
Royal Society of Arts.—John Street, Adelphi, London. Paper by Mr. R. Burrell on "The Reform of the British Patent System." 8 *p.m.*

Wednesday, May 15th–Thursday, May 23rd.

World Power Conference.—Barcelona, Spain. Sectional meeting on "Complete Utilisation of Water Power Resources."

Thursday, May 16th.

Institution of Electrical Engineers (Irish Centre).—Physical Laboratory, Trinity College, Dublin. Annual general meeting. 7.45 *p.m.*

Saturday, May 18th.

Association of Mining Electrical Engineers (South Wales Branch).—South Wales Institute, Cardiff. Annual meeting. 6 *p.m.*

LONDON ELECTRICAL ENGINEERS.

26th A.A. Battalion, R.E. (T.A.) (*Commanding Officer:* Lt.-Col. C. H. S. Evans, O.B.E. Headquarters: Duke of York's Headquarters, Chelsea).—According to the current Battalion Orders, 303 Company held a week-end camp on May 4th-5th. A similar camp for 302 Company is fixed for June 8th–9th. Musketry programme provides for firing by 301 and 303 Companies on May 26th and 302 Company on June 30th, all at Rainham Ranges. There is also a prize shoot open to all trained men of companies, at Rainham, on June 23rd.—A lantern lecture on the possibilities of aviation was given by Sir Alan Cobham on April 24th.

27th A.A. Battalion R.E. (T.A.) (*Commanding Officer:* Lt.-Col. M. G. Bland, O.B.E., T.D. Headquarters: Rochester Row, S.W.1). In Battalion Orders for May, it is announced that approval is given for Hon. Col. R. E. B. Crompton to continue the appointment for a further period of one year to take effect from Dec. 19th, 1928. The number of recruits needed is now about 37. As recruits cannot be accepted after the first week in July (for this year's camp) early application is desirable.—The annual musketry course will be fired as follows:—305 and 306 Companies, June 9th; 304 Company and recruits, June 23rd; Lewis guns and inter-company teams, July 7th.—Easter camp was held at Biggin Hill; 10 officers and 52 other ranks attended.—A cinema lecture on the "Manufacture of Batteries and Electric Bulbs" was given by Siemens Bros. on May 4th.

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THE ELECTRICIAN

Established 1861. The Oldest Weekly Illustrated Journal of

Electrical Engineering, Industry, Science and Finance.

Bouverie House, 154, Fleet Street, London, E.C.4. Telegrams: "Benbrotric, Fleet, London."
Telephone: City 0244 (Ten lines).

[Closed on Saturdays in accordance with the "Five-Day Week" plan adopted by Benn Brothers, Ltd., and its associated organisations.]

No. 2659. [No. 20. Vol. CII.] Friday, May 17, 1929. Annual Subscription, 25s. Overseas, 30s.

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Current Topics.

Our Overseas Trade.

THOUGH at first glance the Board of Trade Returns for April are not over encouraging, closer inspection shows that though there have been fluctuations in imports and exports since the corresponding month of 1928, the figures for the month under review indicate a general improvement, in that several of our basic industries have increased their export shipments. Particularly satisfactory is the return of the coal export trade, shipments during April amounting to 4 756 122 tons, valued at £3 865 895, representing an increase of 1 034 099 tons when compared with the figures for the corresponding month of last year. Similarly, the export of vehicles—under which heading are included ships, locomotives, and aircraft—improved during April to £5 897 553, an advance of £1 662 779 on the corresponding figure for April, 1928. Included in this total is £2 772 960 on account of shipbuilding, which during the four months of this year shows an improvement of £3 054 178 when compared with the same period of 1928, and nearly £6 000 000 when contrasted with the corresponding months of 1927. Since these two industries, coal and shipbuilding, have at last shown some indication of moving out of the mire in which they appeared to be lodged, the returns make interesting reading for this reason alone. There are, however, other industries which show improvement in the April returns, not the least of which is the electrical industry. Detailed figures of the electrical returns will be found elsewhere in this issue, where it is shown that exports of electrical machinery and apparatus improved last month by £301 543 when compared with the March figures; and by £244 743 when compared with April, 1928. These increases were chiefly brought about by larger shipments of various motors and generators, rubber covered and non-rubber covered wires, wires other than submarine, and telegraph instruments, which between them accounted for an increase in trade of £209 787. Though the exports of telegraph and telephone instruments alone improved by £28 500, imports of the same class of goods increased by £45 666, indicating, therefore, that there is still plenty of potential custom in these goods in the home market, competed for by the foreigner. Other large imports were rubber covered wires, with an increase of £15 424, electric lamps, £7 902, and various electrical goods, £30 277. On the whole, however, the April figures, with a favourable balance of exports over imports of £1 130 997, may be regarded as satisfactory, and, with total exports for the four months of this year exceeding total imports by nearly £4 000 000, we may be said to be holding our own. Though this total excess may not be as high as many would like to see it, it is well to remember that the severe weather experienced during February hindered to a large extent trade which would have normally been conducted during this period.

The Incandescent Lamp Jubilee.

WE are glad to learn that, as a result of the attention drawn in these columns to the proposed American celebration of "Light's Golden Jubilee," the matter received some discussion at the annual meeting of the Institution of Electrical Engineers, and that the suggestion, made by a reader of THE ELECTRICIAN, that the Institution should send a protest to the National Electric Light Association of America against a proposal to give credit for the invention of the electric incandescent lamp to Mr. EDISON instead of to the late Sir JOSEPH SWAN is likely to be acted on by the I.E.E. Council. In announcing that the Council proposed to take some action, COL. EDGCUMBE expressed doubt as to whether the publicity of the Institution would reach the level of the American publicity. We do not think this is very material, for so long as Mr. EDISON is not proclaimed to the world as the inventor of the *first* incandescent electric lamp, and mention is made of the name of the first inventor, we see no reason for attempting to outvie the Americans in the publicity field. Already, in our own quiet way, we have celebrated the jubilee of the first lamp, and the Americans are certainly entitled to celebrate the jubilee of the second lamp in the field—if they feel so disposed. Our sole concern in this question has been to vindicate the rights of a great British inventor, and when we learn that the N.E.L.A. arrangements have been suitably modified we will gladly let the matter drop.

Battersea: A Reply.

IN the various references we have made to the agitation against the erection by the London Power Co. of its proposed new power station at Battersea, we have endeavoured to regard the matter chiefly from the customer-relationship point of view, believing that a public utility undertaking which causes avoidable annoyance to its customers and prospective customers is more correctly described as a public nuisance. We have also expressed uneasiness at the apparent indifference of the Power Company to the widespread newspaper agitation which its proposals have aroused, and many of our readers must have shared our surprise that no reply was forthcoming in answer to

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the criticisms which have been appearing in the public Press during the past two months. We are glad, in common fairness, to state that information which we have received this week clearly shows that the company is fully alive to the importance of making a considered reply to its critics. As evidence of this desire we have been supplied by the London Power Co. with a copy of a letter, embodying a complete statement of the company's position, and an answer to the criticisms. This letter was sent nearly a fortnight ago to a daily newspaper, which did not publish it until Wednesday of this week. For the information of our own readers we reproduce on another page the substance of the London Power Co.'s defence. Beyond pointing out that the statement reveals confidence in the early solution of the difficult problem of dealing with sulphurous emissions, and puts forward a strong reasoned argument against the removal of the station to a down-river site, we propose for the time being, at any rate, to reserve comment on the technical points at issue.

An Example to Follow.

SINCE Mr. F. W. PURSE found a way of making the I.E.E. Wiring Regulations compulsory in the borough of which he is chief electrical engineer, i.e., by incorporating the I.E.E. Regulations with the Borough Council's by-laws, there has unfortunately not been a rush on the part of other municipalities to follow West Ham's courageous lead. We were, therefore, gratified to hear Mr. J. CHRISTIE'S announcement at the Sussex Branch dinner of the E.C.A., that similar action is proposed at Brighton, and that when the regulations are actually embodied in the Corporation's by-laws the Electricity Department will take care to see that they are rigidly enforced. Many other municipal engineers could take similar action. Thus they would not only secure the obvious advantages derivable from reliable installations in their consumers' premises, but would also help materially to raise the standard of electrical installation work.

The B.B.C. Report.

THE governors of the British Broadcasting Corporation have published their second annual report and according to its reading, the year under review "witnessed a steady endeavour to improve the quality and increase the variety of programme material transmitted, and developed the plans for better distribution combined with a series of alternative programmes, referred to in the last report as the regional scheme." The governors record as an "important event" the formation of the National chorus of 250 amateur singers, while "symphonic work of the first order by 'simultaneous broadcast'" is promised in the early future. The report reads as though there were never any disagreement with the material broadcast, and though the revue and variety section of the programmes is dismissed in eight lines, symphony music, chamber music, opera and oratorio, special programmes (i.e., Schubert's Centenary), appreciation of music, dramatic productions, debates and discussions, running commentaries, etc., occupy over two pages, while education and religious service material occupy another page. The children's hour is dismissed in seven lines. From the point of view of a report this unequal allocation of space may be in order, but it indicates that the governors of the B.B.C. are still very devoted to that side of broadcasting which is popularly known as "highbrow." Apart from programme material the report contains much of interest and shows, among other things, the success of the S.O.S. messages broadcast during the year, in that of the 751 transmitted, over 40% were successful. The Sunday evening "Good Cause" feature was also a successful one, for during the year no less a sum than £60 000 was contributed by listeners. Dealing with the finances of the Corporation, the governors state that the income from licences was £871 763 and from publications £120 635, the total with interest and sundry receipts being £1 002 505. Expenditure was £879 324, of which £538 990 was devoted to programmes, and, considering the number of stations to be maintained, this certainly appears to be a satisfactory proportion.

An Engineering Achievement.

PARTICULARS given in the report concerning the engineering side of the Corporation show that during 68 000 hours of working the percentage breakdown was as low as 0·035%, or 0·005% more than in 1927, due to damage done to transmitting aerials by the gales of November last. In connection with the latter erections, some interesting experiments were carried out by means of kites on Salisbury Plain, and though the first kite aerial was probably that used by SENATORE MARCONI in his first transatlantic experiments at Newfoundland, the purpose of these two flights was strangely different. Whereas in their early use it was thought that height would result in the desired signals being received, in the case of the B.B.C. experiments their use was adopted for reasons of economy in an investigation of the problem of working several transmitters on one frequency in order to make the most of the available wavelength channels. Considerable experiment was made during the year under review with transmissions on short waves, and though the report makes no mention of any revolutionary discovery, it nevertheless records "good progress." The engineering department of the B.B.C. has also developed a new electrical control apparatus for use in the Manchester station, and though, as with many other organisations, the engineering side of the business receives the least publicity, there is evidence in the report that our belief and confidence in the B.B.C. from the technical viewpoint are not misplaced—in spite of the attractions which the "talkies" appear to have for wireless engineers in general, and B.B.C. engineers in particular.

Contractors' Overhead Charges.

ALTHOUGH primarily of interest to electrical installation contractors, the detailed examination and analysis of trade charges in the electrical installation industry which is given elsewhere in this issue also merits some attention from supply engineers, consulting engineers, architects, quantity surveyors, and even of consumers. For some time past the view has been expressed from within the industry as well as from without, that the cost of installations is too high, and that this is exerting a braking effect upon the development of electricity consumption. Unfortunately, many of the contractors have been quite unable to contest such allegations because their cost-accounting systems have been so rudimentary in character that there has been difficulty, not in deciding whether the profit made was too high, or even adequate, but in discovering whether there was any actual profit on their transactions. The complexity of the business and the relatively high proportion of overhead charges to the cost of materials used makes certain knowledge of costs absolutely essential in the conduct of a successful business. Such investigations as have already been made show that, far from charging too much, many contractors do not charge enough, though a minority admittedly secure a profit of sorts through charging the public for its inefficiency. We understand that much useful work has been done recently by the Electrical Contractors' Association on the problem of overhead charges, but many installation contractors still find difficulty in deciding exactly which items of expense should be allocated to establishment charges and the relative percentage of these items to the total. Our article this week, which is contributed by an installation engineer who has devoted much time to study of the question, provides an answer to most of these questions. We fully expect that some of the allocations in this analysis will arouse critical discussion and the usual facilities will be provided in our correspondence columns.

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THE BATTERSEA POWER STATION.*

A Reply to Recent Criticisms—Hopes for New Methods of Flue Gas Treatment—Economic Reasons for Choice of Site.

By W. F. FLADGATE (Chairman, London Power Co., Ltd.).

THE London Power Co. has not hitherto intervened in the controversy regarding the erection by the company of a power station at Battersea. But the time has now, I think, arrived when I should state for the information of the public the material facts of the case, and explain the views and intentions of the Power Company.

The question of erecting a station on the Battersea site had come before the directors of the London Power Co. in the later part of 1926, and they were advised that, from the engineering and economic point of view, the site was the very best that could possibly be obtained. They made no secret of the fact that they were acquiring that site, and brought their project prominently before the Committees of both Houses when the " Chiswick Station " Bill was under consideration, not by way of opposing the proposal of the Joint Electricity Authority, but as a complementary proposition.

Consideration of Site.

Before definitely deciding on the Battersea site, the London Power Co. gave very careful consideration to the question of an alternative site down the river. In view of the heavy transmission costs they were quite unable to make out an economic case for such a site, and a more recent survey and consideration of this possibility, with estimates based on the use of still higher voltages, has confirmed the correctness of their earlier opinion.

One of the first steps taken by the Central Electricity Board was to consider the scheme for the South-East of England. This scheme scheduled several stations of the London Power Co. as being " selected " stations, and the station which was proposed by the Joint Electricity Authority at Chiswick was put forward in that category. The Central Electricity Board gave the most careful consideration to the scheme, and in the result discarded the station at Chiswick and selected for adoption the station at Battersea. The whole of the approved plans for dealing with South-East England and the transmission system in connection therewith are based upon the erection of a station at Battersea.

The Power Company, who had acquired the site at a very large price, accordingly proceeded with the completion of their plans for the Battersea station, which had been submitted to and approved by the Electricity Commissioners and which have also been approved by the Central Electricity Board. Considerable progress has now been made in the construction of the works and plant.

So far as the commercial side of the undertaking is concerned, it is right to point out that the London Power Co. is in no sense a commercial undertaking. By its constitution it is precluded from making any profit. It can only pay a fixed interest on its securities. The whole of the saving which the company may be able to make is to be applied in reducing the charges for current to their constituent companies, thus enabling those companies to supply the public of London at a cheaper price.

When the Electricity Commissioners issued their statutory consent to the erection of the Battersea station, they attached to their consent the condition :—

> The Company shall in the construction and use of the said generating station, take the best known precautions for the due consumption of smoke and for preventing as far as reasonably practicable the evolution of oxides of sulphur and generally for preventing any nuisance arising from the generating station or from any operations thereat.

The London Power Co. has always fully recognised the importance of the obligations thus imposed upon it, and from the outset has given careful consideration to the steps to be taken to secure its performance. In particular, as regards the treatment of the flue gases from the boilers, which is the topic to which criticism has recently been chiefly directed, the company has specially invoked the assistance of their own, and independent, expert chemists in connection with the design and equipment of the station.

It is no doubt true that the problem of dealing with sulphur fumes is a comparatively new one in its application to power stations, but it is manifestly unfair to the London Power Co. to pronounce it in advance to be incapable of solution, and to do so casts an unmerited slur on the present state of advancement of the arts of engineering and chemical science.

The advice which the company has received from its advisers, to whom it has given the freest possible hand, fortunately belies the pessimistic anticipations which have been so widely circulated, and affords reliable ground for believing that by the proper selection and pre-treatment of the coal before burning, and by the adoption of suitable plant, it is practically possible to render innocuous the fumes which arise in the process of generation. I can assure the public that the company will not be deterred by any considerations of cost from adopting every possible precaution which can be devised. It is in their own interest to do so. Problems of no less difficulty have been surmounted in the past history of the electrical industry.

Lest the omission of any reference to smoke and dust should be construed as evidence of the company's inability to cope with these, I may say at once that not the slightest apprehension is felt by the advisers of the company on this score. There is an abundance of experience to work upon in this connection.

I turn now to another and different aspect of the matter. I refer to the criticism that the erection of a power station at Battersea would be ' an economic mistake."

Let us examine this question, which, after all, is only a variation of the oft-debated problem as to whether it is more economical to site a station (*a*) as near as possible to the centre of gravity of its load, or, (*b*) at some distant site which may have the advantage of remoteness, but which has the concomitant disadvantage of necessitating long overhead or cable trunk lines traversing—in great part—congested areas by several divergent routes.

Careful estimates have been prepared of the transmission capital costs and annual losses which would be involved in dealing with the whole of the energy from a station of the size of Battersea located some 15–17 miles down river, as compared with a station on the Battersea site. These estimates are necessarily only approximate in the absence of a detailed survey of the possible routes. They do, however, cover transmission partly by overhead lines—where feasible—and partly by cables, and at the alternative voltages of 66 000 and 132 000.

Question of Costs.

Shortly, it may be said, that in the case of a station at the suggested distance, the extra capital costs on transmission would range from £3 000 000 to £1 850 000, according to the system and voltage adopted. After due consideration, and making allowance for all contingent factors incidental to the use of a transmission voltage of 132 000—on the most favourable basis it would not appear safe to reckon on a lower figure than £2 100 000.

Against the incidence of the capital charges on this latter figure, together with the line maintenance costs, the line losses and the rating, may be set the saving of sixpence per ton on sea-borne coal direct to both sites, by steamer, amounting in the aggregate, and on the ultimate output of the station, to some £15 000 per annum. Most careful inquiries have been made before accepting the above figure of sixpence per ton, and the company is assured that although this figure may fluctuate slightly from time to time, it is an outside figure and should be accepted by " anyone who knows the trade."

The advisers of the London Power Co. have come to the definite conclusion that—apart from the difference in value of the respective sites, which, after all, has no very appreciable bearing on this question—there would have to be a difference in the cost of coal at least 6s. per ton in favour of the down-river site to justify its selection, and to counteract the additional transmission and transformation costs.

It will, I think, be generally admitted amongst engineers that cables operating at 132 000 V and upwards are at the present time more or less " on trial." They can hardly be

* Being extracts from a letter embodying a complete statement of the London Power Co.'s position, and in answer to newspaper criticisms.

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said as yet to have emerged from the experimental stage, and experience is very limited.

Whatever the future may hold in store in this direction—and it is probably hopeful—a note of caution is surely necessary before London is committed to such a system for the transmission of the entire energy output of a station of the magnitude of Battersea situated on the lower reaches of the river.

It is understood that the Central Electricity Board has placed an order for a limited amount of this class of cable. This work is, however, regarded by that body as being of a trial or experimental character, and the order has been placed at the entire financial risk of the contractor, with stringent guarantees of replacement by cables operating at lower voltages.

Cable-laying in Congested Streets.

It may be convenient to refer at this point to an observation made by Sir John Snell, when considering the Chiswick Bill, before the Parliamentary Committees, which has a distinct bearing on the present case—namely, that owing to the high cost of laying cables through the congested streets of London, and the high cost of reinstatement of the paving, etc., it is not commercially practicable to transmit the large quantities of energy which are and will be (particularly *will* be) required in the West End of London, wholly from the eastern end.

In this view the London Power Co. most fully concur, fortified, as they are, by their experience of the present condition of the streets in the area over which they have the right to lay cables—namely, the whole of the County of London. In these circumstances, if the energy generated at stations on the lower reaches of the river Thames has to be transmitted to the West, it could only be done by devious routes north or south of the Metropolis, thus adding very greatly to the transmission costs, and which has not been fully taken into consideration in compiling the foregoing estimates.

The London Power Co. do not subscribe to the principle that a generating station should be located near to a particular colliery or to a particular group of collieries, which is not in their ownership or under their control. They believe that the best interests are served by selecting a site available, if need be, to all the coal fields of the country. If the Kent coal be all that is claimed by its sponsors there is nothing to prevent its use at the Battersea site.

Reference has been made to the practice in other countries with the suggestion that their example should be copied in the case of London. What are the facts? Take Berlin for an illustration. At the present time the bulk of the electrical requirements are supplied from four power stations within the city limits, and a fifth station, also within the city, is under construction.

By the year 1932, it is estimated that out of a total demand of 720 000 kW, only some 60 000 kW will be sent into the city from stations situated on the brown coal fields—in the form of bulk supply. There is little here, therefore, to support the argument advanced against Battersea in favour of long distance transmission from remotely situated stations. The position in Paris is similar.

The case of Melbourne and the Morwell brown coal fields has no relevance to the present controversy, as will be admitted by those who have any knowledge of the situation, political and economic, in Victoria, Australia.

Again, take the large American cities—viz., New York, Brooklyn, Chicago, Baltimore, Philadelphia, Milwaukee, etc., and we find that their stations are either entirely or mostly within city limits and as close up to the load as possible. This is particularly the case in New York, where huge stations—greatly in excess of Battersea—are located in some of the densest parts of the city, one such new station now in commission being designed for an ultimate capacity of 1 000 000kW.

And be it remembered that American coals, especially those of the Middle West are much higher in their sulphur content than are British coals, and yet the sulphur problem does not appear to have impressed itself on our American friends.

It has been stated that a proposal brought forward in 1906 by the London County Council for the erection of a station at Battersea was rejected by Parliament. Agreed; the ground of the refusal was not the unsuitability of the site, but the desirability of bringing forward a more comprehensive scheme for London and the surrounding district.

The whole object of the building of these new modern stations is to bring about two things—first, the gradual elimination of a number of other stations which are less efficient, which burn more coal per unit generated, which are liable to cause nuisance, and which are not in a position to adopt the up-to-date improvements that large new stations can afford to include; and second, the reduction by the increase in the use of electricity of the quantity of coal burnt both industrially and domestically. On balance there can be no doubt that a less quantity of deleterious fumes will find their way into the atmosphere under the modern system than under the existing regime.

The South-East England Electricity Scheme forms part of a comprehensive scheme for the British Isles which has been formulated for the express purpose of providing electric light and power in greater quantities and at less cost than hitherto. Any hindrance of this scheme can only be regarded as retrograde, and would delay the closing down of less suitable stations.

I conclude by summarising the position as it appears to the London Power Co.:—

(*a*) The principle of establishing a power station on the river within the Metropolitan area was before both Houses of Parliament so recently as 1927, and was approved by them after very exhaustive investigation and on evidence for and against, which dealt particularly with the question of the alleged nuisance caused by chimney fumes.

(*b*) The London Power Co. obtained a statutory sanction towards the end of 1927 for the establishment of a power station at Battersea by the body expressly set up by Parliament in 1919 to decide all such matters.

(*c*) The Battersea station was approved and selected by the Central Electricity Board, in 1928, as an integral feature of their adopted scheme for South-East England after hearing objections thereto—principally on the ground of nuisance.

(*d*) On the strength of their statutory position the London Power Co. has raised three millions of money for the express purpose of building a station on the site sanctioned.

(*e*) The London Power Co. have entered into contractual obligations for civil engineering works and plant—including the purchase of the site—amounting to £2 000 000—in every case with British firms employing British labour.

(*f*) It has not been proved, nor indeed even seriously suggested until quite recently, that it would have been economically sounder to have built the station on the lower reaches of the river.

(*g*) Neither has it been demonstrated that the disastrous effects upon the atmosphere, which have been so freely foretold in communications founded in many instances on an entire misconception of the position, are in the least likely to materialise in actual practice. In this connection—as an example—one has only to refer to a statement made to the effect that with the station completely erected and working at full capacity, then using 10 000 to 12 000 tons of coal per week, one-third of the total plant will use 2 000 tons per day. Our critics might at least be arithmetically accurate.

I.M.E.A. CONVENTION.

Brief Details of the Papers to be Read at Torquay—The Social Events.

WE understand that the following papers will be read and discussed at the annual convention of the Incorporated Municipal Electrical Association, to be held at Torquay from June 3rd to 8th:—"Whitleyism in the Electric Supply Industry," by Ald. W. Walker (June 4th); "Some Notes on Recent High Court Cases and Current Legal Problems in Connection with the Generation and Supply of Electricity," by Mr. J. H. Rothwell; and "The Heavy Oil Engine and Its Application in Electricity Supply Undertakings," by Mr. G. Porter (June 5th); and "Standardisation of Methods of Charge," by Mr. E. J. Jennings (June 6th).

The social events will include a reception by the President on June 3rd, a reception by the Mayor and Mayoress of Torquay on June 4th, a garden party at the invitation of the Torquay Electricity Committee, and a dance at the invitation of the Mayor and Mayoress of Torquay on June 5th, and the annual dinner, followed by a dance, on June 6th. The special Women's Day programme includes a lecturette by Miss M. Partridge on "Women's Work in Connection with Rural Electrification in Devonshire."

Mr. P. A. Spalding has submitted a report to Omagh U.D.C. on the proposals to supply electricity in the town. He states that the initial cost of a complete scheme for the entire urban area should not exceed £10 000. A charge of 9d. per kWh for lighting would be fully competitive with gas at 5s. 5d. per 1 000 cubic feet. The Council has decided to adopt the scheme and to engage Mr. Spalding to prepare plans and act as the Council's engineer.

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TRADE CHARGES IN THE ELECTRICAL INSTALLATION INDUSTRY.

Detailed Analysis of Items Comprising Overhead Expenses—What is a Reasonable Profit?—Low Earnings of Installation Engineers—Standardising Cost Accounting.

(SPECIALLY CONTRIBUTED).

ELECTRICAL installation engineers (contractors) and many other people inside and outside the industry, including supply authorities, consulting engineers, architects, quantity surveyors and consumers, are exhibiting considerable interest at the present time regarding the amount to be allowed for overhead charges, on-costs, establishment charges or trade charges (as this item is variously termed) and also the profit accruing to electrical installation engineers as a recompense for their labours.

Many people, with little or no knowledge of the trade, feel that trade charges in the installation section must be and are exorbitant, and that the contractors seriously assist in maintaining an unreasonably high price for good quality residence, factory and similar wiring.

Architects have repeatedly taken exception to the writer's charge of 20% for trade charges, excluding profit, and have stated, in explanation of their criticism, that builders take on work at 10%, 7½% and even 5% on cost. The reply is, of course, obvious. We deal in comparatively inexpensive things which are troublesome and require a lot of detail work, whereas builders deal in relatively costly articles which are, on the whole, simple and are ordered in large quantities.

To take the extreme case, a bronze ceiling plate and lampholder, special shade and "flame" lamp are required, wired with old gold flexible, as an extra to contract. Visualise the staff work required to get this material on to the job, and the value of the material when it is on the job.

Unfortunately, no figures are yet available for publication from British firms, but quite recently a conference was held in the U.S.A. between representatives of the National Electric Light Association, the National Electric Manufacturers' Association, the Electrical Supply Jobbers' Association, and the Association of Electragists International, for the purpose of finding out what, if anything, is retarding the growth of electrical service, more particularly in the residence or domestic field.

The Electragists stated their views in an admirably prepared and reasoned pamphlet, entitled "The Economic Factors Affecting Wiring Development," and a considerable amount of space was devoted in this booklet to the subject of Overhead and Profit.

A copy of this booklet has fallen into the hands of the present writer, and as the analysis he made for his own use may be of interest to many readers of THE ELECTRICIAN, it was considered desirable to publish it.

Before going into the figures, a few of the more important introductory remarks will be quoted, as they apply with equal force in this country.

Cost of Ignorance.

"Ignorance of the cost of business operations stands in the way of progress of men in every industry more than any other one thing.

"While it is important that we secure adequate profits from the operation of our business, these profits should be secured from efficient business operations rather than from charging the public for our inefficiency.

"It is foolhardy for a man to sell his business service blindly at the prices he thinks other men are asking, without knowing the relations of his own costs to those prices, for the percentage of successes among those 'other men' who are setting his prices is pitifully small.

"The final item of cost on every job is 'overhead.' In the electrical installation business the overhead is exceptionally low. It is lower than that of the retailer, the manufacturer or the central station.

"The actual figures are for 1925 and were obtained from 18 firms, small and large, situated in different parts of the country." (Note, six only are quoted as being representative.)

"Nine concerns that made a profit had an overhead of 30·6% to 41·9% of the prime cost.

"The successful ones paid very low salaries to the head of the business. The fellow who did £2 200 worth of business paid himself less than £5 3s. per week, and, besides working with the tools, he did all his own book-keeping. *He couldn't get a man to work for him for that amount.*

"It makes no difference what kind or what priced materials are used in wiring; these overhead costs must be paid. If the jobs are decreased in cost, then the ratio of overhead goes up. It is not possible to decrease these costs by decreasing the cost of wiring materials.

"The average overhead of the successful electrical installation engineer is around 35% of the materials and labour cost. For the unsuccessful ones it was over 40%.

"It is generally admitted that in a competitive business, a 10% profit on capital invested in a business is not unfair or excessive. The utilities, in a non-competitive market, are permitted to earn up to 8%.

"What do the electrical installation engineers get? Nine successful ones earned 0·5 of 1%, 0·8 of 1%, 2%, 3·5%, 4%, 4·6%, 4·7%, 6·5%, and 7% on operations.

"If the central stations enforce such a policy (e.g., hammering down the price of installation work), sooner or later the industry will pay the price. The low priced men cannot give service and do a workable job at these prices unless somebody drops a lot of money, paying their cost of doing business. Public dissatisfaction is bound to arise, and that will be expensive to the supply people."

Establishment Charges.

Many electrical installation engineers and accountants seem to find considerable difficulty in deciding exactly which items of expense should be allocated to establishment charges, but reference to the large table accompanying this article (page 582) should go a long way to settle this difficulty and should prove a useful guide. If British electrical installation engineers have their accounts prepared on this basis in future they will be in a position to compare their costs with the costs of other British firms which may be published from time to time with benefit to all concerned.

If there were sufficient general demand from members, the Council of the Electrical Contractors' Association would undoubtedly arrange for a standard set of books and forms to be printed and sold to members at advantageous prices.

All amounts shown in the tables have been converted from dollars to pounds sterling, and comparative figures are given as a percentage of the Total Prime Cost of Sales (line 34). No adjustment has been made for the higher cost of living and scale of wages and salaries prevailing in America.

MANAGEMENT SALARIES.—Under this head there is included remuneration paid to all officers and managers. Owners of the business engaged in active management should pay themselves a salary equal to that which it would require to secure someone else to fill their positions. Commissions allowed to agents for securing orders are not treated as salaries, but are shown separately under "Commissions Allowed."

Turnover.	Management Salaries.	% of total P.C. (Line 34).
£	£	
2,195	255	16·9
5 550	428	10·9
12 750	1 030	11·0
27 270	2 680	14·0
53 500	3 460	8·8
87 500	5 130	7·8

Taken as a whole, the figures are irregular, but from and including the fourth line, they show the decreasing ratio expected. The amounts falling under this section probably appear high to us, but in this connection it should be noted that wiremen are paid from 75 cents to one dollar per hour in California and $1.50 in New York, say, approximately 6s. 3d. per hour.

As a suggestion for British partners or owners of businesses who desire in future to charge their services, the scale of 5% up to £10 000 sales invoiced and 2½% beyond may be considered —e.g., for a £30 000 turnover :—

	£10 000 at 5% =	£500
	20 000 at 2½% =	500
Total sales	£30 000	£1 000 salary, plus profits.

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If desired this can be adjusted as follows :—

First £10 000 at 5%.
Next £20 000 at 3½%.
After 2½%.

The thing is to get a basis and to see that your customer pays reasonably for the service you render him. Profit on capital invested in your business is an entirely different thing from payment for service rendered, and not to charge the business with the services of a working director is unduly to deflate the establishment charges and to deceive anyone who is using the figures as a basis of calculation.

Payments to Employees.

OTHER SALARIES.—All other employees on the pay roll of the firm other than journeymen and helpers, are included in this section.

As shown, the item appears to be small in relation to the management salaries :—

Turnover.	Other Salaries.	% of total P.C. (Line 34).
£	£	
2 195	—	—
5 550	322	8·25
12 750	715	7·68
27 270	1 390	7·27
53 500	2 540	6·47
87 500	7 000	10·65

The results are regular with the exception of the last, which shows an unaccountable rise.

TOTAL SALARIES.—Probably the more natural way would be to lump the salaries, and this is done in the table following, with the addition that a column is added showing the ratio of total salaries to wages paid to operatives.

Unfortunately the latter figure will vary considerably, depending on the ratio of showroom sales to contract work.

Turnover.	Total Salaries.	% of Total P.C. (Line 34).	Labour (Line 31).	% Salaries of Wages.
£	£	%	£	
2 195	255	16·9	256	10·0
5 550	750	19·25	1 335	56·2
12 750	1 745	18·68	2 740	63·8
27 270	4 070	21·26	6 000	68·2
53 500	6 000	15·27	9 420	63·8
87 500	12 130	18·45	23 700	51·3

English practice would be nearer 25% to 33⅓% as the upper limit for ratio of salaries to wages paid in a normal installation business.

As we have already noted that management salaries are excessive, possibly the explanation will be more obvious if other salaries are examined in relation to wages.

Turnover.	Other Salaries.	Labour.	% Other Salaries to Wages.
£	£	£	
2 195	—	256	—
5 550	322	1 335	24·2
12 750	715	2 740	26·1
27 270	1 390	6 000	23·1
53 500	2 540	9 420	27·0
87 500	7 000	23 700	29·5

These are closer to good British practice, but they show an upward rather than a downward tendency for the larger businesses.

NON-PRODUCTIVE LABOUR.—An account is provided for wage payments to electricians and auxiliary workmen, that cannot be allocated to specific jobs. There is only one item of £130 and it does not call for further comment.

RENT.—In this account, all payments made as rental of all offices and warehouse space, also taxes and insurance on leased property are included.

In the event of the firm holding the freehold, a sum equivalent to the letting value should be included. Similarly, if it is a freehold property and a mortgage has been obtained, interest payable on the mortgage should be included here. Possibly a better name for this item would be premises account.

Examination of the figures gives the following results :—

Turnover.	Rent.	% of Total P.C. (Line 34).
£	£	
2 195	25	1·66
5 550	275	7·05
12 750	168	1·80
27 270	372	1·94
53 500	1 470	3·75
87 500	1 480	2·25

A London firm would consider the first four figures very low, as space fetches anything from 5s. to 25s. per sq. ft.

Provincial firms would probably be able to produce figures comparing favourably with the first four in the above table.

LIGHT, HEAT AND POWER.—These figures scarcely call for comment, as they are relatively insignificant. Payments made for light, heat and power, both for shops, offices, and warehouses should be included.

STATIONERY AND OFFICE SUPPLIES.—This item includes cost of stationery, books, forms and miscellaneous office supplies, together with postage, coinage, etc., thereon. Typewriter repairs, ribbons, waste paper baskets and items having a short life, which it is not desired to charge to capital account would be included here.

TRAVELLING AND ENTERTAINING.—Wherever possible hotel, rail and other expenses incurred by members of the staff in connection with contracts would be charged to "direct job expense" of the contract concerned. The balance of items not otherwise allocatable would be charged to this account.

The large table shows low figures under this section, due apparently to the fairly extensive use of motor cars.

Turnover.	Travelling and Entertaining.	% of total P.C. (Line 34).
£	£	
2 195	—	—
5 550	68	1·74
12 750	46	0·49
27 270	47	0·24
53 500	540	1·38
87 500	—	—

The last firm possibly include expenditure under this section under "miscellaneous."

TELEGRAPH AND TELEPHONE.—

Turnover.	Telegraph and Telephone.	% of Total P.C. (Line 34).
£	£	
2 195	14	0·93
5 550	18	0·46
12 750	46	0·49
27 270	103	0·54
53 500	123	0·31
87 500	300	0·46

These figures appear to be closely comparable with firms of similar size operating in this country.

POSTAGES.—This section includes cost of postage stamps, and registered letters.

Turnover.	Postage.	% of Total P.C. (Line 34).
£	£	
2 195	7	0·46
5 550	8	0·20
12 750	30	0·32
27 270	35	0·18
53 500	87	0·22
87 500	—	—

The last firm probably include this item under "telegraphs and telephones," or, alternatively, under "miscellaneous."

Low Advertising Allowance.

ADVERTISING.—All expenses for advertising, of whatever nature, e.g., printing, addressing, posting, artists' work, photographs, etc., are included in this item.

As British firms are frequently accused of slackness in this matter the data is printed below for careful consideration.

Turnover.	Advertising.	% of Total P.C. (Line 34).
£	£	
2 195	4	0·26
5 550	31	0·79
12 750	196	2·10
22 270	95	0·48
53 500	405	1·03
87 500	308	0·56

TAXES.—Income and property tax are included in this section. The desirability of including these in overheads appears to be open to question. Property tax chargeable against freehold property may appear more appropriately under rent, while income tax is a charge against profits, e.g., no profits, no income tax, but the "overheads" remain.

Turnover.	Taxes.	% of Total P.C. (Line 34).
£	£	
2 195	7	0·46
5 550	10	0·25
12 750	76	0·81
27 270	5	0·03
53 500	244	0·62
87 500	1 400	2·13

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INSURANCE.—Payments on account of all insurance premiums paid are included with the following exceptions—

a. Motor car—chargeable to same.

b. Workmen's compensation, national health, etc.—included under wages.

c. Fire, loss of profits, etc., due to same cause to be charged "rent" or "premises" account.

Items to be considered in connection with insurance include loss of wages or cash in transit between bank and office and office and job, damage to property and persons on contracts, rent of office during reconstruction of premises after fire, building and contents against fire and possibly burglary, loss of material on contracts, accidents to members of the staff on contracts, etc., in addition to the workmen's compensation, etc.

Turnover. £	Insurance. £	% of Total P.C. (Line 34).
2 195	7	0·46
5 550	21	0·53
12 750	71	0·76
27 270	335	1·75
53 500	367	0·93
87 500	470	0·72

The reason for the high figure paid by the fourth firm is not clear. The average is about 0·75 of 1%.

ASSOCIATION EXPENSES.—With one exception these only average 0·1 of 1%, and do not call for comment.

CARRIAGE.—This item varies considerably between the different firms, probably due to different methods of accountancy. For example, the carriage on goods purchased is part of the cost of the goods and may be charged to the job direct. Carriage on goods sold will probably be charged on the invoice to the customer, or if delivered by motor van the cost will appear in that section. In the later returns, this item is deleted altogether.

Examined in detail, the figures are as follows :—

Turnover. £	Carriage. £	% of Total P.C. (Line 34).
2 195	35	2·33
5 550	46	1·18
12 750	—	—
27 270	54	0·28
53 500	600	1·53
87 500	183	0·28

A Debatable Point.

INTEREST.—In the present writer's view, it is a debatable point whether interest should be included in "overheads." Viewed from one angle, it is part of the cost of running the business and is therefore chargeable. From another angle, it indicates shortage of capital. If the capital is available, money will not be borrowed and the profits should be larger.

In the accounts under examination all charges for interest are included, whether for notes payable, trade acceptances payable or open account.

The item only affects three of the firms and is of relatively small importance.

CARS AND LORRIES.—Items included in this account include cost of maintenance and operating the vehicles, such as rent of garage, repair and renewals of equipment, petrol and lubricating oil and tyres, together with fire, theft and liability insurance.

The detailed examination follows :—

Turnover. £	Cars and Lorries. £	% of Total P.C. (Line 34).
2 195	95	6·30
5 550	88	2·26
12 750	105	1·12
27 270	527	2·76
53 500	625	1·59
87 500	770	1·17

MAINTENANCE AND REPAIR.—Repairs to furniture and fixtures, painting and repair of premises and minor alterations, are charged to this account.

Analysis provides the following result :—

Turnover. £	Maintenance and Repairs. £	% of Total P.C. (Line 34).
2 195	—	—
5 550	—	—
12 750	13	0·14
27 270	—	—
53 500	—	—
87 500	890	1·35

Painting and repairs to premises would be preferably charged to premises account.

MISCELLANEOUS EXPENSES.—All miscellaneous and incidental disbursements, not otherwise detailed, are included in this account, e.g., donations and subscriptions to charity, 'bus, tube and tram fares, advertisements for employees. Careful check should be kept on this account, and if any item constantly reappears and assumes substantial proportions, consideration should be given to the desirability of opening a separate account for it.

Analysed, the following results are obtained :—

Turnover. £	Miscellaneous. £	% of Total P.C. (Line 34).
2 195	8	0·53
5 500	40	1·02
12 750	93	1·00
27 270	170	0·89
53 500	113	0·29
87 500	289	0·44

An Interesting Item.

BAD DEBTS.—Always an interesting item, if and when it appears. Some regard it as a direct reflection on the counting house in failing to collect money quickly, while others regard it as a necessary and justifiable business risk, e.g., nothing venture, nothing have.

Turnover. £	Bad Debts. £	% of Total P.C. (Line 34).
2 195	10	0·66
5 550	10	0·25
12 750	46	0·48
27 270	400	2·09
53 500	190	0·48
87 500	115	0·17

Some meticulous people may argue that this is not a true "overhead," but a charge against profits. Others will reply that it is part of the recognised cost of carrying on business, and therefore chargeable. In any case, it is desirable to fix a reasonable limit to the amount and to investigate details closely if and when it exceeds that figure.

DEPRECIATION.—Many installation engineers entirely overlook the necessity of dealing adequately with these items. Several methods are employed for ascertaining reasonable allowances, as for instance :—

Tools.—Allow the first year's purchases to show on the balance sheet at cost, and charge all subsequent purchases to renewals. Alternately, charge all tools having a reasonable life to capital account and write off 33⅓% of the *original* or first cost each year.

Lorries and Cars.—At least 33⅓% should be written off the *first* cost annually.

Furniture, Fixtures and Fittings.—A reasonable sum is 10% of the first cost, except when buildings are leased. In this case, sufficient must be written off fixtures and fittings attached to the building to reduce the book value to nil at the expiration of the lease.

Stock.—Each installation engineer must decrease this item on his own experience, but 12½% is suggested as a reasonable figure.

Analysed, the total results are as follows :—

Turnover. £	Reserves for Depreciation. £	% of Total P.C. (Line 34).
2 195	34	2·26
5 550	33	0·84
12 750	78	0·82
27 270	371	2·94
53 500	862	2·17
87 500	679	1·01

In the event of premises being held under a repairing lease, a further allocation to a special reserve fund will be necessary, calculated in a manner such that "*x*" annual payments, accumulated at compound interest over the period of the tenancy, will provide, at the expiration of the tenancy, a sufficient sum of money to execute all repairs, repainting, etc., to the satisfaction of the landlord under the terms of the tenancy agreement.

TOTAL OVERHEAD EXPENSES (EXCLUDING PROFIT).—As has been previously stated, the total results are undoubtedly high compared with good British practice, due principally to the high ratio of managerial expenses.

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Analysed in detail the following result is obtained :—

Turnover.	Total Overheads.	% of Total P.C. (Line 34).
£	£	
2 195	531	35·11
5 550	1 444	36·99
12 750	2 880	30·70
27 270	6 887	35·00
53 500	12 325	31·33
87 500	20 113	30·58

Figures for businesses of similar size in this country would probably vary between 25% and 17½%. The general average being 20 or 22½% for a turnover between £25 000 and £50 000.

Revised Grouping.—Information to hand indicates that the revised grouping of accounts adopted by the Association of Electragists International is as follows :—

Salaries (Managerial and Other Salaries); Non-Productive Labour; Rent or Premises Account; Light, Heat and Power; Stationery and Office Supplies; Travelling and Entertaining; Telegraph and Telephone; Postage; Advertising; Taxes; Insurance; Association Expense; Warehouse Upkeep; Maintenance and Repairs; Interest; Cars and Lorries; Miscellaneous; Reserve Appropriations; Allow-for loss on Notes and Accounts Recoverable; Allowance for Depreciation on Furniture and Fixtures; Allowance for Depreciation on Cars and Lorries; Allowance for Depreciation on Tools; Allowance for Depreciation on Stock. No provision appears to have been made for legal charges and audit fees, both of which are essentially "Overheads."

Allocation of Overhead Costs.—After the overhead costs have been ascertained for several years, the question arises, how the estimated costs for the current year are to be fairly allocated over the work to be done during the current year.

Clearly the overhead costs represent the average cost of either repairing a faulty flexible to a vacuum cleaner or of carrying out a £5 000 contract. Again, one £5 000 contract can be carried out at less cost for supervision and clerical work than one hundred jobs each of the value of £50.

Some firms decide that the ascertained establishment charge is the average cost, and every job they tender for, whether it be large or small, is priced on the same basis, e.g., if material and labour cost £5 they add 20% and 10%. Similarly, if the materials and labour cost £1 000 they add 20% and 10%. This method is very sound in practice, and if the principle is adhered to and the estimated costs are accuiate forecasts of the actual cost of the job there is little risk of the results of the year's trading showing an unsatisfactory result.

Other firms add 33⅓% and 10% to labour and 10% and 10% to material because, as is well known, the risk of loss, and also the supervision required, is much greater on labour than on material. In fact, drawing office and estimating costs are allocatable to labour overheads, because if material only is sold, these departments would disappear.

"Pious Hope."

Again, it is argued that the cost of a purchased article is an ascertainable fact, whereas the estimated cost of labour for a contract is an expression of pious hope at the best, and it is an accepted business principle that the greater the risk, the greater the margin of profit.

Other firms frankly recognise that large contracts can be carried out at less cost than small ones and calculate a sliding scale. Thus, for example, consider a business having a total

ANALYSIS OF ESTABLISHMENT CHARGES AND PROFIT AND LOSS STATEMENT.

		1		2		3		4		5		6	
1	Volume of business (turnover)	2 195		5 550		12 750		27 270		53,500		87 500	
2	State	Mass.		Ohio		Alab.		New York		Calif.		New York	
		£	%	£	%	£	%	£	%	£	%	£	%
3	Management salaries	255	16·90	428	11·0	1 030	11·00	2 680	14·00	3 460	8·8	5 130	7·80
4	Other salaries	—	—	322	8·25	715	7·68	1 390	7·27	2 540	6·47	7 000	10·65
5	Total salaries	255	16·90	750	19·25	1 745	18·68	4 070	21·27	6 000	15·27	12 130	18·45
6	Non-productive labour	—	—	—	—	—	—	130	0·68	—	—	—	—
7	Rent	25	1·66	275	7·05	168	1·80	372	1·94	1 470	3·75	1 480	2·25
8	Heat, light and power	5	0·32	6	0·15	58	0·62	64	0·33	224	0·57	500	0·77
9	Stationery and office supplies	7	0·46	6	0·15	91	0·97	73	0·38	214	0·54	425	0·65
10	Travelling and entertaining	—	—	68	1·74	46	0·49	47	0·24	540	1·38	—	—
11	Telegraph and telephone	14	0·93	18	0·46	46	0·49	103	0·54	123	0·31	300	0·46
12	Postage	7	0·46	8	0·20	30	0·32	35	0·18	87	0·22	—	—
13	Advertising	4	0·26	31	0·79	196	2·10	95	0·48	405	1·03	368	0·46
14	Taxes	7	0·46	10	0·25	76	0·81	5	0·03	244	0·62	1 400	2·13
15	Insurance	7	0·46	21	0·53	71	0·76	335	1·75	367	0·93	470	0·72
16	Trade Associations	3	0·19	34	0·87	4	0·04	36	0·18	19	0·04	114	0·17
17	Carriage	35	2·33	46	1·18	—	—	54	0·28	600	1·53	183	0·28
18	Interest	14	0·93	—	—	14	0·15	—	—	242	0·61	—	—
19	Cars and lorries	95	6·30	88	2·26	105	1·12	527	2·76	625	1·59	770	1·17
20	Maintenance and repair	—	—	—	—	13	0·14	—	—	—	—	890	1·35
21	Miscellaneous	8	0·53	40	1·02	93	1·00	170	0·89	113	0·29	289	0·44
22	Bad debts	10	0·66	10	0·25	46	0·48	400	2·09	190	0·48	115	0·17
23	Depreciation (Reserve for)—												
	a. Furniture, fixtures and fittings	23	1·53	—	—	11	0·11	97	0·51	69	0·17	132	0·20
	b. Cars and lorries	11	0·73	23	0·59	34	0·36	210	1·10	244	0·62	188	0·28
	c. Loose tools	—	—	6	0·15	33	0·35	64	0·33	62	0·15	208	0·30
	d. Stock	—	—	4	0·10	—	—	—	—	320	0·81	—	—
	e. Machinery and fixed tools	—	—	—	—	—	—	—	—	167	0·42	151	0·23
24	Total Overhead Expense	£531	35·11	£1 444	36·99	£2 880	30·79	£6 887	35·96	£12 325	31·33	£20 113	30·58

PROFIT AND LOSS STATEMENT.

25	Sales invoiced	2 200	5 550	13 000	27 800	53 886	87 860
26	Returns and allowances	—	—	240	457	386	—
27	Cash discounts allowed	5	—	10	73	—	360
28	Total deductions from sales	5	—	250	530	386	360
29	**Nett sales invoiced**	**2 195**	**5 550**	**12 750**	**27 270**	**53 500**	**87 500**
	Cost of Sales.						
30	Material or goods	1 250	2 570	6 570	11 600	29 800	40 500
31	Labour	256	1 335	2 740	6 000	9 420	23 700
32	Direct job expense	—	—	—	303	—	—
33	Commissions paid	—	—	13	1 210	—	1 530
34	**Total prime cost of sales**	**1 506**	**3 905**	**9 323**	**19 113**	**39 220**	**65 730**
35	**Gross margin**	**689**	**1 645**	**3 427**	**8 157**	**14 280**	**21 770**
36	(Line 24) Total overhead expense	531	1 444	2 880	6 887	12 325	20 113
37	**Profit from sales**	**158**	**201**	**547**	**1 270**	**1 955**	**1 657**
	Other Income.						
38	Commissions received	4	—	405	—	—	—
39	Cash discount earned	8	—	76	284	—	653
40	Sundry receipts	87	—	—	15	—	147
41	Rent charged (not taken out)	25	—	—	—	—	—
42	Total nett Income	£282	£201	£1 028	£1 569	£1 955	£2 457

(Conversions from dollars to pounds sterling by slide rule.)

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turnover of £40 000 and an overhead cost of 21%. Calculated on material and labour, the Association of Electragists consider a reasonable scale to be as follows :—

Prime Cost of Job ..	£5	£10	£20	£50	£100	£250	£500	£1 000	£2 500
Overhead % of Prime Cost	45%	38%	30%	25%	24%	22%	19%	16%	14%

If this scale is adopted, variations to contract cannot be taken at contract rate because a £2 500 contract would be taken at 14% on the prime cost to cover overheads and the appropriate addition for a £5 extra would be 45% or £2 5s. and not 14% or 14s.

The various methods applied to a contract of which the net cost of material and labour are respectively £55 and £45 give the following results.

(1) FLAT RATE OF 20% AND 10%.

Materials	£55	
Labour	£45	
E.C. Add 20%	£100	
Net Cost of Job.. ..	20	
	£120	
Add 10% Profit ..	12	
Selling Price		£132

(2) VARIABLE ON MATERIAL AND LABOUR.

Material.. ..	£55 0 0		
E.C. 10% ..	5 10 0		
Total Cost ..	£60 10 0		
Profit 10% ..	6 1 0		
		£66 11 0	
Labour	£45 0 0		
E.C. 33⅓% ..	£15 0 0		
Total Cost ..	£60 0 0		
Profit 10% ..	6 0 0		
		£66 0 0	
Selling Price			£132 11 0

(3) SLIDING SCALE.

Material ..	£55 0 0		
Labour	£45 0 0		
	£100 0 0		
E.C. for £100 @ 24%	£24 0 0		
Total Cost ..	£124 0 0		
Profit 10% ..	£12 8 0		
Selling Price			£136 8 0

In practice, in mixed contracting work, the second method appears to give the best result, because if the contract value is inflated by fittings, batteries, engines, switchgear or other costly plant which does not involve much staff work, the total price works out to a reasonable figure.

An expression of opinion in the correspondence columns by readers who are interested in the subject will undoubtedly prove of very considerable interest to all concerned, and particularly to the writer of this article.

SUSSEX CONTRACTORS.

Speeches at Annual Branch Dinner of Electrical Contractors' Association.

MOST of the members of the Sussex Branch of the Electrical Contractors' Association, and guests representative of supply and manufacturing interests, were present at the annual dinner of the Branch, held on May 8th, at the Old Ship Hotel, Brighton. Mr. H. L. Holford, the chairman, presided. For the first time in its history the Branch invited ladies to the dinner.

The toast of "The Corporations of Brighton and Hove" was proposed by Mr. HOLFORD, who outlined the great possibilities for electrical expansion in these south coast towns. Ald. H. J. GALLIERS (the Mayor of Brighton) in reply, gave details of the progress of Brighton's electricity undertaking, and mentioned that expansion was so rapid that further large capital expenditure would probably be called for within the next year or so. He pointed out that under the national electricity scheme they could not hope to make a profit on the generating side; this would come from distribution. He thought it was only right that a municipal undertaking should make some profit, though he did not countenance the making of big profits and their allocation to rate relief purposes. The MAYOR OF HOVE, who also replied, testified to the progress of the Hove undertaking, as an instance of which he mentioned that the number of electricity consumers had increased by 25 per cent. during the past year.

Co-operation at Eastbourne.

Proposing "The Electrical Contractors' Association and Allied Associations," Councillor R. S. CHATFIELD made appreciative reference to the co-operation existing between the Eastbourne electricity undertaking and the local contractors. The Corporation had built new electricity showrooms in keeping with the importance of the town, and had a special arrangement with E.C.A. contractors, at whose request a small sub-committee of the Electricity Committee was about to be formed to discuss certain outstanding matters with regard to the supply of goods.

Mr. W. H. WALTON (the President), who replied, commented on the amicable relations existing between all the Sussex branches and the municipal electrical engineers, and went on to speak of the work of the Association along two special lines—improving the quality of installation work and apprentice training—which would not only benefit the contractors themselves, but also the electrical industry as a whole. The Association had in preparation a booklet making a direct appeal to every architect in the land to use better workmanship and materials for electrical installations. This publication would tell the truth about good wiring and emphasise the dangers of shoddy wiring. It would raise the status of reputable contractors throughout the country, and would attract wide attention. The Association was making marked progress too in other directions, notably in the arrangement of special syllabuses for the education of apprentices. The Association was represented on the new committee appointed by the Electricity Commissioners to deal with assisted and hire-purchase wiring, and a further very formidable piece of work was involved in the preparation of a register which would eventually contain the names of all the recognised wholesalers, retailers and large users. The provision of the national grid meant that loads must be built up, and this in turn meant more installation work for many years to come.

"The Sussex Electricity Supply Engineers" was proposed by Mr. L. C. PENWILL, who drew attention to the fact that no fewer than eight supply engineers—Messrs, J. Christie, C. B. Smith, R. N. Torpy, G. Porter, J. K. Brydges, C. A. Frost, M. Whittle, and Major Grace—were present at the dinner.

Value of Registration.

Mr. J. CHRISTIE, who replied, said it should be obvious that supply engineers and contractors had a common interest. The success of a supply authority depended on the number of installations connected to its mains. If the Sussex contractors' prices were right, they should be very prosperous, for in Brighton alone nearly 3 000 new consumers were connected up annually. Every industrial establishment of any account in Brighton already used electric power. In the future they must look more and more to domestic heating and cooking for development. Consumption in Brighton was increasing rapidly, and if the present rate of progress were maintained, the undertaking would double its output every four or five years. Only about 25 per cent. of the energy generated at Brighton was sold for lighting, and the average price obtained for all purposes was less than 1¾d. per kWh. Arrangements were being made to hold a large exhibition at the Corn Exchange early in October, and if electrical people supported it properly, it would prove to be one of the best exhibitions ever held in the provinces. As a station engineer, he would like to see far more contractors enrolled on the National Register, as this would help supply authorities in declining to connect installations done by incompetent men. The time had come when a determined effort should be made to rope in all the competent contractors outside the Register, and all, be they "big" or "little" men, should have a chance. It was well known that the I.E.E. Wiring Regulations were not compulsory rules, but only recommendations. In Brighton, however, steps were being taken to provide, in a Bill that was being promoted, for embodying the I.E.E. Regulations in the Corporation's bye-laws. When this measure was passed, he would see that it was rigidly enforced.

The toast of "The Ladies and Visitors" was the subject of an amusing piece of oratory by Mr. A. C. WATTS, and a brief reply was made by ALD. BARNETT MARKS. In the absence of Mr. Walter Riggs, "Our Chairman" was wittily proposed by Mr. R. WILSON SMITH, and briefly acknowledged by Mr. H. L. HOLFORD.

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THE I.E.E. ANNUAL MEETING.

Premium Awards—The Council and "Light's Golden Jubilee"—New Bye-Laws and Re-admission of Ex-enemy Members.

THE annual general meeting of the Institution of Electrical Engineers was held on April 9th, Lieut.-Col. K. Edgcumbe (president) in the chair. The award of premiums was an nounced as follows :—

The Institution Premium to Messrs. Johnstone Wright and C. W. Marshall ; Ayrton Premium to Mr. L. G. H. Sarsfield ; Fahie Premium to Messrs. A. E. Foster, P. G. I.edger and A. Rosen ; John Hopkinson Premium to Sir C. A. Parsons, F.R.S., and Mr. J. Rosen ; Kelvin Premium to Messrs. E. B. Wedmore, W. B. Whitney and C. E. R. Bruce ; Paris Premium to Mr. J. L. Carr ; Extra Premiums to Capt. J. G. Hines, Mr. B. L. Goodlet, Mr. L. H. L. Badham and Mr. W. Phoenix ; Wireless Premiums to Mr. T. L. Eckersley, Capt. P. P. Eckersley and Mr. A. B. Howe, Messrs. R. M. Wilmotte and J. S. McPetrie.

The PRESIDENT presented the Council's Report, and commented on one or two features. He expressed satisfaction at the increase of membership by 518, and drew attention to the committee which was to consider how the Institution can be of greater value to overseas members.

The adoption of the Report was seconded by Mr. P. ROSLING.

The Summer Meeting Date.

Mr. L. W. PHILLIPS discussed a number of matters in the Report, and first congratulated the Council upon furnishing technical libraries for the local sections. With reference to the appointment of a lecturer to give special students' lectures during the year, he suggested that a feature of such lectures should be the lives of pioneers of the electrical industry. He also suggested that the Summer Meeting might be held at some other period of the year than June, as this was not always a convenient time for many members to attend.

Speaking of the Jubilee of the incandescent lamp, he suggested that insufficient publicity had been given to this by the Council, and that the occasion warranted something more than a half-hour lecture, as was the case this session.

With regard to the Electrical Appointments Bureau, he drew attention to the fact that there were only 36 names on the list of applicants on March 29th, as against 65 last year, and inquired whether this was due to the better state of the industry or to the fact that the Appointments Bureau was not very productive in finding jobs. Referring to the disappointment expressed in the Report that only 900 members were sufficiently interested in "Science Abstracts" to purchase copies, he pointed out that members of other societies were supplied with "Science Abstracts" at lower rates than those charged to members of the Institution, and suggested that this might be the reason for the small number of copies purchased.

The PRESIDENT, referring to the matter of the Appointments Bureau, said that more appointments had been found last year than in previous years, and that accounted for the smaller number of names on the books. The other points would be considered by the Council, but as regards publicity, the Institution was not an organisation for such work, and left that matter to the E.D.A. and similar bodies.

Major THEODORE RICH, speaking with regard to the Jubilee of the incandescent lamp, said that in a few months' time, in America, they were going to have a big celebration in connection with this, but in the announcements with regard to it the name of Swan was not mentioned. He suggested that the Institution should gently hint that Swan had something to do with the invention of the incandescent electric lamp, because it was quite evident that the celebration in America would give all the credit to Edison.

The PRESIDENT replied that the Council had been considering this point only that afternoon. The Americans were proposing to hold what they called "Light's Golden Jubilee," which in America would be largely connected with the name of Edison, and the Council was proposing to take some action. In any case, he doubted whether the publicity of the Institution would reach the level of the American publicity.

The Annual Report was then adopted.

Lieut.-Col. CORTEZ LEIGH (hon. treasurer) presented the accounts, which showed a credit balance of £6 040. In doing so he mentioned the fact that this would be his last year as hon. treasurer, and expressed satisfaction that during his three years of office the assets of the Institution had increased by £22 431. The Council, he added, was considering a proposal to establish a scholarship available at universities, and also other means for making satisfactory use of the funds available. Finally, Lieut.-Col. Cortez Leigh paid a tribute to the great assistance which he has been given by the staff.

Mr. W. C. P. TAPPER congratulated the Council on having at last got rid of the Tothill Street property. He noticed that a profit of £5 000 had been made, but it would be interesting to know the percentage return on the investment since the property was first acquired. Finally, Mr. Tapper made the suggestion that instead of accumulating assets, it would be wise to spend the money in some useful manner.

The HON. TREASURER stated that during the first few years of the investment on the Tothill Street property the return was 3%, but in more recent years it had been 4½%.

Mr. LL. B. ATKINSON reminded the meeting that this did not include the £5 000 profit.

The PRESIDENT, referring to Mr. Tapper's last point, said the difficulty in recent years had been to make both ends meet, and therefore, perhaps, the Council had been a little ultra conservative. Now that the position had improved, steps were being taken to make the best use of the money available, and one matter had already been mentioned, namely, a scholarship. It might be said by some that the best thing to do would be to reduce the subscriptions, but a little arithmetic would soon show that this could only be a very small reduction, and would not justify the loss in funds involved. He felt that the money could be more usefully employed in other directions, and that was being carefully considered.

The accounts were then adopted. Votes of thanks were unanimously accorded to the hon. local secretaries and hon. secretaries abroad, and also to the retiring hon. treasurer.

The PRESIDENT added to the hon. treasurer's remarks on the excellent manner in which the staff carried out its work under Mr. Rowell, and the meeting concluded.

A Special General Meeting was then held to consider modifications of the Bye-Laws.

The "Companion" Class.

The PRESIDENT, in explaining the scheme, which was given in detail in a circular which had been issued to the members, said the matter had been very thoroughly considered by a committee of the Council, which had consulted with the Local Sections. He drew attention to the formation of a new class known as "Companions," and outlined the other alterations to be made as regards Graduates and Students in order to remove the difficulties that had been recognised for some time. As regards the formation of the class of "Companions," he said there had been more discussion over that word than over any other matter, but even those who objected to it had eventually to acknowledge that they could not provide a better one. There was a precedent for it, because the Institution of Mechanical Engineers had a Companion class, and the intention was that in that class should come men who were not necessarily electrical engineers, but who were eminent in some other branch of engineering, and in this way the Institution would keep in touch with those other branches. The President also drew attention to the fact that, under the Bye-Laws as proposed to be modified, ex-enemy members would no longer be under the disability that they could not re-join until a special meeting had been called by the Council.

The proposed alterations were put to the meeting, and were seconded and discussed.

Mr. PHILLIPS drew attention to the alteration of Bye-Law 23 relating to enemy members and, as he had done on the occasion of several previous annual general meetings of the Institution, expressed dissatisfaction at the manner in which the Council had dealt with this matter. He reminded the meeting that it was eleven years since the war ended, and yet no action had been taken by the Council to deal with the position of ex-enemy members. The history of electrical science, and indeed other sciences, clearly indicated their international character, and therefore they should not perpetuate hostile feelings among nations. Notwithstanding the alteration in the Bye-Laws now proposed, he felt that it left the position in a very unsatisfactory state and he moved the deletion of the final words in the proposed Bye-Law, namely, "and for such further period thereafter as the Council may determine."

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In other words, he wished that ex-enemy members should automatically become members again at the close of hostilities.

Sir THOMAS PURVES as Chairman of the Committee which has dealt with this matter, whilst expressing sympathy with Mr. Phillips's views, said he did not think the amendment would be of any value because a member who had ceased to be a member through a state of war would have to apply for readmission in any case.

Mr. PHILLIPS said what he desired was that such a member should be able to apply for membership immediately on cessation of hostilities and that the Council should not have the power to prevent him doing so.

Mr. F. GILL suggested that such a member would be in a better position under the new Bye-Law, because if he were to apply immediately after cessation of hostilities, there might be such feeling still existing that he would be rejected, whereas if it were left to the discretion of the Council, they, feeling the pulse of the Institution, would be able to judge the best time for inviting ex-enemy members to rejoin.

Mr. Phillips's amendment was then put to the meeting, and lost by a large majority, only three voting for it.

Service Candidates.

Mr. A. C. SPARKS referred to the difficulty of officers in the Army, Navy and Air Force obtaining admission to the Institution through not being able to obtain the necessary support from people who must, under the Bye-Laws, personally know their qualifications. The difficulty he said arose through so many of these officers being stationed abroad, and therefore being unable to obtain the necessary signatures. Mr. Sparks also referred to the period of office of members of Council, and suggested that it should not be possible for a member to serve for so long as eight years out of ten and it would be more to the advantage of the Institution to reduce the period in order to spread service on the Council over a wider field. A maximum of five years, he suggested, was ample.

Sir THOMAS PURVES speaking with regard to the difficulties of service members getting the necessary signatures, said that that condition had been modified in such cases, and he hoped publicity would be given to the fact that qualified people placed in such difficulty could obtain membership on the recommendation of persons who had interviewed them and formed a judgment.

The PRESIDENT referring to Mr. Sparks's comments as to length of membership of Council, suggested that there were certain difficulties in the way of making an alteration which would reduce the period to five years. He indicated, on the advice of the solicitor, that it was not a matter which could be gone into in detail at this meeting but he promised that the Council would carefully consider what Mr. Sparks had said.

Mr. E. H. O'SHAUGHNESSY suggested that the difficulty could be handled by the members themselves, because when they saw a man was nominated for a second term of office, they could make other nominations.

The resolutions regarding the alterations in the Bye-Laws were then unanimously adopted.

CORRESPONDENCE.

The Editor welcomes the free expression in these columns of genuine opinion on matters of public interest, although he disclaims responsibility alike for the opinions themselves and the manner of their expression.

[TO THE EDITOR.]

The Incandescent Lamp Jubilee.

SIR,—I am obliged for the space which you gave me in your columns for May 10th, on this subject, but I find since I wrote you, through the courtesy of Mr. Lane Fox Pitt himself, who has lent me a copy of his patent No. 3988 of October 9th, 1878, that he was not only the first patentee of electric distribution at constant potential, with everything in parallel, but that he was also, in the same specification, the first to patent what is now known as the gasfilled metal-filament lamp, his patent being prior to any lamp patent of Swan, and before even Edison's British patent for a platinum-wire lamp, which is dated the 23rd of the same month and year.

No doubt modern lamps of this character use filaments of tungsten, and are filled with Argon gas, while Lane Fox Pitt used a platinum-iridium alloy for his filament, and nitrogen for his gas. In his time, however, neither tungsten in the form of wire, nor Argon in any form, were known, and in his patent specification Mr. Lane Fox Pitt was careful to say specifically: "In order to prevent the deterioration of the material when incandescent, I sometimes surround it with an atmosphere of nitrogen gas," just as in modern lamps Argon is introduced to prevent the deterioration (probably evaporation) of the tungsten.

No doubt tungsten is a better substance than platinum-iridium to use as a filament, as being able to stand higher temperatures, while no doubt Argon, as a more suitable gas, is better than nitrogen; but in both cases the principle involved is exactly the same, namely, to use a filament with the highest possible melting point, and to prevent evaporation of this hot filament by counter bombardment by a neutral gas.—I am, etc.,

A. A. CAMPBELL SWINTON.

40, Chester Square,
London, S.W.1.
May 13th.

[TO THE EDITOR.]

SIR,—The suggestion that Edison was the inventor of the first incandescent electric lamp is definitely refuted in the "General Electric Review" for May, by Mr. C. L. Clarke, who was intimately connected with Edison's work in the early days. This writer, in an article on "Edison's First Commercial Lamp," says:—

"Edison knew on October 21, 1879, after months of intensive effort, that in all its fundamentally essential details he had at last invented an electric lamp to take the place of the ordinary gas lighting burner. . . ."

". . . Edison's horseshoe lamp, with its carbonised bristol-board filament, was the original sprout from the seed sown by his discovery and invention of October 21, 1879, which demonstrated that the seed had commercial life, and started its growth and spread throughout the world."

This insistence on a date in 1879 is of particular interest in view of the facts recorded in the memoir, "Sir Joseph Wilson Swan, F.R.S.," reviewed in your columns last week. Here it is recorded that:—

"At a meeting of the Newcastle-upon-Tyne Chemical Society held on December 18th, 1878, Swan was able to show an incandescent carbon lamp, which consisted wholly of a glass bulb, pierced with two platinum wires supporting between them a straight thin carbon conductor $\frac{1}{15}$th inch in diameter. . . . On January 17th, 1879, the lecture was repeated and a similar lamp exhibited at Sunderland."

"The news that Swan had solved the problem of incandescent electric lighting by means of a vacuum lamp quickly spread through Newcastle, and he was invited to give a public lecture describing his invention. Accordingly, on February 3rd, 1879, he delivered a lecture on electric lighting to an audience of over 700 people. . . . At the lecture he exhibited in operation a lamp similar to that shown in December, 1878. The same lamp was exhibited again in operation at a lecture which he gave at the Town Hall in Gateshead on March 12th, 1879, before an audience of about 500."

Comparison of the two sets of quotations clearly shows that Swan's lamp was publicly exhibited ten months before the date put forward by the Americans as the birthday of the incandescent lamp. It is thus a ludicrous essay in relativity for the N.E.L.A. to organise a "Golden Jubilee of Light." They have obviously chosen the wrong year and the wrong inventor.—I am, etc.,

"QUID PLURA."

Liverpool.
May 13th.

[TO THE EDITOR.]

SIR,—The quotations you give from the N.E.L.A. "Bulletin" of the preparations that are being made in America for the celebration of the "Golden Jubilee of Light" stand as an interesting object lesson, not only of the power of auto-suggestion, but also of the very thorough way in which the Americans celebrate an occasion which they consider worth while. A nation-wide programme covering nearly five months(!), with an international broadcast to wind up, is arranged by the Americans. Over here a short lecture in the privacy and subdued illumination of the lecture theatre of the Institution of Electrical Engineers was the sole outward mark of British remembrance of the work of a great British inventor. One can hardly wonder that the news of our blatant publicity has not yet reached the eyes and ears of the N.E.L.A.—I am, etc.,

L. C. SMITHERS.

Lincoln.
May 11th.

[TO THE EDITOR.]

SIR,—My dictionary supplies a possible reason for the proposed American celebration of the "Jubilee of Light." In the sense used in Jewish history the word "jubilee" signifies "every fiftieth year . . . at which time all the slaves of Hebrew blood were liberated, and all lands which had been alienated during the period reverted to their former owners."

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Perhaps the alienated credit for the invention of the incandescent lamp may revert in a similar way to its former owner.
—I am, etc., G. L. K.

London, S.W.12.
May 14th.

Some Fallacies of Load Factor.

[To the Editor.]

Sir,—So far as Mr. Edward V. Clark is interested in the motives and practice of municipalities and companies, I should like to point out that very small profits and very large sales have made Mr. Henry Ford the richest man in the world; also that Mr. Ford's aim has always been service. Nevertheless, I agree with Mr. Clark that the 100% L.F. ideal is not the best way to set about the business. My reason for saying this is that the load factor system of analysis is not sound.

I disagree with Mr. Clark when he brushes aside the rateable value tariff as unsuitable for universal use, but I presume he does not realise it is a quantity tariff with the rateable value expedient applied in the case of small consumers.

The following sketch of the two forms of analysis may make the matter clear:—

Load Factor.	Quantity.
Fixed Charge. — Management, Rates, Distribution, some Wages and Repairs, some Coal, and all Capital charges, divided by kW demanded equals a charge per kW demanded.	Management, Distribution divided by number of consumers equals charge per consumer. Add capital charges on Mains for any selected size group, with capital proportion of rates divided by number of consumers in the group equals total charge per consumer.
Running Charge. — Remainder of Coal, Wages, and repairs, divided by number of units sold, equals charge per unit.	Coal, Wages and Repairs divided by units sold equals charge per unit. Add Capital charges for Generating Plant with proportion of Rates for the same sized group, with fixed average load factor for the group, expressed as a charge per unit, equals total charge per unit.
Comparative Charges for Small Consumer.—Say £4, plus 0·5d. per unit.	Say £3 10s., plus 1·125d. per unit.

A load factor system would probably be divided up into two or three sections according to size, or for purposes such as power, and a quantity system into any number or sized sections, possibly six. Each section in size has an increasing charge per consumer, and a decreasing charge per unit, so the tariff is continuous. There is a point between each section where the resultant charge is the same on either scale.

From this sketch the possible application to the national system will be apparent, though the actual figures might prove to be impracticable.

It will be admitted that the main cost of the "grid," such as poles, insulators, switchgear and housing, also administrative expenses and maintenance, are not in any way related to the demand. On the other hand, generating plant should be cheaper, partly on account of large scale, and partly on account of less spare plant. Also the Board's consumers will not vary so much in load factor, probably between 20 and 35%.

When all adjustments have been made in the sale of energy to selected stations, which may be about 74%, the balance might be divided up in proportion to size, for fixed charges, plus a uniform rate for unit charge. Or, failing this, a distribution on the rateable value basis might be more acceptable than a load factor system. A good deal might depend on the growth of this system amongst authorised distributors.

In such a case Mr. Clark would be consistent in his plea that load should be left to look after itself, a recommendation with which I cordially agree.—I am, etc.,

J. Rutherford Blaikie.

Bedford,
May 12th.

The Wireman's View-point.

[To the Editor.]

Sir,—As a wireman who tries to take an intelligent interest in the machine of which he forms but a cog, may I offer some views on the electrical contracting trade from this point of view.

From the public point of view it is reasonable to assume that little skill is required in the electrical contracting industry, in that every plumber, hot water fitter, jobbing builder and decorator, claims to be an "electrical engineer," while on the other hand what genuine electrical contractor is there who claims to be plumber, fitter, decorator, or builder? With such conditions prevailing, the public give their contracts to the lowest tender, believing the work of such tenderer to be up to standard. While there are such people as plumber, gasfitter, builder, decorator, etc., competing in the contracting industry, there will always be shoddy wiring, in the same way that there will always be good electrical wiremen unemployed, and wishing they were plumbers or gasfitters.

Some people in the industry claim that compulsory registration would alter the position, but here again, with competition as it is, as much as they dislike it, contractors are compelled to accept work at cut prices in order to keep their businesses going, with the result that unless a wireman works "fast and furious," taking little heed of shoddy wiring, but keeping his eye on the clock, so that as little time as possible need be spent on the job, his employer will lose money, while he (the wireman) will lose not money, but his job, for being too slow. There are exceptions, of course, but such is the general position as the writer has found it.

Another thorn in the electrical contracting industry is the employment of boy labour, that is, one man in charge of a number of boys attempting to do an experienced man's work. As regards indentured apprentices, it ought in many cases to be made a criminal offence to delude a lad into thinking that he will one day be able to obtain satisfactory employment, as the tuition given is sometimes of the scantiest. At most his only guarantee is regular employment during the period of his apprenticeship.

The writer is in no way a Jeremiah, but the conditions as met with by a workman in the industry are often of better barometric value with a view to prophesying the future storms, than many of the round-the-table conferences of partners and directors. Until the "kerbstone" contractor is eliminated, and prices for installation work are sufficient to pay for good materials and men, the industry as a whole will be in disrepute, and shoddy wiring will prevail.—I am, etc.,

"Wireman."

London.
May 3rd.

Advertising Abuses.

[To the Editor.]

Sir,—May I, as an advertising man in the electrical industry, add to the congratulations which Mr. Charles Pinkham has doubtless already received for his courage in exposing a scandal which constitutes a growing strain on the resources of electrical manufacturing firms. The extremely careful and tactful way in which most of these propositions are put forward makes it impossible for any one advertising manager to take up a firm stand with any likelihood of success. There are always so many who will privately admit the existence and baneful effects of the abuse, but do not feel justified in coming forward publicly in a matter which may involve their firm in loss of business.

It seems to me that while Mr. Pinkham and others connected with the big firms may boldly resist the advances of the advertising blackmailer, the smaller firms cannot afford to take the big risk. In the circumstances, could not a body like the Incorporated Society of British Advertisers take some collective action to put an end to this invidious form of coercion?—I am, etc.,

"Advertising Manager."

Brighton.
May 14th.

[Several letters are unavoidably held over.—Ed.]

BOOKS RECEIVED.

Self and Society Booklets, Nos. 13–18. (London: Ernest Benn, Ltd.) 6d. each, net; No. 13, "Parliament and the Consumer." By A. V. Alexander. Pp. 32; No. 14, "The Making of an Educationist." By A. Mansbridge. Pp. 35; No. 16, "Everyman's Statistics." By J. W. F. Rowe. Pp. 39; "Twenty Faces the World." By P. Redfern. Pp. 32; "The Wilderness of American Prosperity." By L. E. Bowman. Pp. 36; No. 18, "The Nation and Its Food." By Rt. Hon. C. Addison. Pp. 32.

"Elementary Applications of Statistical Method." By H. Banister. (London: Blackie and Son.) Pp. 56. 3s. 6d. net.

"Can We Trade With Russia?" By E. Luboff. (London: Anglo-Russian Press.) Pp. 48. 1s. net.

"Electric Wiring." By W. S. Ibbetson. (London: E. and F. N. Spon.) Pp. viii+424. 7s. 6d. net.

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ELECTRIC FANS FOR 1929.

Details of Some of the New and Improved Designs for A.C. and D.C. Supply—Special Selling Facilities Offered by Manufacturers.

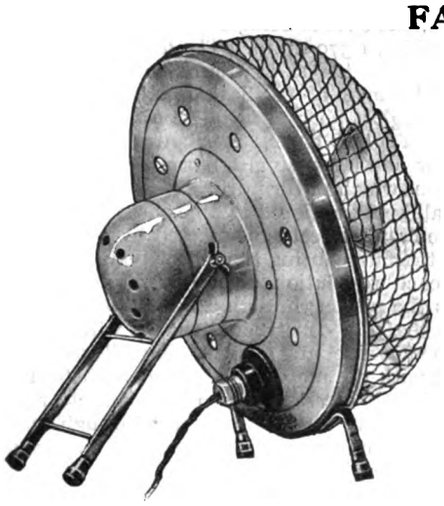
THE gradually improving weather suggests that electrical contractors will soon be receiving inquiries for electric fans, and in order to assist in the stocking of different types, we give this week a number of suggestions received from manufacturers. With such a machine as a fan the development of new models each year is unnecessary, though as will be appreciated from the following descriptions many improvements have been introduced since last year.

Some of this year's models are new, however, and among these may be mentioned the type No. S.14 026 of SIEMENS ELECTRIC LAMPS AND SUPPLIES, LTD., of 38–39, Upper Thames Street, London, E.C.4. The oscillating device incorporated is a departure from the earlier pattern and the mechanism has been reduced to a few simple parts enclosed in a grease-tight gear box. There is only one range of oscillation, the makers having found in practice that it is seldom one requires to vary the arc of oscillation. Improvements have been made in the design of the fan motors, while the base is of wide diameter to prevent overturning the fan accidentally. In d.c. models, the commutators have what the makers claim to be an unusually large number of segments and the new type of brush-holders with metallic caps will be appreciated. The speed regulator is made of non-combustible and non-hygroscopic materials. Lower current consumption has also been considered without sacrifice in breeze volume.

The "Cosmos" fans offered by METRO-VICK SUPPLIES, Trafford Park, Manchester, for the 1929 season include several 12 in. and 16 in. oscillating desk and bracket fans designed to give an oscillating movement of 90 deg., while the mechanism consists of a few simple parts enclosed in an aluminium casing. The power absorbed is low, and the fans pass through the angle of oscillation approximately twelve times per minute. The "Cosmos" 54 in. ceiling type fan for d.c. supply is fitted with a motor of the two-pole series-wound enclosed ventilated type. The a.c. fan is of single-phase, enclosed ventilation, induction type, and the makers claim that the careful design and conservative rating ensure coolness in operation. The fan consists of three blades, and has a current consumption at 220 V of 0·455 A. Type O.1 fan regulators for d.c. ceiling fans and type F.1 for a.c. ceiling fans are also new "Cosmos" developments. Designed for wall mounting, eight stops are provided to give, full on, six speed reduction stops and off. The standard finish of these regulators is white enamel with bronze lines to match the fans. The type F.1 regulator can be supplied with a static condenser fastened to the casing, and permanently connected in circuit, so as to render unnecessary the connecting up of any extra apparatus when this type of regulator is used. The condenser is automatically discharged when the switch is brought to the "off" position. The makers state that the combination results in an improved power factor and decreased power charges per fan motor, as compared with fans installed without the condenser type of regulators. Figures furnished by

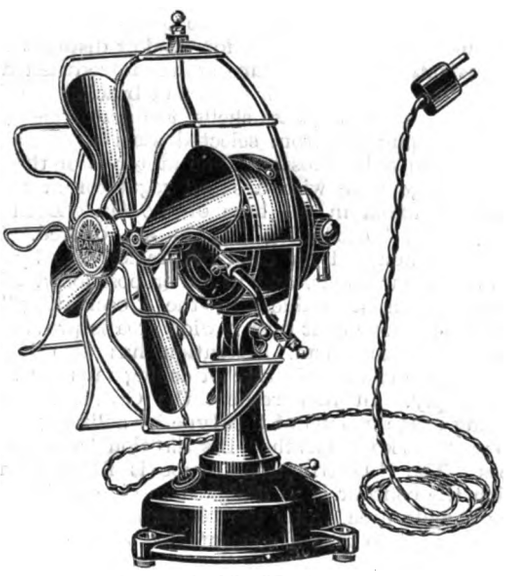
(*Continued on next page.*)

FAN SUGGESTIONS FOR 1929.

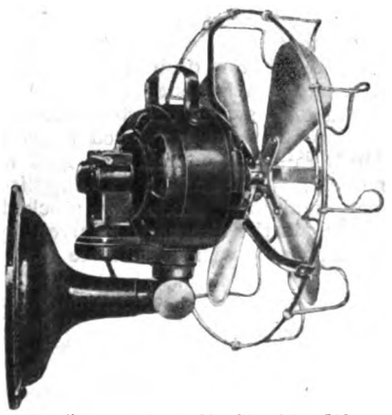


The "Elite" model by the Revo Electric Co., Ltd.

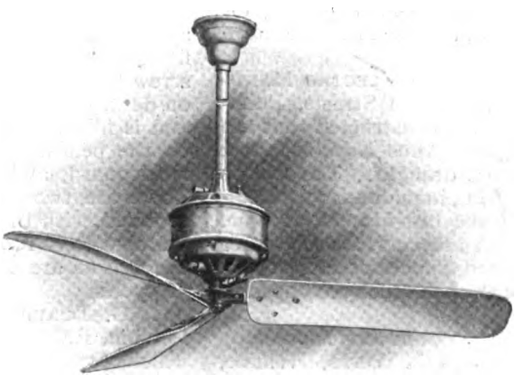
A 12 in. "Cosmos" oscillating fan.



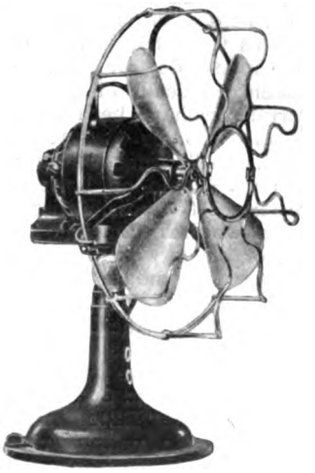
An example of the "Bandy" fan by Berkeley and Young, Ltd.



The "Verno" fan by Marelli and Co., Ltd., in use as a bracket type.



A 54 in. d.c. ceiling fan by Metro-Vick Supplies.



The "Verno" fan as a desk type.

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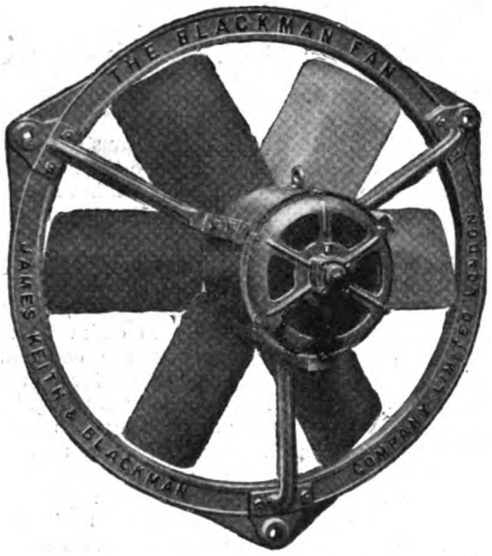
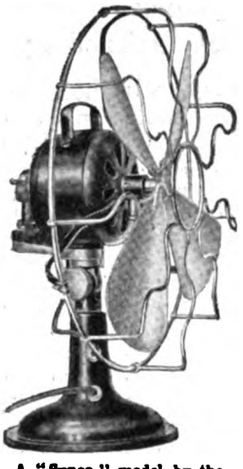
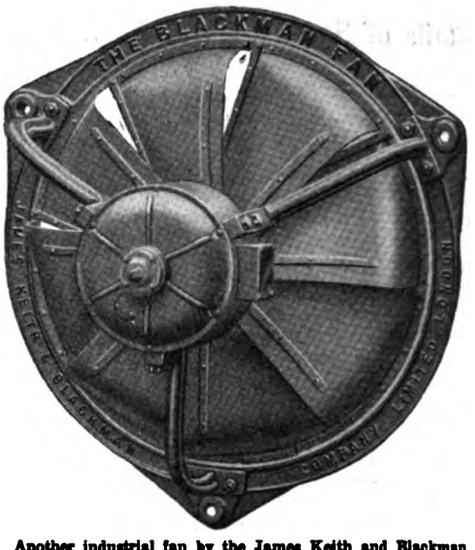


An a.c. single-phase "Streamline" fan, by the James Keith and Blackman Co., Ltd.



A "Sunco" model, by the Sun Electrical Co., Ltd.



Another industrial fan by the James Keith and Blackman Co., Ltd.

Metro-Vick Supplies show that with an 8μF condenser the power factors of 200/230 V and 220/250 V fans are improved up to 0·95 and unity respectively.

The General Electric Co., Ltd., of Magnet House, Kingsway, London, W.C., is again conducting a special fan campaign in the form of proportioned advertising in commercial, industrial and technical journals and in high-class magazines. To supplement these advertisements sales-helps have been devised for trade use of dealers, while showcards and cut-outs are available for window displays and counter demonstrations. The company has introduced a new range of induction type fans for desk and bracket mounting, fitted with a motor having cast shells, the stator being built up of stampings punched from selected steel sheets, and carefully insulated to reduce losses. The motor is of the shaded pole squirrel cage type with a speed regulator in the form of a choker, situated in the base of the fan. Both "non-oscillating" and "oscillating" types are offered. The former pattern is adapted for desk or bracket use by means of a trunnion attachment, and in either position a wide range of adjustment is available. In the "oscillating" pattern a continuous movement over a wide area is provided by means of special mechanism. Attention has also been given to the design and manufacture of ceiling fans for both a.c. and d.c. supply. In this respect the G.E.C. has modified its existing range of fans of this type by splitting each type into two patterns known as the "Distribution" and the "Velocity" types. The "Distribution" type is fitted with blades on which the contour is so designed to give a distributed breeze over a wide area, while the blades of the "Velocity" type are arranged to give a concentrated breeze over a relatively restricted area.

L. G. Hawkins and Co., Ltd., 30–35, Drury Lane, London, W.C., are specialising this year on the "Supreme" 8 in. model for a.c. or d.c. supply, finished in nickel plate. The makers advise us that they have had one of these fans running for twelve hours a day for three weeks, and the rise in temperature has been practically nil.

Particulars have been received from the Electro Manufacturing Co. of America, 32nd and Arch Streets, Philadelphia, of a "Circulair" fan which is so constructed that the blades revolve in an horizontal plane, thus avoiding to a large extent the possibilities of direct draught. The unit is made in two sizes, namely, 9 in. and 6 in., in mahogany, walnut, ivory, or black, with the choice of the top fitment or cone. The latter may be in the form of an ash tray, flower holder or humidifier. The motor is designed for either a.c. or d.c. at 110 or 220 V. The illustration of the fan which accompanies this article shows the desk model.

Another departure from the usual design in fans is made by the Revo Electric Co., Ltd., of Britannia Works, Tividale, Tipton, in the "Elite" model. This fan, made for both a.c. and d.c. in voltage ranges from 100–250, has 10 in. blades, and is made in three types for both forms of supply. The motor is of the enclosed type, fitted with supporting legs of the adjustable type to allow of variation of the angle of the blades. The latter are enclosed in a brass wire guard. Other fans by the same firm include desk fans of the oscillating and non-oscillating types, cabin and ceiling fans, port hole and exhaust fans.

The latest additions to the range offered by Marelli and Co., Ltd., of 19–20, Garlick Hill, London, E.C.4, include an oscillating type of fan, having 12 in. or 16 in. blades. The base is hinged, thus permitting the model to be used as a wall fitting or desk type. This machine is available in both sizes for a.c. or d.c., the speeds being for the a.c. 12 in., 1 360 r.p.m. and for the 16 in., 1 370 r.p.m. The d.c. machines have speeds of 1 500 r.p.m. for the 12 in., and 1 420 r.p.m. for the 16 in. The normal range of oscillation is about 85 deg., the fan moving through a horizontal plane approximately 16 times per minute. The oscillating mechanism consists of a worm on the motor shaft meshing a worm wheel on which axis is fitted a pinion, which in turn drives a gear wheel acting as a crank wheel, all being enclosed in a gear case at the back of the motor. The crank wheel is connected by a link to the stationary base of the fan, causing the motor body and blades to oscillate with each revolution of the crank wheel. The worm wheel drives the pinion through a ball clutch placed on the vertical pinion shaft, so constructed that it will slip automatically should the fan meet any obstruction while oscillating, without interfering with the motor. This in conjunction with another simple device enables the fan to immediately reverse and automatically resume its oscillatory motion through another angle. The oscillatory motion may be stopped or resumed by the turning of a lever which engages or disengages the pinion.

The Bergmann Electric Co., Ltd., 82, Victoria Street, London, S.W.1, informs us that the range of fans offered last year will be available again this season. The range includes industrial and domestic types, the latest model being an induction type oscillating model.

Berkeley and Young, Ltd., Hays Mills, Birmingham, are again featuring their "Bandy" range of fans. These are fitted with universal movement, and by means of a thumb screw the fan may be set to run in any desired position either on desk, table, wall, or bracket. Each model is of single speed and is fitted with "on and off" switch conveniently placed on the pedestal. Blades are of stout lacquered brass with rigid guard, and the finish in black enamel and gold lines. There are two sizes, namely, 10 in. and 12 in., supplied, if required, with three speed regulators. Models are stocked for voltages from 100–250 V, and, in the alternating current type, the motors are of the commutator variety suitable for 25 to 50 cycles.

S. G. Leach and Co., Ltd., of 26/30, Artillery Lane, London, E.C., are again featuring the "Universal" desk fan which, fitted with 12 in. diameter blades, is provided with a quick break switch, having three speed positions. The fan is made in both the oscillating and non-oscillating types, and can be obtained for any voltage from 100/250, d.c. or a.c., a universal motor being used.

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THE A.E.G. ELECTRIC CO., LTD., 131, Victoria Street, London, S.W.1, are again offering the attractive table lamp and fan combination, called the "Ventilux." The company also supplies desk, trunnion, oscillating, ventilating, and ceiling fans, the DVO2 of the latter class being an oscillating model. The diameter of the blades is 12 in., approximately, while the total length is about 33 in. The machine is fitted with a special wind guide blade which gives a regulation of the rotary speed. A special feature of the machine is the method of lubrication.

THE GLOBE ENGINEERING CO., LTD., of Brighouse, advise us that they are now manufacturing alternating current fan motors, particularly 12, 15, 18 and 24 inch single-phase and three-phase fan motors of the totally enclosed self-starting type; larger sizes to specification are also manufactured. The same firm are also makers of a.c. and d.c. motors for direct coupling to blowers, and also supply complete plants for organ blowing, including motors of specially silent type when required.

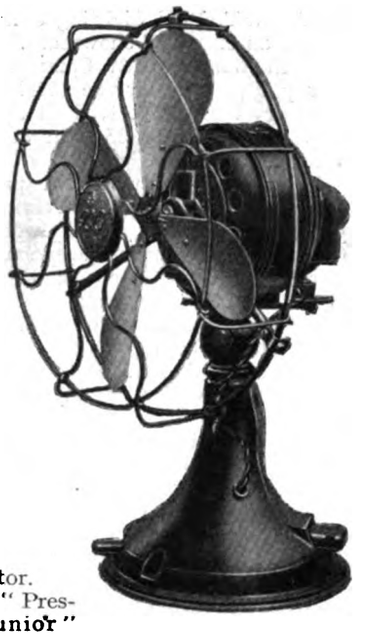
THE STANDARD ELECTRICAL CO., Myrtle Engineering Works, Cross Roads, Keighley, who have been specialising, for nearly 30 years, in the manufacture of box blade propellers, also paddle and multivane steel plate fans, for medium and high pressures, offer their services, in the application of fans for any duty. They are also suppliers to the trade of d.c. and a.c. fan motors.

"Sunco" fans, by the SUN ELECTRICAL CO., LTD., of 118/120, Charing Cross Road, London, W.C.2, cover both domestic and industrial requirements. Their latest domestic type is a swivel and trunnion, desk and bracket oscillating model, fitted with 10 in. diameter blades, with a consumption of 26 W in the case of d.c. and 30 W in the case of a.c. supply. The fan oscillates in a horizontal plane through an angle of 110 deg., the motion being stopped if desired by the setting of a lever. A safety clutch is provided, which operates automatically, and, in the case of obstruction, allows the fan to reverse and resume its oscillatory motion in another direction. Other fans in the "Sunco" range include revolving ceiling types which, made with four blades of either 12 in. or 16 in. sweep, are suitable for a.c. or d.c. supply of 100 to 250 V. The 12 in. d.c. model is fitted with a motor giving 1 350 revs. per min., and has a consumption of 42 W, while the 16 in. d.c. fan revolves at 1 420 revs. per min., and has a consumption of 72 W. An a.c. series-commutator machine fitted with 12 in. blades has a speed of 1 500 revs. per min., with a consumption of 58 W. The 12 in. a.c. induction type of ceiling fan has a consumption of 58 W and a speed of 1 400 revs. per min., whereas the 16 in. model, with a consumption of 115 W, has a speed of 1 375 revs. per min. A wide range of box-blade and three blade, light and heavy duty, propeller, ventilating and exhausting fans is made by the Sun Electrical Co., Ltd., in addition to a number of ventilating ring types. Automatic shutters for box-blade exhaust or ventilating ring type fans are also supplied, the purpose of these being to prevent back draught when the fan is not running.

A desk type "Circulair" fan by the Electro Manufacturing Co.

A special fan window fitting by the General Electric Co., Ltd.

Since the publication of our last fan number, the JAMES KEITH AND BLACKMAN CO., LTD., 27, Farringdon Avenue, London, E.C.4, has placed on the market a range of single-phase condenser type fans. These have been designed for standard supplies of 200 to 250 V at 50 cycles, and the motors have double windings with one circuit directly connected to the mains and the other to the main in series with a condenser which is embodied in the switch supplied with the fan. The motor is self-starting by means of a single-way switch so that should the supply be cut off and later restored, independently of the switch, the motor is not liable to damage. Owing to the leading current in the condenser circuit compensating for the lagging current in the main winding the motors have a high power factor. As both sets of windings are used, a larger output is obtainable from the motor.



A G.E.C. suggestion.

The "Prescot Junior" d.c. ceiling fan by BRITISH INSULATED CABLES, LTD., Prescot, is again expected to be of interest to the public, and though no improvements have been made since last year, it lacks nothing in appearance or efficiency. The motor is of the enclosed type and has a consumption of 80 W at 220 V. The blades are of aluminium, set at an angle of 12 deg., and have a diameter of 48 in. The makers state that the motor is designed to develop at the fan blades a mechanical power equal to about 40% of the electrical power consumed. Its normal speed is 300 r.p.m.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby, is again specialising in 12 in. and 16 in. oscillating and non-oscillating fans, including a number of bracket types. All models are suitable for a.c. or d.c. at pressures from 100 to 120 V and 200 to 240 V. A wide range of ceiling and exhaust fans is offered, exclusive of the ship and train models. Box blade fans are made in sizes ranging from 12 in. to 36 in., and have consumptions from 60 to 240 W, according to type. Propellor fans are offered in sizes from 12 in. to 36 in., with air deliveries up to 14 000 c. ft. Automatic shutters and regulators both for a.c. and d.c. are also offered.

We are given to understand by WM. E. CULKIN AND CO., of School Close Mills, Neville Street, Leeds, that they are in a position to repair and rewind for the trade all types of small electric motors such as are used in fans, electric cleaners, washers, etc.; the conversion of motors from d.c to a.c. supply is also part of the service offered.

Electric motors and fans are also manufactured by VERITYS, LTD., of 31, King Street, London, W.C. These are made for both a.c. and d.c., and have a wide oscillating range. The consumption of the 12 in. model is 30 W, and a special slipping clutch is included, which, the maker's claim, protects the fan from damage due to obstruction, etc.

The series of fans made by the EDISON SWAN ELECTRIC CO., LTD., 123/5, Queen Victoria Street, London, E.C., includes models for desk and wall use, both oscillating and non-oscillating types, for d.c. and a.c. supplies. The diameters range from 12 in. to 16 in. The d.c. 12 in. model has a running speed of 1 200/1 300 r.p.m., while the 16 in. type has a speed of 1 000/1 100 r.p.m. The a.c. 12 in. and 16 in. fans have speeds of 1 400 and 1 350 r.p.m., respectively. Ceiling fans of various types are also made by the Edison Swan Co., the fixed, rotating and oscillating models being designed for both a.c. and d.c. supply, according to requirements.

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NEWS IN BRIEF.

A British Trade Fair in Buenos Aires—Madagascar and Electrical Appliances—The Batti Wallahs' Society—Electrical Imports and the Irish Free State.

BARNSTAPLE Lighting Committee is to prepare a scheme for an electrical showroom.

Rotherham Health Committee is to invite tenders for X-ray apparatus for the Oakwood Hall Sanatorium.

Newry U.D.C. received 51 applications for three electrical engineer apprenticeships in connection with the electricity station.

Telephone subscribers in part of Stockport and Hazel Grove have sent to the Postmaster-General a protest with 500 signatures against the proposal to transfer them from the main Stockport automatic exchange to a new manual exchange at the south end of the borough. It is alleged that the change will result in increased cost of calls.

An electric pump is to be installed at North Berwick swimming pool for supplying sea water.

Funds are being raised for the provision of a new electrically-blown organ at St. Dunstan's Church, Canterbury.

The G.W.R. has decided that the lighting of the passenger and goods stations at Hayes are to be converted from gas to electricity.

Amongst the craft taking part in the Upper Thames Club handicap at Bourne End last week-end, was the "Cyra" owned by Mr. J. S. Highfield.

Members of the North Wales Branch of the Electrical Association for Women made a tour of inspection on May 9th of the Cunard Liner "Samaria" lying in Huskisson Dock, Liverpool.

The annual general meeting of the South Wales Branch of the Association of Mining Electrical Engineers, will be held to-morrow (Saturday), at the Esplanade Hotel, Porthcawl.

A proposal, put forward by the British Chamber of Commerce in the Argentine, for a British Trade Fair to be held in Buenos Aires during November, 1930, and February, 1931, has been endorsed by the Department of Overseas Trade, the Association of British Chambers of Commerce and the Federation of British Industries.

The report of the Reading telephone district for 1928 states that the growth noted in the previous year was maintained, 2 445 exchange lines and 3 986 telephone stations being added. Local and junction calls were 17 511 200 in 1927 and 19 329 523 in 1928, while trunk calls rose from 3 844 888 in 1927 to 4 143 177 in 1928.

The Postmaster-General announces the opening of a public telephone service between this country and Finland. At the outset the communication will be available from any part of this country but only to the south-western portion of Finland. Day charges per 3 minutes range from 21s. to 24s. 9d. and night charges from 12s. 9d. to 14s. 9d.

The Administrative Council of Madagascar has passed a resolution exempting from customs duty on importation into Madagascar of material destined for radio-telegraphic stations imported for the account of the State or the colony; and labour saving machinery and articles for the development of the colony. If within three months of the receipt of the resolution the French Government does not issue a Decree rejecting the proposal contained in the resolution, the latter will be promulgated in the colony and enter into effect.

Coventry Watch Committee is extending the police telephone box system. Boxes are now to be provided throughout the Foleshill division at a cost of £433.

The Federation of British Industries has signed a contract for the erection of a new building on a site in Tothill Street, London, S.W.1. Firms engaged in the work will all be members.

At the luncheon of the Batti Wallahs' Society, to be held at the Hotel Cecil on May 30th, Mr. Henry S. Horne will deliver an address entitled, "A Layman's View of the Electrical Industry."

LOOKING BACKWARD.

FIFTY years ago, according to THE ELECTRICIAN *of May 17th, 1879:—*

Some enterprising publicans were illuminating the exterior of their premises with electric light.

There were in England 320 duplex telegraph circuits at work, covering a total mileage of 40 000.

The noise made by the regulators of electric lamps shown at the Albert Hall Exhibition was at times sufficient to interfere with certain of the musical effects produced at concerts.

Edison secured a British patent for "Improvements in Lighting by Electricity." This was nothing like Swan's carbon filament lamp but "a candle or light-giving body . . . in which particles of metal or metallic oxide are moulded into a mass, adapted to the passage of the electric current, and rendered luminous by the same."

* * *

TWENTY-FIVE years ago THE ELECTRICIAN, *dated May 20th, 1904, reported that:—*

The I.E.E. Summer Meeting was to be held in America.

Mr. G. C. Lloyd became secretary of the Institution of Electrical Engineers.

Woolwich was the only Metropolitan council empowered to supply and let on hire electric wiring installations, fittings, and appliances.

* * *

TEN years ago it was stated in THE ELECTRICIAN *of May 16th, 1919, that:—*

Among metal stocks held by the Ministry of Munitions were 51 130 tons of copper.

The Electricity Supply Bill which provided for the establishment of the Electricity Commission was before the House of Commons.

Sir William Slingo estimated it would cost £5 000 000 and take ten years to instal automatic equipment in London's telephone exchanges.

Douglas (Isle of Man) Corporation is considering an electrical installation at the new pavilion on Douglas Head.

The new 12 kW Marconi transmitter at Bratislava is now broadcasting on 277·8 metres, and may be heard in this country.

The summer meeting of the Western Centre of the I.E.E. will be held on May 24th to 27th, when a visit will be made to Cheltenham.

Imports of electrical goods and apparatus into the Irish Free State during March were valued at £78 963 as against £37 885 for the same month last year.

A joint meeting of the Physical Society and Society of Glass Technology was held on Tuesday, at the Research Laboratories of the General Electric Co., at Wembley.

Burnley Electricity Department reports 428 prepayment meters fixed and 390 consumers on rateable value system. Appliances fixed on hire or hire purchase 73, and new consumers connected 71.

The summer meeting of the South Midland Centre of the I.E.E. will be held on July 2nd, when a visit will be made to Avonmouth docks. Inspection will be made of the e.h.t. and l.t. electrical equipment at the Royal Edward Dock; the motor-driven grain machinery; cold storage equipment; the new intake machinery, and the large squirrel cage motors with direct switching.

A report on the market for electrically driven water pumps in Brazil has been prepared by the Department of Overseas Trade from information forwarded by the Commercial Secretary at Rio de Janeiro. Copies can be obtained from the Department. (Reference A.X. 7 886.)

In a statement made to the Railway Committee of the Canadian House of Commons regarding a proposed increase of the capital of the Bell Telephone Co. of Canada to $150 000 000, Mr. C. F. Wise said it was proposed to spend $126 239 000 during the next five years upon extensions of the company's systems. Extensions in 1929 alone would cost $27 165 000.

It is announced that $82 000 000 (about £16 500 000) will be spent by the American Telephone and Telegraph Co. during the present year on new long distance telephone facilities in the United States. The programme includes the supply of a million loading coils, and about 24 000 telephone repeaters, as well as the stringing of 74 000 miles of new aerial wire, and the construction of three additional short wave transoceanic telephone systems supplementary to the present telephone facilities to Europe.

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OVERSEAS TRADE.

Exports of Electrical Goods for Four Months Exceed Imports by £3 901 419.

EXPORTS of electrical machinery, apparatus and material, shipped from the United Kingdom during April, 1929, amounted to £1 674 234, against £1 429 491 during the same month last year, the increase being £244 743. Imports for the month under review amounted to £543 237, as compared with £454 012 for the same month of 1928, an increase of £89 225. For the four months of the year the total exports of electrical goods amounted to £6 123 591 or £79 717 less than for the corresponding month of last year. Imports for the same period amounted to £2 222 172, an increase of £199 385.

A comparison of exports for April with imports for the same month gives a favourable balance of £1 130 997, and for the four months the balance is £3 901 419.

The improvement in electrical exports for the month was made in shipments of such items as motors, other than for railways and tramways, and generators, the increase being £57 315. Other items which contributed to the increased business were rubber insulated wires and cables, other than telephone and telegraph, increase £11 721; similar wires, other than rubber covered, £43 475.

On the import side, though electrical machinery declined by £2 348, rubber covered wires increased by £15 424, and telegraph and telephone instruments by £45 666.

The following are detailed figures :—

	Month of April		Four Months.	
	1928.	1929.	1928.	1929.
IMPORTS.	£	£	£	£
Electrical Machinery	148 325	145 977	594 569	573 214
Electrical Wires and Cables, Insulated—				
Rubber insulated (not being Telegraph or Telephone Wires or Cables)	11 725	27 149	55 584	74 237
Insulation other than rubber (not being Telegraph or Telephone Wires or Cables)	39 139	38 665	174 171	183 956
Telegraph and Telephone Wires and Cables (not being Submarine Cables)	9 491	6 071	38 942	21 875
Submarine Telegraph and Telephone Cables	—	—	—	—
Telegraph and Telephone Instruments and Apparatus (except wireless valves)	44 633	90 299	195 215	407 745
Carbons, Electric	13 867	27 169	48 239	66 518
Electric Lamps and parts thereof—				
Electric Glow Lamps	23 752	23 376	192 983	115 726
Arc Lamps and Electric Searchlights	313	331	1 498	3 438
Parts Thereof (except Carbon Rods)	3 796	35	7 099	2 911
Batteries and Accumulators (including parts)	37 559	42 625	166 860	186 727
Electrical Instruments (other than telegraphic and telephonic) : Commercial (including ammeters, voltmeters, etc), House Service Meters, and Scientific	20 373	14 525	92 226	76 828
Switchboards, other than Telegraph and Telephone	32	131	426	1 339
Electrical Goods and Apparatus, all other Sorts	101 007	132 284	454 975	507 658
Total of Electrical Goods and Apparatus	454 012	543 237	2 022 787	2 222 172
EXPORTS.	£	£	£	£
Electrical Machinery—				
Railway and Tramway Motors	16 021	15 578	190 735	125 341
Other Motors and Generators	213 461	165 674	831 714	748 625
All other Sorts	271 777	329 092	1 214 510	1 297 948
Electrical Wires and Cables, Insulated—				
Rubber Insulated (not being Telegraph or Telephone Wires or Cables)	113 261	124 982	468 091	485 881
Insulation other than Rubber (not being Telegraph or Telephone Wires or Cables)	116 784	160 259	499 068	520 197
Telegraph and Telephone Wires and Cables (not being Submarine Cables)	76 792	145 568	372 044	332 729
Submarine Telegraph and Telephone Cables	12 300	21 264	83 308	42 077
Telegraph and Telephone Instruments and Apparatus (except wireless valves)	238 541	267 041	1 051 892	938 102
Carbons, Electric	719	698	7 554	2 428
Electric Lamps and Parts—				
Electric Glow Lamps	41 211	52 638	159 765	189 641
Arc Lamps and Electric Searchlights	315	676	3 884	3 764
Parts thereof (except Carbon Rods)	1 256	1 364	1 816	3 305
Batteries and Accumulators (including parts)	81 780	76 151	344 473	334 965
Electrical Instruments (other than telegraphic and telephonic) : Commercial (including ammeters, voltmeters, etc.), House Service Meters and Scientific	33 457	30 033	131 245	113 688
Switchboards, other than Telegraph and Telephone	3 700	5 057	30 976	24 831
Electrical Goods and Apparatus, all other Sorts	208 116	278 159	812 233	960 168
Total of Electrical Goods and Apparatus	1 429 491	1 674 234	6 203 308	6 123 591

THE GENERAL ELECTION.

Candidates Include Representatives of Electrical Finance and Industry.

Amongst the Parliamentary candidates nominated for the next election are a considerable number who are engaged in or associated with the electrical industry. These include the following :—

Mr. J. W. McKAY, secretary of the Electrical Wholesalers' Federation. Mr. McKay possesses valuable experience of Parliamentary work and a long acquaintance with the electrical industry. He was at one time the South Wales and West of England representative of the Brush Electrical Engineering Co. and the British Electric Traction Co. (Lib.), for Coventry.

Mr. R. S. CHATFIELD, chairman of the Electricity Committee of Eastbourne Corporation (Lab.), for Eastbourne Division of East Sussex.

Mr. R. R. FAIRBAIRN, formerly manager of the Worcester tramway undertaking (Lib.), for Worcester.

*Mr. W. PRESTON, head of the firm of William Sanders and Co., electrical engineers, Wednesbury (Lib.), for Worcester (Con.), for Walsall.

*Lieut.-Col. Sir FREDERICK HALL, a director of the County of London Electric Supply Co., and the South London Electric Supply Corporation (Con.), for Dulwich.

*Mr. R. G. ELLIS, a director of the Yorkshire Electric Power Co. (Con.), for Wakefield.

Mr. P. J. PYBUS, chairman of the Power and Traction Finance Co., and a director of Willans and Robinson, the English Electric, and other electrical companies (Lib.), for Harwich.

*Mr. GEORGE BALFOUR, chairman of Balfour, Beatty and Co., the Scottish Central Electric Power Co., and a director of numerous other electricity supply and traction companies (Con.), for Hampstead.

*Sir PHILIP DAWSON, consulting electrical engineer, a partner in the firm of Kincaid, Waller, Manville and Dawson, a director of Johnson and Phillips, the Reading Electric Supply Co., Wessex Power Producers, Ltd., and other companies. He was a member of the Railway Electrification Advisory Committee set up by the Ministry of Transport, and of the Water Power Resources Committee of the Board of Trade (Con.), for Lewisham West.

*Ald. J. P. BURMAN, a member and formerly chairman of Birmingham Corporation Electricity Committee (Con.), for Duddeston Division of Birmingham.

Mr. SIDNEY E. GARCKE, a director of the British Electric Traction Co., and chairman of Tilling and British Automobile Traction and associated companies (Con.), for Kingswinford Division of Staffordshire.

Mr. E. A. HAILWOOD, managing director of Hailwood and Ackroyd, Ltd., makers of electric and other safety lamps, glassware, etc. (Ind.), for Belfast East.

Mr. E. KILBURN SCOTT, consulting engineer, and author of books on electrical and other subjects. He was for some years dynamo designer to John Fowler and Co., Ltd., and the Brush Electrical Engineering Co. He was also for some time engaged with Mr. Wilson Hartnell on electric lighting plants, etc., and has also been in the service of W. T. Goolden and Co., and Johnson and Phillips, Ltd. He was formerly in charge of the electrical engineering department of Sydney University, and has been a lecturer at University College, London (Lib.), for Leeds South.

SCOTTISH CENTRE I.E.E.

Members of the Scottish Centre of the I.E.E. paid their annual visit to Dundee on April 26th and 27th. Members and friends, along with members of the Dundee Sub-Centre, had luncheon at the Queen's Hotel, and in the evening the seventh ordinary meeting of the session was held at the Technical College, Bell Street, at which Mr. D. S. Munro, chairman of the Scottish Centre presided. A short informal paper on "The Lothians Protective Gear for Distribution" was read by Mr. H. C. Babb, on which there was a brief discussion. Thereafter, Mr. W. Holmes presented his paper on "Load-Levelling Relays and their Application in Connection with Future Metering Problems." Mr. Holmes's paper elicited a keen discussion on the part of Messrs. D. H. Bishop, Edwin Seddon, H. C. Babb, and George Fowler, to which Mr. Holmes made suitable reply.

* Represented the same constituency in the Parliament recently dissolved.

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LEGAL INTELLIGENCE.

Further Evidence in Respect of Extensions of B.T.-H. Lamp Patents.

THE hearing of the application of the British Thomson-Houston Co., Ltd., for an extension of the Patent No. 10 918, dated May 8th, 1913, was again before Mr. Justice Luxmoore in the Chancery Division, on May 8th, 9th, 13th and 14th (see THE ELECTRICIAN of May 10th).

Sir Duncan Kirby, K.C., representing the Nox Electric Company, said their case was that they had a definite agreement with the British Thomson-Houston Co. for a licence. The suggested terms of the licence now put forward entitling the Nox Co. to manufacture 100 000 gasfilled lamps annually were inadequate in that the total number of lamps manufactured last year was 17 millions, and it was doubling every five years.

Sir A. Colefax, K.C., said the total output of the Nox factory was, according to the evidence, 750 000 lamps a year. The offer of a licence to manufacture 100 000 gasfilled lamps, plus a 10% increase annually, was, in the circumstances, in order.

Mr. John Gray, of the B.T.-H. Co., who was put into the box by Sir A. Colefax, stated, in reply to questions of opposing counsel, that at an interview with the representative of the Nox Co. it was fair to infer the B.T.-H. Co. would grant the Nox Co. a licence to manufacture, but he assumed that there would be negotiations as to the terms of the licence.

Position in 1914.

Mr. Corselles, for Kye Electric, Ltd., and Tungstalite, Ltd., two of the objectors, suggested that in 1914 the production of gasfilled lamps was 28 000 and of drawn wire lamps 9½ millions, and in 1918 the figures were 1¾ millions of gasfilled lamps and 18½ millions of drawn wire lamps.

Mr. Gray replied that the B.T.-H. Co., the General Electric Co., and the Siemens Company accounted between them for 80% of the total number of gasfilled lamps. They did not pay royalties to each other, and he did not think the royalties received by the B.T.-H. Co. had totalled more than £150 000.

Mr. Shelley (for the Nelson Electric Co.) asked if it had not been the policy of the B.T.-H. Co. to emphasise the gasfilled lamps during the past six years and not so much to develop the vacuum lamps?

Mr. Gray agreed that the sale of gasfilled lamps had increased compared with vacuum lamps, but could not say it was the firm's policy to press the sale of internally frosted lamps to the exclusion of other types.

Replying to Sir Arthur Colefax, Mr. Gray said, at his interview with the representative of the Nox Co. the question of terms to be inserted in the licence to them was not discussed.

Mr. Victor Wilson, of the General Electric Co., Ltd., said his company made a substantial proportion of the English lamp output. As manufacturers they did not pay royalties to the B.T.-H. Co. He had no doubt that the war was the impediment to communal manufacture of the gasfilled lamp.

This concluded the evidence for the applicants, and evidence of opposition witnesses was called.

Dr. Elkan Wechsler, representing Tungstalite, Ltd., said their output of incandescent electric lamps was about 1 000 a day with a quarter of a million per annum. He was formerly with Pope's Electric Co., Ltd.

Sir A. Colefax suggested to witness that Pope's did not manufacture gasfilled lamps during the war.

Witness said his recollection was that they did. He was chemist there and made experimentally the first gasfilled lamp, he thought about the end of 1918, Pope's having become licensees of the B.T.-H. Co. in April, 1918.

Mr. B. Wechsler, also associated with Tungstalite, Ltd., said his experience was that 40 and 60 W gasfilled lamps were not superior in lighting qualities to vacuum lamps, but were often inferior.

Mr. B. R. Agazar, representing Kye Electric, Ltd., said he had been associated with a number of companies which dealt in imported lamps. Two of these companies had been proceeded against by the applicants for infrigement of patent, and the relief sought was granted. In the case of Kye, Ltd., one of the companies who were the defendants in an action for infringement by the applicants in 1928, the company was compulsorily wound up. Kye Electric, Ltd., was a fresh registration. It dealt entirely in lamps of its own manufacture, and its output was now 30 000 lamps a week.

Mr. Horace Woolridge, of the Nox Co., said his company manufactured not only lamps but glass for the lamps. Their output was 750 000 a year, which they expected to increase to a million next year.

Sir A. Colefax said he would not contend that the Nox Co. were not a proper company to receive a licence.

Mr. Norman E. Paine, of the Nelson Electric Co., Ltd., said their output of lamps varied from 3 000 to 11 000 a week.

This concluded the evidence.

Sir Duncan Kirby, for the Nox Co., said they were content to leave the matter of the limitation in the licence offered to them to further discussion, and he did not further oppose the extension of the patent.

Mr. Corsellis, on behalf of Tungstalite, Ltd., and the Kye Electric Co., Ltd., contended that the patentees, rather than having made a loss owing to the war, had made a gain.

Mr. Shelley, for the Nelson Electric Co., said the evidence showed that there had been a considerable diminution in the price of gasfilled lamps in the period since the war, and that during the war the price was high, and maintained at more or less the same level.

Mr. Stafford Crossman, for the Comptroller-General of the Patents Office, said that the view of the Comptroller was that, if his Lordship thought there ought to be an extension of the patent, in all the circumstances, having regard to some extent to the sale by applicants of imported lamps, any extension his Lordship granted should not exceed two years. Further, any extension granted should be subject to an undertaking by the applicants that they would use their best endeavours to register all the licensees mentioned in their affidavits. The majority of the licensees were not, at the moment, on the register.

Sir A. Colefax, replying on behalf of the B.T.-H. Company, contended that so far as the municipal contracts were concerned, those contracts were not with the applicants but with the Electric Lamp Manufacturers' Association. There was no restriction on the user of lamps, but the conditions of the contracts were merely to give special conditions as to discount if the municipality undertook to purchase lamps only from members of the Association. He submitted that the contracts did not come within the scope of the section of the Act at all. He had no objection to a condition being imposed as part of an order, for the prolongation of the patent, making provision for the use of a manufactory having been established in this country for the manufacture of gasfilled lamps during the interval between the expiry of the patent and the date of the grant of the extension. But he did object to the insertion of any condition which would have the effect of franking the import of foreign lamps during the interval.

The Judgment.

Mr. Justice Luxmoore, in giving judgment said, in considering the question of extension he was bound to take into consideration the fact that it must necessarily take some time to put the articles made under this patent on the market commercially, and that during the war period some work was done on the patent, mainly, it was true, in connection with large lamps; further, he might take into consideration the fact that the profit on those lamps was probably higher than it would have been on small lamps. Further, the company during the war were making large-sized lamps and were gaining experience which must have been valuable to them with regard to the future development of their patent. After very careful consideration, he had come to the conclusion that the proper period for extension was two years. In coming to that conclusion he had been assisted by the view expressed by Mr. Crossman on behalf of the Comptroller that two years was a proper period for extension. The patent would be extended for two years and applicants must use their best endeavours to obtain the registration of licensees forthwith. There would be no order as to costs.

We are asked to make it clear to readers that the ZENITH ELECTRIC CO., LTD., was not concerned in the legal action referred to in our issue of May 3rd, and that it has no direct or indirect connection with any other firm having a somewhat similar title.

POST OFFICE WORKING WEEK.

The Conference of the Union of Post Office Workers at Eastbourne on May 10th, passed a resolution calling upon the incoming Government to re-nationalise the beam and cable services. The executive was instructed to concentrate on an endeavour to secure a working week of five days. Belfast was elected as the conference town for 1930.

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PERSONAL.

SHOEBURYNESS Urban Council has appointed Mr. R. H. Holmes, of Pembroke, as electrical engineer and manager.

Estate of the gross value of £4 259, with net personalty £4 185 was left by the late Dr. Lionel Sells, a pioneer in X-ray work.

Mr. A. W. Makovski, of Tamplin and Makovski, Ltd., has been re-elected president of the Reigate and Redhill Chamber of Commerce.

Mr. A. H. Darker, chief electrical engineer of J. Stone and Co., will return to London after a world tour on June 6th, by the s.s. "Orama."

The rumour that Sir John Snell contemplates relinguishing his position with the Electricity Commission during the next twelve months is not confirmed.

The marriage of Mr. E. C. Brunt, of the Potteries Electric Traction Co., and Miss G. M. Ford, was solemnised at St. Luke's Church, Endon, recently.

Bury Electricity Committee has recommended that the salary of Mr. J. G. Potts, borough electrical engineer be increased from £850 to £950 per annum.

Mr. H. Willoughby Ellis has been nominated as president of the E.C.A. Allied Associations for 1929–30. Mr. H. C. Hazel has been nominated vice-president.

Mr. Samuel Insull, president of the Commonwealth Edison Co. of Chicago, has presented £10 000 to Queen's University, Kingston, Toronto, to endow a chair of preventive medicine.

Mr. C. E. Satchell, superintendent of telegraphs at Reading Post Office, has, on his retirement, received a canteen of cutlery and a barometer from the staff, and a clock from the controlling officers. Mrs. Satchell received a handbag and a bouquet.

Mr. James L. Gunn, general manager of the Grenock and Port Glasgow Tramways Co., has been appointed to the managership of Aberdeen Corporation tramways in succession to Mr. W. Forbes, who has been appointed to a similar position at Cardiff.

Sheffield Electricity Committee has decided to invite the following applicants to interview a sub-committee with respect to the position of general manager and electrical engineer, recently vacated by Mr. G. E. Fedden: Mr. S. E. Britton, Mr. W. H. Duffett, Mr. H. G. Fraser, Mr. E. Morgan, Mr. F. N. Rendell-Baker, Mr. C. L. E. Stewart, Mr. J. R. Struthers, Mr. H. E. Yerbury.

It is understood that the recent resignation of Mr. R. Lomax from the position of borough electrical engineer of Stockport was the result of a suggestion that he agree to a reduction of his salary. A member of the Council has caused a statement to be made that remarks relative to Mr. Lomax, made at a Council meeting, were not intended to disparage him in any way.

At the opening of the new Mining Laboratory of the Armstrong College, at Newcastle-on-Tyne, by the Prince of Wales, on Tuesday, a souvenir miner's lamp was presented to the Prince. The student chosen to make the presentation and welcoming speech was E. Maurice Fisher, eldest son of Mr. H. J. Fisher, the chief electrical engineer of Lambton and Hetton Collieries, Ltd., and president of the Newcastle Section of the Association of Mining Electrical Engineers.

It is reported that Mr. T. Edison has offered a free college scholarship, consisting of all tuition fees for four years, to the high school or preparatory school student who gives the best answers to one of his questionnaires. The governor of each State and the Commissioners of the District of Columbia will be asked to designate one male student who evidences high ability in scientific subjects during the school year 1928–29. Each of the 49 winners will receive a trip, at Mr. Edison's expense, to the Edison Laboratories, where the examination will be conducted.

Obituary.

MR. A. TAYLOR, on May 5th. He was chief electrician at the Markham Main Colliery, Armthorpe.

MR. ROYDON R. DOUGLAS, on April 18th, aged 62 years. He founded the Douglas Electric Construction Co., of New Orleans, and directed its affairs until September, 1927. He was born in Manchester.

MR. HORACE LESLIE HOTCHKISS, on May 10th, aged 87 years. He was for over 60 years connected with various telegraph companies. He started with the Gold and Stock Telegraph Company in 1867, and four years later organised the American District Telegraph Company. In 1873 he took part in establishing the Exchange Telegraph Company in London, and was a director of the company.

B.B.C. ANNUAL REPORT.

Income from Licences Over £871 763—Expenditure on Programmes £538 990.

ACCORDING to the second annual report just issued by the British Broadcasting Corporation, the financial policy of previous years was continued. The income for the year was £1 002 505, of which £879 324 was absorbed by expenditure, leaving a balance of £123 181 to be carried to the revenue appropriation account. The development of the service, the report states, called for a proportionately greater revenue expenditure in relation to both total income and licence income than in the year previous. In 1927, against a licence income of £800 959, the total revenue expenditure was £773 289, which left a balance of £27 669; apart from other income, towards the cost of current and contemplated capital expenditure; in 1928 the licence income (£871 763) fell short of the revenue expenditure total by £7 560 9s. 5d. In depending upon the revenue from publications for necessary capital expenditure during the year, as well as for a prudent reserve for future capital expenditure, the corporation, in effect, ensured the normal development and expansion of programme services. It is proposed to transfer the balance of £34 167, including £18 228 brought down from 1927, to capital account to cover capital expenditure during the year (other than on regional stations), and to transfer £100 000 to capital expenditure to be incurred in the construction and equipment of regional stations. The balance carried forward will be £7 242.

The Balance Sheet.

The balance sheet shows that the capital account was increased to £419 213, with £250 068 representing permanent assets. The depreciation reserve was increased (because of additions to the assets to which it applies) to £57 500 by a further provision of £31 150. The book value of plant and furniture discarded during 1928, amounting to £1 592, has been written off against this reserve, leaving a balance to be carried forward of £55 907. Investments increased to £256 937 and represent approximately funds appropriated and carried forward in respect of capital account, depreciation and contingency reserves. There were no special departures in expenditure.

The proportions to total expenditure of programme and engineering expenses—constituting the direct cost of the broadcasting service—were 61% and 19% respectively.

The expenditure on programmes amounted to £538 990. Administration salaries and expenses were £56 211. Governors' fees amounted to £6 100.

Wireless licences at December last numbered 2 628 392, exclusive of free licences for the blind, representing an increase on 1927 of 233 218.

Efforts were made to improve the quality of reception of matter experimentally broadcast to and from overseas by the use of short waves, and good progress was made in co-operation with Marconi's Wireless Telegraph Company.

The percentage breakdown was 0·035 in 68 000 hours' transmission; the increase of 0·005% over the 1927 percentage being due to damage to aerials during the November gales. During the year constructional work on the first of the regional stations was begun at Brookman's Court, Herts., and this station, when completed, will serve London and an area enclosed by a circle roughly 60 miles round London. A mobile transmitter mounted on a lorry was in use to determine the most advantageous site for the other stations.

The new studios at Manchester were put in hand and a new design of electrical control has been developed. The complete studio equipment will probably be the most up-to-date of its kind in the world.

The temporary station at Keston became inadequate for the work of checking the frequencies used by various European stations in addition to those in this country, and it was necessary, therefore, to undertake the building of a permanent structure at Tatsfield. The experimental transmitter at Daventry 5GB, although erected to investigate problems connected with design, has acted as a service station for the east and west Midlands. Freedom from breakdown was remarkable, as the original experimental plant and equipment were still in operation.

During the year 751 S.O.S. messages were broadcast from all stations, of which 316 (42·1%) were successful, 400 (53·3%) were unsuccessful, and in 35 (4·6%) cases the result was unknown.

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BUSINESS OPENINGS.

Latest Particulars of Electrical Engineering and Wiring Installation Contracts for which Tenders are being Invited at Home and Abroad.

WE give below the latest particulars of contracts for which tenders are invited. The closing date is given, when available.

CHERTSEY GUARDIANS, May 18th.—Electric lighting installation at the Institution, Ottershaw, near Chertsey. Specifications from Mr. F. J. Wareham, clerk, Council Offices, West Byfleet, Surrey.

PANNAL (YORKS) PARISH COUNCIL, May 20th.—Electric or gas lighting, from October 1st to March 31st, for three years. Further particulars from Mr. J. H. Brooksbank, clerk, Lund House Green, Harrogate.

BELFAST CORPORATION, May 21st.—Manufacture, supply and erection of (*a*) h.t. armour-clad switchgear (specification No. W. 80), and (*b*) air preheaters for boilers (No. W.81); also for manufacture and supply of (*c*) 22 000 V, three phase transformers (No. W.82), and (*d*) cable drum trailer and tractor (No. W.83). Specification, etc., from Mr. F. H. Whysall, city electrical engineer, East Bridge Street, Belfast; deposit £2 2s. each for items (*a*), (*b*) and (*c*).

BELFAST CORPORATION, May 21st.—Manufacture, supply and erection of 22 000 V 3-phase overhead transmission line. Specification (No. W.84), etc., from Mr. F. H. Whysall, city electrical engineer and general manager, East Bridge Street, Belfast; deposit £2 2s.

BETHNAL GREEN (LONDON) BOROUGH COUNCIL, May 22nd.—Electric lighting installations in two blocks of tenement buildings. Specification, etc., from Mr. H. W. Couzens, 9 Old Queen Street, London, S.W.1; deposit £2 2s.

LARNE GUARDIANS, May 22nd.—Electric light installation in connection with conversion of workhouse buildings into a district hospital. Specifications can be seen and forms of tender obtained at the office of Mr. W. Pleasance, 44, Wellington Place, Belfast, or at the Union Offices, Larne.

RICHMOND (SURREY) GUARDIANS, May 22nd.—Re-wiring for electric lighting of certain buildings at Grove Road Institution, Richmond. Particulars from Mr. C. L. Fenn, Guardians Offices, Parkshot, Richmond, Surrey; deposit £1.

WEST LANCASHIRE RURAL DISTRICT COUNCIL, May 23rd.—Electric lighting scheme for parish of Aughton. Specifications, etc., from Mr. James Scott, 358, Royal Liver Building, Liverpool; deposit £2 2s.

BOOTLE CORPORATION, May 24th.—Electrician's work in connection with erection of 122 houses, under the Northfield Road housing scheme. Specifications from the Borough Engineer, Town Hall, Bootle; deposit £2 2s.

CENTRAL ELECTRICITY BOARD, May 25th.—Supply and erection of 33 000 V metal clad switchgear, in connection with South-East England Electricity Scheme. Specification (No. S.E.E.—G.S.1) from Mr. Richard H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

EPSOM URBAN DISTRICT COUNCIL, May 25th.—Supply and erection of l.t., d.c. switchboard, with the changing over of connections, with certain instruments and gear from the existing switchboard. Specification, etc., from the Resident Electrical Engineer, Electricity Works, Depot Road, Epsom; deposit £3 3s.

GEORGE HERIOT'S SCHOOL, EDINBURGH, May 30th.—Electrical installation. Specification, etc., from Mr. John Anderson, superintendent of works, 20, York Place, Edinburgh.

MASSEREENE HOSPITAL, ANTRIM, May 30th.—Electric power plant and lighting installation for laundry. Specification D from Mr. F. D. Brown, consultant, 93, Ann Street, Belfast.

Lighting of Schools.

WEST RIDING ELECTRICITY COMMITTEE, May 31st.—Electric lighting of Maltby Crags and Aston Schools. Forms of tender from Mr. A. Adcock, Craigmoor, Godstone Road, Rotherham.

CROYDON CORPORATION, June 3rd.—Supply and erection of (*a*) one 20/25 000 kW turbo-alternator, with condensing plant, pumps, etc.; (*b*) boiler house extensions, with two 100 000 lb. per hour boilers, stand-by coal conveyor from siding, coal-handling plant at siding, steam piping and receiver, etc.; (*c*) engine room extension, switch house, bridges, and pump house; (*d*) 6 600 V switchgear, transformers, etc. Specifications, etc., from the Engineer and Manager, "Electric House," 38, High Street, Croydon; deposit £1 1s. for each section.

SUTTON AND CHEAM URBAN DISTRICT COUNCIL, June 7th.—Installation of fire alarm system, connected with the fire station. Plans showing positions of fire alarm boxes, etc., from the Engineer and Surveyor.

EAST HAM EDUCATION COMMITTEE, June 12th.—Electric lighting installation at the Salisbury School. Specification, etc., from the Secretary, Education Office, Town Hall, East Ham, London, E.6; deposit 10s. 6d.

CENTRAL ELECTRICITY BOARD, June 17th.—Supply, delivery and erection of 33 kV and lower voltage switchgear. Specifications (N.W.E. S.S.3 for indoor metal clad switchgear and N.W.E. S.S.4 for outdoor type switchgear) before May 21st, from Mr. Richard H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

Overseas.

UNLESS otherwise stated, particulars of overseas contracts are to be had from the Department of Overseas Trade (Room 52), 35, Old Queen Street, Westminster, London, S.W.1. *Note.—An asterisk denotes that local representation is, in practice, essential.*

BLOEMFONTEIN MUNICIPALITY, May 18th.—Supply and erection of (*a*) turbine and generator, condensing plant and auxiliaries and switchgear and cables; (*b*) cooling spray pond equipment, or cooling tower (contract No. 1). (Reference B.X. 5 192.)

PLOVDIFF (BULGARIA) PROVINCIAL COUNCIL, May 20th.—Supply of two Francis turbines, two 5 000 kVA generators, two 5 000 kVA, two 1 000 kVA and two 150 kVA transformers, for Votscha-Kricim power station.

PRETORIA MUNICIPALITY, May 20th (extended from May 6th).—Supply of cables, switchgear and transformers. (Reference B.X. 5 245.)

INDIAN STORES DEPARTMENT, May 21st.—Supply of 400 kW 6-phase rotary converter and accessories for His Majesty's Mint at Calcutta (order No. N./9691). (Reference B.X. 5 255.)

MONTEVIDEO PORTS ADMINISTRATION, May 22nd.—Supply of four electric cranes, to lift 3 tons, mounted on trucks. (Reference A.X. 7 814.)

SOUTH AFRICAN POSTS AND TELEGRAPHS, May 23rd.—Supply of rubber covered wire and telephone cable (contract No. 153). (Reference B.X. 5 229.)

EGYPTIAN PRISONS ADMINISTRATIONS, May 25th.*—One year's supply of lamps and electrical articles (section 7). (Reference C. 3 022.)

INDIAN STORES DEPARTMENT, May 27th.—Supply of 500 kW, 6-phase rotary convertor, starting panel, etc. (order No. N./9 736). (Reference B.X. 5 279.)

PRETORIA MUNICIPALITY, May 27th.—Supply of transformers required in connection with extensions of e.h.t. system. (Reference B.X. 5 258.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, May 28th.—Supply of telephone jacks and number plates (schedule C.417). (Reference B.X. 5 202.)

CLUJ (ROUMANIA) MUNICIPALITY, May 30th.—Compressor for cooling plant of ammonia system, with air-cooling coils, and a.c. motor and condenser, at the Slaughter House. (Reference A.X. 7 838.)

SOUTH AFRICAN POSTS AND TELEGRAPHS, May 30th.—Supply of telegraph materials, tubular arms, crossheads, bases, stay plates, etc. (tender No. 152). (Reference A.X. 7 767.)

JOHANNESBURG MUNICIPALITY, June 1st.—Supply and delivery of oil switches. (Reference B.X. 5 283.)

JOHANNESBURG MUNICIPALITY, June 1st.—Supply and delivery truck type cubicles. (Reference B.X. 5 285.)

TANGANYIKA GOVERNMENT, June 1st.—Concession for utilisation of Pangani River Falls for the development of electric power. Copies of the draft concession may be obtained from the Crown Agents for the Colonies, 4, Millbank, London, S.W.1.

VALPARAISO PORT ADMINISTRATION, June 1st.—Four electric travelling cranes of portal type (capacity 3 metric tons each). (Reference A.X. 7 892.)

AUCKLAND ELECTRIC POWER BOARD, June 3rd.—Supply of cables and accessories. (Reference B.X. 5 248.)

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NEW SOUTH WALES PUBLIC WORKS DEPARTMENT, June 4th.—Supply of 18 electrically operated water level indicators (contract No. 61/1928–29 W.S. and S.). Reference (B.X. 5 233).

VICTORIAN ELECTRICITY COMMISSION, June 4th.—Supply of 22 000 V transformers and spares (specification No. 29/36). (Reference B.X. 5 216.)

ANTWERP MUNICIPALITY, June 17th.—Supply of 32 electric travelling cranes for new dock. (Reference A.X. 7 924.)

POSTMASTER-GENERAL'S DEPARTMENT, Melbourne, June 18th.—Supply of switchboard cable (contract C. 427). (Reference B.X. 5 228.)

NEW ZEALAND POSTS AND TELEGRAPHS, June 18th.—Supply of telephone cords (No. P. and T. 151/1425). (Reference B.X. 5 251.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, June 20th.—Two 5-ton electrically driven hoist blocks, with overhead conductors, runway girders and switches (tender No. 1 446). (Reference T/A.X. 7 867.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, June 20th.—Supply of one 10-ton and three 4-ton electric level luffing cranes (tender No. 1 437). (Reference A.X. 7 828.)

NEW SOUTH WALES PUBLIC WORKS DEPARTMENT, June 22nd.—Supply and erection of transformers, with certain spares, for Burrinjuck hydro-electric development (contract No. 29/29). (Reference B.X. 5 230.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, June 25th.—Supply of protected type telephone cable terminal boxes (schedule C.430). (Reference B.X. 5 231.)

VICTORIAN RAILWAY COMMISSION, June 26th (extended from May 15th).—Supply of geared, three-phase, electric winding engine. (Reference A. 7 650.)

SOUTH AFRICAN POSTS AND TELEGRAPHS, June 27th.—Automatic wall and table pattern telephones (tender No. 158). (Reference B.X. 5 273.)

VICTORIA STATE ELECTRICITY COMMISSION, July 1st.—Supply and delivery of 44 000 V transformers. (Reference B.X. 5 293.)

Construction of Power Station.

STATE ELECTRICITY WORKS, MONTEVIDEO, July 8th.—Construction and equipment of 50 000 kW power station.

POSTMASTER GENERAL'S DEPARTMENT, MELBOURNE, July 9th.—Resistances and reactances (schedule C. 426). (Reference B.X. 5 281.)

NEW SOUTH WALES GOVERNMENT RAILWAYS, July 10th.—One 750 kW turbo-alternator; 2 200 V ironclad switchgear; two switch operating batteries; and two motor generator sets. Specifications from the Chief Electrical Engineer, 61, Hunter Street, Sydney.

NEW ZEALAND PUBLIC WORKS DEPARTMENT, July 16th.—Supply of 250 galvanised steel transmission line towers to carry copper conductors, or 190 towers to carry steel-core aluminium conductors. (Reference A.X. 7 735.)

NEW ZEALAND POSTS AND TELEGRAPHS, July 16th.—Telephone bells (P. and T. No. 151/1 444). (Reference B.X. 5 272.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, August 6th.—Supply of 120-ton, four-motor, overhead travelling crane and runway (specification No. S.M. 358). (Reference A.X. 7 810.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, August 13th.—Water turbine driven generating sets and switchgear, for Waitaki power development (section 2). (Reference B.X. 5 278.)

Tenders Accepted.

GLOUCESTER CORPORATION.—Marconiphone Co., Ltd., 50 h.t. units, 38s. 6d. each.

GRAVESEND EDUCATION COMMITTEE.—G. E. Wallis and Sons, Ltd., electric lighting.

STIRLING CORPORATION.—A. Brewster, electrical works in connection with Trip Road housing scheme.

WIMBLEDON CORPORATION.—J. P. Hall and Sons of Peterborough, supply of feed pump, £626 10s. (Recommended.)

COLCHESTER CORPORATION.—Brightside Foundry and Engineering Co., Ltd., pipe work for the electricity works, £2 950.

CHESTERFIELD CORPORATION BATHS COMMITTEE.—The Chesterfield Engineering Co., for installing electric ventilating fans.

GLASGOW CORPORATION.—A. A. M. Turnbull and Co. electrical work at new police station, Millerston, £274 10s. 8d (Recommended).

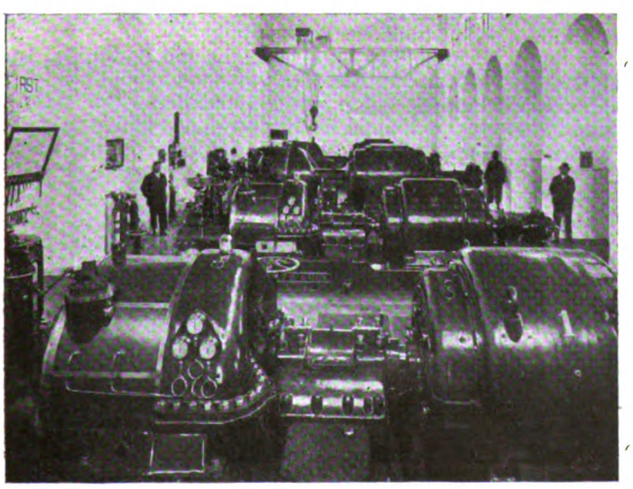
MANCHESTER EDUCATION COMMITTEE.—Electrical installations: John Adams, Ltd., School Lane school and Kingsway school; Sudlow and Co., Hough Road school.

HALIFAX CORPORATION.—Babcock and Wilcox, Ltd., two steel boilers with auxiliaries, £83 411; British Thomson-Houston Co., Ltd., switchgear for turbo-alternator, £720; Herbert Morris, Ltd., steel rails for crane gantry, £188.

LEEDS CORPORATION.—Squires and Sons, Ltd., electric light installation at Gateforth sanatorium, £102 14s.; Sun Electrical Co., Ltd., and George Casperson, supply of electric light fittings for 12 months; Measurement, Ltd., supply of meters for 12 months (about 2 500), schedule prices.

CENTRAL ELECTRICITY BOARD.—Watshams, Ltd., secondary transmission lines, for South-East England scheme; and secondary transmission lines for Central England scheme; Siemens Bros. and Co., Ltd., and John Collier and Co., Ltd., secondary transmission lines, and English Electric Co., Ltd., secondary transformers for North-West England and North Wales scheme. Approximate total £300 000.

MANCHESTER CORPORATION.—Metropolitan-Vickers Electrical Co., Ltd., 10 000 kVA transformer for Oldham Road sub-station; Forest City Electric Co., Ltd., automatic point-controllers; Herbert Morris, Ltd., 5-ton crane for Polygon depot; British Thomson-Houston Co., Ltd., 33 000 V switchgear for sub-stations and Barton power station; A. E. Sudlow and Co. (sub-contractors), switchgear, cables and lighting at Hyde Road car works extensions; Brush Electrical Engineering Co., Ltd., tramcar trucks; Nesta, Ltd. and G. D. Peters and Co., Ltd., upholstered seats for tramcars; Equipment and Engineering Co., Ltd., electric rail welding equipment.



A GENERAL view of the turbine room of the Electricity Department at Tientsin, with a street scene, on the right showing the effective lighting arrangements. Mr. R. A. Williams in his report for 1928 points out that 9 825 314 kWh were generated during the year with a coal consumption of 14 218 tons, the slight increase over last year's consumption being due to railway troubles during the summer. Sales of current during 1928 increased by 30% by comparison with 1927.

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LONDON JOINT AUTHORITY.

Statistics Relating to Undertakings in the London and Home Counties.

THE second issue of the "Electricity Supply Return" for the London and Home Counties Electricity District has just been published by the Joint Authority. Earlier issues of the return, published by the London County Council, dealt with the period 1901–2 to 1924–25. The first four issues related to undertakings operating within the county of London; those for 1905–6 to 1917–18 related to an area somewhat larger than Greater London; those for 1918–19 and onwards related to the London and Home Counties Electricity District.

This issue follows generally the arrangements adopted in the earlier returns. Advantage has been taken of the facilities offered by the Electricity Commissioners to avoid disagreement between the figures published by the Commissioners and those appearing in this return. The area of the Electricity District is approximately 1 796 square miles and includes the whole of the counties of London and Middlesex and parts of the counties of Herts, Essex, Kent, Surrey, Bucks and Berks. It stretches from Hertford and St. Albans in the North to Dorking and Reigate in the South, and from Windsor in the West to Gravesend in the East. The population of the District, according to the 1921 Census, was 8 178 766, and the assessable value at April 6th, 1927, approximately £83 340 000. The figures given in the return relate to the whole area of the undertaking, although in some instances the area of supply of an undertaker extends beyond the boundary of the electricity district.

Total Capacity of Stations.

The total capacity of the generating stations at the end of 1927–28 was 1 254 507 kW as compared with 1 103 647 kW in 1926–27, and 1 061 642 kW in 1925–26. The total connections at the end of the year 1927–28 on the systems of all the undertakings comprised in the return represented a demand of 2 170 778 kW; for the two previous years the figures were 1926–27, 1 907 489 kW, and 1925–26, 1 754 707 kW. The total rated evaporative capacity from and at 212 deg. F. of the boiler plant installed in all the generating stations for the year 1927–28 was 14 779 210 lb. per hour, the figure for local authority stations being 7 057 910 lb. per hour (Metropolitan borough councils 4 444 070 lb. and extra-London local authorities 2 613 840 lb.), that for company stations 7 721 300 lb. per hour (London companies 6 648 300 lb.; extra-London companies 1 073 000 lb.).

The number of units generated in 1927–28 show an increase of 20·8% on the figures for 1926–27, and an increase of 34·9% on the figures for 1925–26. Of the total number of units generated and purchased by authorised undertakers in 1927–28, *i.e.*, 2 893 904 220 units; 124 273 134 units were used on works and 269 532 767 units were lost and unaccounted for, making a total of 393 805 901 units, which represents 13·6% of the total units generated and purchased by authorised undertakers. The total number of units sold (excluding bulk supplies) during 1927–28 was 1 493 880 881 compared with 1 234 462 574 for 1926–27, and 1 107 814 528 for 1925–26. The total sales (less bulk sales) for 1927–28 show an increase of 21·0% on the sales for 1926–27, and 34·9% on the sales for 1925–26.

The total expenditure charged to capital account by local authority and company undertakers amounted to a total at the end of 1927–28 of £70 592 497, as compared with £61 722 210 in 1926–27, and £57 775 603 in 1925–26. The total working costs of all undertakings (including cost of energy purchased in bulk, but excluding capital charges) amounted during the year 1927–28 to £8 556 020. The gross surplus on the working of all the undertakings comprised in the return amounted during 1927–28 to £7 601 421 made up as follows:—Metropolitan borough councils, £1 480 069; extra-London local authorities, £1 107 747; London companies, £4 009 015; extra-London companies, £1 004 590. The gross surpluses for the two preceding years were, 1926–27, £5 871 702; and 1925–26, £6 298 077.

The balances on net revenue account at end of year 1927–28 after appropriations for that year had been made were increased by the following amounts:—Metropolitan borough councils, £50 829; extra-London local authorities, £130 472; London companies, £595 197; extra-London companies, £46 298.

ELECTRICITY SUPPLY.

CREWE T.C. has applied for a loan of £15 000 for electricity extensions.

Halifax T.C. has applied for a loan of £30 000 for mains.

The Bolsover Colliery Company is to lay underground cables at Edwinstowe.

Residents of Berkswich are to approach Stafford Corporation, with a view to securing a supply for the parish.

Eastbourne Electricity Committee has decided to extend mains to Willingdon and Wannock at a cost of £5 832.

Burton-on-Trent Electricity Committee seeks sanction to borrow £10 000 in connection with assisted wiring.

West Lancashire R.D.C. has decided to include Banks, along with Hesketh, Tarleton, and Rufford, in a draft Order.

Ormskirk Electricity Committee has concluded negotiations with the Central Board for a bulk supply for the Ormskirk area.

Morecambe Electricity Committee has granted the request of the L.M. and S. Railway Co. for a supply of about 150 000 kWh per annum to its laundry.

Uttoxeter U.D.C. is to proceed with necessary work under the electricity scheme, and to arrange for wiring houses, at a charge additional to the tariff rate.

Bermondsey (London) Electricity Committee has prepared loan estimates of £20 000 for mains and services, £2 500 for meters, and £7 500 for installations.

Burnley T.C. has received sanction to loans of £35 000 for mains extensions during the next three years, and £6 260 for the construction of workshops and stores.

Walsall Gas Committee has decided that, for the purpose of reducing the maximum demand for electricity, a static condenser be purchased for the gas works for £270.

Leeds Electricity Committee has directed that assisted wiring charges through prepayment meters shall be 2d. per kW in excess of the flat-rate charge for lighting until 160 kW have been consumed for every £1 of cost of installation.

Bedford Electricity Committee proposes to erect an 11 000 V overhead line, at an estimated cost of £4 900, including transformers, switchgear, etc., between the Cryselco Works and the London Brick Co. and Forders, Ltd., and for supplying the intervening rural area.

Blackburn T.C. has received the consent of the Electricity Commissioners for a change over from d.c. to a.c. in certain districts of the Borough.—The Electricity Committee has authorised the overhaul of the turbo-generators at the Whitebirk generating station.

At a conference of local authorities of the Isle of Wight, it was decided to recommend support to an application by the Isle of Wight Electric Light and Power Co., Ltd., for a Special Order to cover that portion of the island not covered by the existing local Orders.

Ripon and Assisted Wiring.

The Ripon Electrical Co. has informed Ripon Electricity Committee that it has a complete scheme ready for operation if the Corporation does not intend to adopt assisted wiring. The company has been asked to submit details.—The Commissioners have approved the agreement between Harrogate and Ripon Corporations for bulk supply.

The South Metropolitan Electric Light and Power Co., Ltd., and the South London Electric Supply Corporation, Ltd., announce a domestic all-in tariff consisting of a standing charge based on the dimensions of premises, plus 1d. per kWh consumed, and an "all-in" tariff for business premises which includes a charge of 0s. 3d. per quarter per 100 W of installed lighting capacity and 1d. per kWh.

As there is no possibility at present of getting a market for power produced from the harnessed tide of the Exe estuary, the Exe Power Experiment Association has decided it must await developments. The local undertaking at Exmouth, which had apparently the only outside market for supplies, has been recently acquired from the Electricity Supply Corporation by Whitehall Services, Ltd.

The Borough Electrical Engineer of Eastbourne has been informed by the Electricity Commissioners that in future all capital expenditure which it is desired to meet out of revenue must be specifically sanctioned by the Commissioners, such sanction being subject to: (*a*) The reserve fund equalling 5% of the total capital outlay, and being invested in statutory securities; (*b*) from 1930 there must also be a working balance on revenue account equal to 5% of the total capital outlay; (*c*) capital expenditure charged to revenue is not to exceed 5% of the revenue of the undertaking for the year.

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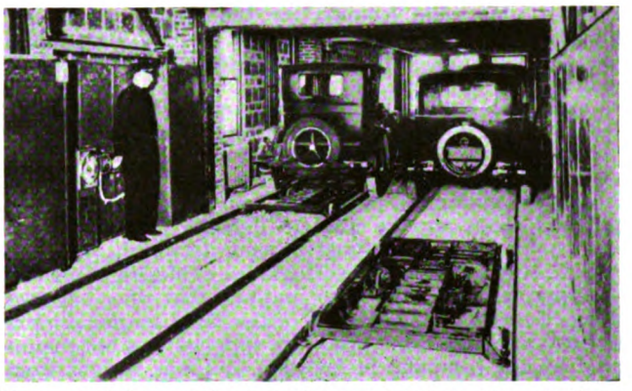
ELECTRICAL NEWS OF THE WEEK IN PICTURES.

One of the earliest pictures to reach us from the flooded area of Launceston, Tasmania, showing part of the damage done to the electricity works. At the time of going to press no technical details are available.

A general view of the Palace of Engineering at the North-East Coast Exhibition, Newcastle-on-Tyne, on Tuesday evening. During the day the exhibition was opened by the Prince of Wales, who inspected a number of the electrical exhibits. Nearly twenty firms engaged in the electrical industry have taken stands, and even at this early stage considerable interest and good attendances are reported. So far the exhibition has not been favoured with good weather, but record crowds are expected.

The outside sales staff of A. H. Hunt, Ltd., showing in the front row, reading left to right, Messrs. Allston (Eastern counties), Patrick (Midlands), Chamberlain (general manager), A. H. Hunt (managing director), C. H. Hunt (director), Baggaley (works manager), and Boon (special sales). Standing, left to right: Messrs. Compton (export), Stevenson (Scotland), Brand (South Western counties), Digby (Irish Free State), Ratcliffe (North Midlands), West (West London), Forbes (South-eastern counties), Richmond (East London), and Devereux (North-eastern counties).



The ground floor of the recently completed 24-storey building in New York devoted to the garaging of cars. It is the first New York example of the Kent Auto Hotel system, developed to eliminate traffic congestion. A car is run-in on the ground floor between rails. An electric trolley then conveys the car to one of three lifts and after a parking space has been booked the vehicle is carried to its berth at the rate of a floor a second. At the appropriate floor the lift doors open and the trolley runs the car to its place.

Three aspects of the stand of Metro-Vick Supplies at the "Brighter Homes" Exhibition, City Hall, Manchester, which has been attracting considerable attention. Features of the exhibit were the daily demonstrations of various domestic operations carried out electrically. In addition there was an attractive display of modern lighting fittings, including new Gilbert-Riley glassware, and examples of mains-operated wireless sets. From a business point of view the exhibition, which closed yesterday (Thursday), is voted to have been a considerable success.

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MERCHANDISE MARKS ACT.

Further Evidence Regarding the Marking of Imported Glassware.

ON May 6th, 7th and 13th, the Committee appointed by the Board of Trade (under Section II of the Merchandise Marks Act), to consider the application of the glass manufacturers for an Order in Council to provide for the marking of imported glassware with an indication of its foreign origin, continued its inquiry from the adjournment on April 30th (see THE ELECTRICIAN of May 3rd).

Illuminating Glassware.

Mr. E. A. Hailwood (Hailwood and Ackroyd, Ltd.) gave evidence in support of the application. He said that his company made a quantity of illuminating glassware equivalent to 7% of the quantity imported. Between 75 and 80% of the consumption in this country was imported. The company's works were so laid out that they could increase their output up to a quantity equivalent to about 25% of the quantity imported. There was misapprehension as to the origin of illuminating glassware, due largely to the fact that many British firms producing complete lighting fittings did not make the glass but imported it, and it was assumed that the glass as well as the other parts of the fittings were British. There was no evidence in the catalogues of such firms that the glass was foreign. On the other hand, owing to the domination of the market by the foreign glass, there was sometimes difficulty in convincing buyers that the British glass was in fact British. His company made the lighting fittings as well as the glassware, but far more of the glassware was sold separately. Referring to a suggestion that three-ply glass could not be made in this country, he said that was not the fact.

Mr. N. L. Macaskie (counsel for the opponents), cross-examining, said that if the glassware of lighting fittings was stamped as being foreign it would be assumed that the whole of the fitting was foreign.

Mr. Hailwood replied that if the vendors of the fittings wanted to make it clear that the fittings were not foreign, they could indicate that they were British.

It was suggested by Mr. Macaskie that, inasmuch as labels were used for indicating prices, etc., on illuminating glassware, labels could also be used to indicate the origin, but witness replied that they would become detached.

Mr. F. L. Mayhew (a sales representative of Messrs. Hailwood and Ackroyd) also gave evidence, and said that when engaged in selling electrical fittings for one of the large manufacturers of electrical apparatus, the glassware supplied was not manufactured by the company in question, but was bought from America and Sweden. Many lighting units sold were considered by the purchasers to be entirely British, and the fittings in most cases bore a label indicating that they were British.

Mr. H. Upston (another sales representative of Messrs. Hailwood and Ackroyd) said that in selling electric lighting fittings many customers had concluded that the glass he was offering was foreign until he had pointed out to them that it was British.

Mr. N. L. Macaskie (counsel for the opposition) asked in how many instances his customers had thought that British glass was foreign during the 2½ years in which he had been with Messrs. Hailwood and Ackroyd.

Mr. Upson replied that there were about 50, or probably more.

Mr. B. Wiles (Hailwood and Ackroyd, Ltd.) corroborated Mr. Upson's evidence.

Accumulator Containers.

Mr. C. M. Mills (the Chloride Electrical Storage Co., Ltd.), opposing the application as regards glass containers for accumulators and batteries, said the company's output was approximately 90 000 cells per week or some 5 000 000 per annum. Of the total sales, 66% were made up in glass jars and of this quantity about 98% were in pressed glass, but since blown glass was used for the larger boxes this percentage represented only about 60% of the total value of glass. The cost of a glass container was approximately 10% of the total cost of a cell. With regard to marking imported accumulator glass containers, his firm knew their country of origin when they were imported. His company obtained its largest proportion of containers from British makers but also purchased abroad because of difficulty in getting necessary types in this country and because it desired to have a second source of supply. His company bought in this country to the extent of between 90 and 95% of their requirements. Continuing, Mr. Mills said that in 1919 it was impossible to obtain certain types of pressed glass containers in this country and it was necessary to buy from Germany and Czecho-Slovakia. Five years ago his company brought into this country samples of containers which the British makers had previously said they could not produce. Since then British makers had overcome the difficulties, and the bulk of the company's supplies were obtained in this country.

Answering questions as to being able to distinguish between British glass and foreign glass containers, witness said British glass was greener in appearance than foreign glass although he did not think the ordinary person would notice it. The trade, however, could tell without any mark. He admitted that British glass manufacturers had gone a very long way to meet the requirements of the battery makers in this country although there were still defects.

Mr. Wethered then cross-examined as to the risk of confusion whether the contents of a battery were foreign as well as the container if the latter were marked, and suggested there could be no such confusion if the container was marked "glass foreign."

Witness replied that it would be fairer to say on the container that the glass was foreign because there was difficulty in obtaining it from British manufacturers.

Mr. Hailwood put it to witness that Messrs. Hailwood and Ackroyd had on one occasion supplied some glass battery containers to the Chloride Electrical Storage Co. but they had been rejected, whereas the very same container had been accepted by the Post Office.

Witness replied that he was not aware of the instance. In answer to further questions by Mr. Hailwood on the point of encouraging the British glass maker, Mr. Mills emphasised the fact that his company bought over 90% of its glass containers in this country. He claimed, therefore, that the British battery makers were doing their best to encourage British glass makers though admitted that the latter had done much to meet the requirements of the British battery maker.

Mr. Hailwood suggested that there was a desire to "stimulate" British glass makers to produce under sweated conditions.

Witness denied that and replied that if the British glass makers did not wish to supply these containers and imported containers had to be marked, then probably the battery makers would have to use compound containers.

BUSINESS ITEMS.

NEW offices at St. Neots have been opened by the BEDS, CAMBS AND HUNTS ELECTRICITY CO.

The address of RADIO INTELLIGENCE, LTD. has been changed to Marconi House, Strand, London, W.C.

The Bucharest Radio Exhibition has been postponed, and will be held from August 15th to October 1st.

ALBERT E. SUDLOW AND CO. have vacated 25, Dickinson Street, Manchester, and have taken over new premises at 60, George Street.

T. BEADLE AND CO., LTD., wholesale electrical factors, of Liverpool, Hull, Grimsby, and Leicester, have opened a new branch business at 96, Hamilton Street, Birkenhead.

Mr. J. F. CROFTS has retired from Messrs. CROFTS AND SMITH, electrical and radio engineers, Queen Street, Deal, and the business will be continued by Mr. E. W. Smith, his partner.

The EDISON SWAN ELECTRIC CO., LTD., 123–5, Queen Victoria Street, London, E.C.4, announces price reductions of "Ediswan" vacuum type grid leaks and anode resistances.

Included in a Bristol Exhibition illustrating modern furnishing tendencies is a number of modern lighting fittings, including designs by Perzel lent by Messrs. TROUGHTON AND YOUNG of Knightsbridge.

For the signalling of the new terminal station at Auckland, N.Z., the Westinghouse electro-pneumatic system of power operation, together with a.c. track circuits and day colour light signals, has been selected, and the contract has been awarded to the WESTINGHOUSE BRAKE AND SAXBY SIGNAL CO., LTD., of 82, York Road, King's Cross, London, N.1. The plant (including the air compressors) will be supplied from England by the Westinghouse Brake and Saxby Signal Co., Ltd., with the exception of the interlocking frame of 128 levers, which will be built at Melbourne, Victoria, in the shops of their associated company, McKenzie and Holland (Australia), Pty., Ltd., Newport, Melbourne.

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COMPANY NEWS.

Electricity Supply Holdings Improve, but Market Generally Inactive—Marconi Report—Cable and Wireless Descriptions Steady—Company News and Meetings—New Companies Registered.

INACTIVITY has characterised share markets during the past week, though one or two movements call for notice. Shropshire, Worcestershire and Staffordshire Power "B" ordinary shares have risen another five shillings and are near £2 10s., and Newcastle-upon-Tyne Supply ordinary shares at 26s. 3d. are 1s. 3d. up. In the manufacturing section British Insulated Cables are up again to 75s., and Henleys at 122s. 6d. are half-a-crown to the good. General Electric have had a further relapse, and the movement was continued below the price officially given in our table. British Electric Transformer shares are 1s. 3d. down at 13s. 9d.

Last Annl. Divd.	Description	This Week.	Last Week.	1926 to 1928. Highest	Lowest
%	**Electricity Supply.**				
(*d*)	Brompton & Kensington Ord. ..	26/-	26/-	35/6	23/9
4	Central Elec. Sup. 4% Deb. ..	94	94	95½	88½
(*a*)	Charing Cross Elec. Ord. (£1) ..	26/-	26/-	51/-	24/3
4½	,, ,, ,, 4½% C.P. (£1)	17/6	17/6	18/3	16/6
(*b*)	Chelsea Elec. Sup. Ord.	26/6	26/-	45/3	24/-
10	City of Lond. Elec. L'ting Ord. ..	33/1½	33/1½	52/10½	26/-
6	,, ,, ,, ,, ,, 6% C.P.	23/-	23/-	24/3	21/6
10	County Lon. Elec. Sup. Ord. ..	56/-	54/-	68/6	25/9
6	,, ,, ,, ,, 6% C.P.	23/-	23/-	24/-	21/3
(*c*)	Kensington & K'bridge Ord. (£1)	26/6	26/6	27/6	23/9
1/9⅜	Lon. Elec. Sup. Ord. (£1) ..	27/6	27/6	37/6	23/-
1/9⅜	Metro. Elec. Sup. Ord.	47/6	41/3	53/-	24/9
4½	,, ,, ,, 4½% C.P. ..	17/6	17/6	18/3	16/3
7½	N'castle & Dis. Elec. Ltg. Ord. ..	27/6	27/6	31/9	17/6
1/2⅝	N'castle-upon-Tyne Elec. Sup.Ord.	26/3	25/-	30/3	19/3
6	N. Metro. Elec. 6% C.P.	23/-	23/-	23/9	20/10
6	Notting Hill 6% C.P. (£10) ..	11	10½	11½	9½
(*c*)	St. James & P.M. Ord (£1) ..	27/6	27/6	28/6	23/6
1/4⅝	Shrops. Worcs. & Staffs. Power B. Ord.	48/9	43/9	37/6	21/4
1/9 1/12	W'minster Elec. Sup. Ord. (£1) ..	26/-	26/-	52/9	24/-
4½	,, ,, ,, 4½% C.P.(£1)	17/6	17/6	17/10½	16/7½
8	Yorks. Elec. Power Ord.	34/-	34/-	38/9	24/6
6	,, ,, ,, 6% C.P. ..	24/-	24/-	26/9	20/7
	Railways and Tramways.				
8	Brit. Elec. Trac. Pfd. Ord. Stk. ..	128	128	152	117
6	,, ,, ,, 6% Pf Stk.	127½	127½	133	103½
4	Cent. Lon. Ry. Ord. Stk. (asstd.)	72	72	72	54
4	,, ,, ,, 4% Deb.	80	80	83	77½
4	City & S. Lon. 4% Perp. Deb. ..	78½	78½*	81	76½
5	Lon. Elec. Rly. Cons. Ord. Stk. ..	73½	73½	75½	42½
4	,, ,, ,, ,, 4% Pf. Stk.	73	73	77	68
4	,, ,, ,, ,, 4% Deb. ..	80	80	83	76½
5	Lon. & Sub. Trac. A. Deb. ..	95½	95½	97½	74
4	Lon. Un. Trams. 1st Deb... ..	64	62	63	39
4½	Met. Elec. Trams, 4½% Deb. ..	72	72	73½	62
5	,, ,, ,, 5% Deb. * ..	67½	67½	70½	65½
3½	Met. Rly. Cons. Ord. Stk... ..	60	59½	81	54½
3½	,, ,, ,, 3½% Pf. Stk. ..	63	63	67	60½
3½	,, ,, ,, 3½% Deb. ..	70	70	73½	67½
5	Met. Dis. Rly. Ord. Stk.	76½	75½	77½	52½
4½	,, ,, ,, 4½% 1st Pref. ..	81½	81½	84	74½
6	,, ,, ,, 6% Perp. Deb. ..	116½	116½	118½	110
4	S. Met. Elec. Trams, 4% Deb. ..	70	70	70	64½
7	Underground Electric Rlys. Ord.	24/-	23/6	28/2	11/-
—	Yorks. (W.R.) Trams, Ord. ..	5/-	5/-	16/-	3/-
4½	,, ,, ,, 1st Deb. ..	59	59	78	60
	Electrical Manufacturing.				
7	Brit. Elec. Transformer 7% C.P...	13/9	15/-	19/10	4/6
15	Brit. Insulated Cables Ord. ..	75/-	67/6	86/3	56/-
6	,, ,, ,, 6% C.P. ..	22/6	22/6	23/10	21/-
7	British Thomson-Houston Pref. ..	23/9	23/9	24/9	19/7
7	,, ,, ,, 7% Deb.	103½	103½	109½	102½
10	Brush Electrical Ord.	28/9	28/9	30/9	24/-
15	Callender's Cable Ord.	87/6	87/6	91/3	66/-
6½	,, ,, 6½% C.P. ..	25/-	25/-	25/9	22/-
7½	,, ,, 7½% B. Pref. ..	27/6	27/6	28/3	25/-
8	Crompton-Parkinson 8% Cum. Pf.	25/-	25/-	27/-	14/-
6	,, ,, 6% Cum. 2nd Pf.	17/6	17/6	19/6	9/7
7½	Edison Swan Elec. 1st Pref. ..	25/7½	25/7½	13/-	7/4½
5	,, ,, ,, 1st Deb. Stk.	86½	86½	92	81½
7½	Elec. Construction Ord.	18/9	20/-	32/6	23/6
7	,, ,, 7% C.P. ..	22/6	22/6	22/9	21/-
—	English Elec. Ord.	6/3	6/3	15/9	5/-
—	,, ,, 6% C.P. ..	8/1½	8/1½	18/9	7/-
7	Ericsson Telephones 7% Pref. ..	20/-	20/-	22/7½	17/6
35	Ever Ready (Gt. Britain) Ord. ..	23/3	23/-	92/3	18/1
6	Ferranti 6% Pref.	18/-	18/-	19/4½	16/9
7	,, 7% 2nd Pref.	21/3	21/3	19/3	13/9
10	General Elec. Ord.	58/9	60/-	46/6	26/6
‡25	W. T. Henley's Ord.	122/6	120/-	120/-	69/3
12½	Johnson & Phillips Ord.	36/3	36/3	67/11	34/-
7½	Lon. Elec. Wire & Smith's Pref...	23/9	23/9	25/-	22/3
7½	Siemens Bros. & Co. Ord. ..	27/6	27/6	36/6	24/9
10	Telegraph Const. Ord. (£12) ..	24½	24½	30½	20
	Telegraph.				
3½	Anglo-Am. Tele. Ord. Stk. ..	61½	61½	63½	56½
10	Eastern Ord. Stk.	280	280	273	135
3½	,, 3½% Pref. Stk.	67½	67½	70½	59
4	,, 4% Deb.	78½	79½	81½	74
10	Eastern Extension Ord. (£10) ..	28	28	27½	14
22	Gt. Northern Telegraph (£10) ..	33	33	43½	26
10	Indo-European (£25)	52½	54½	48½	30
20	Marconi's Wireless T. Ord. ..	85/-	85/-	84/4	12/-
15	,, Int. Mar.	65/-	65/-	90/-	16/6
10	Western Tel. Ord. (£1)	28	28	27½	12½

(*a*) 19.⅘d. per share. (*b*) 1s. 9·3d. per share. (*c*) 1s. 6·949d. per share.
(*d*) 1s. 8·706d. per share. (*e*) 1s. 7·181d. per share. ‡ Including 1s. bonus.
* Ex dividend.

AEONIC RADIO, LTD.—Directors propose immediate increase of cap. by issue of 1 250 000 shs., to be offered to the shhldrs at par.

RICHARD JOHNSON AND NEPHEW, LTD.—Div. at rate of 8% on ord. shs. recmded. Pref. div. for half-year will be payable June 1 and ord. June 4.

BRITISH ELECTRIC TRACTION CO., LTD.—Directors recmd. cash div. of 5%, less tax, def. ord. stk. and bonus of 10% fully-paid £1 def. ord. shs. for year ended March 31.

SHROPSHIRE, WORCESTERSHIRE AND STAFFORDSHIRE ELECTRIC POWER CO.—An offer to purchase whole of "A" and "B" ord. shs. at 50s. p. sh., ex. divs. payable May 15, has been received.

CALCUTTA ELECTRIC SUPPLY CORPORATION, LTD.—Pft. for 1928, £401 803, plus £47 683 brt. in. Deb. int., £27 500; pref. div., £48 889; div. on ord. shs. (5% actual) for half-year to June, 1928, £67 652; sinkg. fund on 2nd mtge. debs., £12 500; res. for taxes, £32 000; res. fund, £75 000; insurance, £3 000; retiring gratuity fund, £2 000; reserved for distributn. to domestic consumers, £22 551; div. on ord. shs. of 7% actual for second half-year, less tax, makg. 12% for year, plus 4d. p. sh. bonus, less tax. Fwd. £41 130.

PYE RADIO, LTD.—Statutory rpt. states that shs. allotted include 150 000 8% cum. participatg. pfd. ord. shs. of £1 ea. and 600 000 dfd. ord. shs. of 1s. ea. Cash recd. in respect of shs., £158 920. Payments: C.O. Stanley, cash purchase consideratn., includg. remuneratn. to W. G. Pye and Co. and int. to Feb. 12, 1929, £88 049; prelim. exes., £17 939; on acct. of new bldgs., £1 000; on acct. of new plant, £142; trading paymts., £58 941; blce. at bankers, £55 756.

EVER READY CO. (GREAT BRITAIN), LTD.—Pft. for year ended March 31, 1929, £210 167 (increase £22 204), plus £30 022 brt. in. To res. £41 130; donatns., £363; intm. div. on pref. shs. at rate of 10% p.a. for half-year ended Sept. 30, 1928, paid Nov. 30, 1928, £10 000; intm. div. at 10% on ord. shs. paid Nov. 30, 1928, £47 000; fin. div. of 5% on pref. shs., makg. 10% for year, £10 000; fin. div. of 25% on ord. shs., £92 500; div. of 25% on ord. shs. issued fully paid as bonus, £18 500; fwd. £30 696.

CHLORIDE ELECTRICAL STORAGE CO., LTD.—Report for year to March 31 shows pfit. of £216 936, agst. £185 097. Directors recmd. 5% div., with bonus of 3s. per sh., tax free on ord. shs., making 25%, providg. £11 500 for benefit employees, transfer of £50 000 to gen. res. (makg. £350 000), carryg. £69 833 fwd., agst. £59 822 bt. in. In Dec. last 65 925 "A" ord. and 14 000 "B" ord. were issued at £4 per £1 sh. These new shares rank for final div. in respect of year to March 31. Meeting, Manchester, May 17.

BIRMINGHAM DISTRICT POWER AND TRACTION CO., LTD.—Rev. for past year amntd. to £120 626, agst. £119 914 1927 and £119 740 for 1926. Deductg. charges for renewals, debenture int., taxes, etc., and addg. £44 995 bt. in, disposable total is £126 882. Allocation to reserve raised from £17 618 to £29 605, makg. £137 500, and the sum placed to deb. stk. sinkg. fund is £13 707, agst. £12 961. Div. of 7% on ord. is proposed, carryg. fwd. £45 855. The redemption of £19 598 of the first deb. stk. has reduced amnt. outstandg. to £244 131. Meeting, May 29.

BRITISH ELECTRIC TRANSFORMER CO., LTD.—In report for 1928 directors state that in order to provide workg. cap. to execute additional orders on hand negotiatns. are under way for the sale of some of co's properties. Pending realisation they have decided to postpone paymt. of half-year's pref. div., payable March 1. At later date consideration will be given to question of payg. div. Accounts for 1928 show that net pfts. dropped from £53 703 in 1927 to £14 740. With £10 855 bt. in total available is £25 595. It is proposed to place to deprctn. res. £4 000 (agst. £5 000). Pref. div. for half-year to June 30 last took £10 500, and it is proposed to carry fwd. £11 095. Meeting, May 21.

BRITISH POWER AND LIGHT CORPORATION (1929), LTD.—This co. invited this week subscriptions for 1 600 000 £1 fully paid shs. The Corporation has made arrangements for the purpose of acquiring a controlling int. in the North Wales Power Co., Ltd., Electricity Distribution of North Wales and District, Ltd., and the whole issued sh. cap. of the East

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Suffolk Electricity Distribution Co., Ltd., the South Somerset and District Electricity Co., Ltd., the Trent Valley and High Peak Electricity Co., Ltd., the West Hampshire Electricity Co., Ltd., and the Ringwood Electric Supply Co., Ltd. The technical and commercial organisatns. of all these cos. will be centralised under the supervision of the corpn.

MARCONI'S WIRELESS TELEGRAPH CO., LTD.—Report for 1927 states that pfit. after pymnt. of deb. int. and pref. div., was £412 971, which, with the £25 196 bt. fwd. from 1926, left available £438 168. Two intm. divs. of 10% absorbed £414 390, leaving to be carried fwd. £23 777. Figures for 1928 are not finally made up or audited, but directors anticipated that profit available after pymnt. of deb. int. and of the pref. div. was approx. £408 500, which, with carry-forward from previous year, leaves total bal. available of £432 278. Directors decided to pay intm. div. out of pfits. for 1928 of 20%, less tax, on ord. shs. and an additnl. 10%, less tax, on 7% cum. partcptg. pref. shs. This will leave £3 252 to carry fwd. More detailed explanation of figures will be given at the general meetg on May 29. On or about May 18 shhldrs. will receive from the Bank of England an offer on behalf of Cables and Wireless to exchange shs. for shs. in that co. The report summarises the events leading up to the formation of Imperial and International Communications and Cables and Wireless. On the assumption that Cables and Wireless could pay int. on its pref. and "A" ord. shs., and that the Marconi Co. could pay 20% on its ord. shs., the div. position of hldrs. of 100 ord. shs. of £1 each, would be: Those who did not exchange would receive £20; those who did, £22 12s. 9d. The holders of 100 7% pref. shs. who did not exchange would receive £17; those who did £22 12s. 9d. Should Cables and Wireless be able to make a distribtn. not only on its pref. and "A" ord., but also on "B" ord. shs., those who did not exchange would be in a less favourable position. Directors recmd. all classes of shhldrs. to exchange their shs. for shs. in Cables and Wireless. At the meeting to be held on May 29, resolutions concerning certain new articles, and conditions for directors will be proposed, and, if passed, will be submitted for confirmation at an extraordinary meeting on June 26.

Company Meetings.

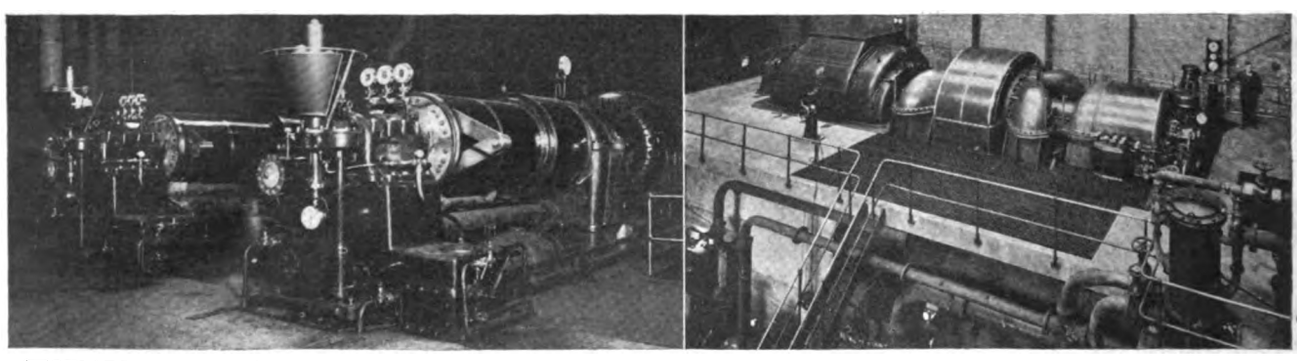
TRUPHONIC RADIO, LTD.—At the statutory meeting on May 10th, Lt.-Col. Sir Rhys Williams (chairman) said that the progress of the company could be described as phenomenal. With very little expenditure on advertising, orders amounting to three times the figure budgeted for had been received. Notwithstanding certain difficulties at the start, which had now been overcome, production had increased from 30 sets a week in February to 700 a week in April. As a result of attempting to fulfil the unexpectedly large orders their purchases of materials and labour costs were greater than was anticipated, and their working capital of approximately £27 000 was inadequate. It would therefore be necessary for shareholders to decide whether the company should limit its output, or whether they should continue to increase their present business, which would require further capital. The chairman having replied to questions, the proceedings terminated.

CABLE, TELEPHONE AND GENERAL TRUST, LTD.—Sir Alexander Roger, presiding at the meeting on May 8th, said they had paid the fixed dividends on the 6% cumulative preference shares and the "A" 7% non-cumulative preference shares, and were able to recommend the payment of a dividend on the ordinary shares of 4%, less tax, for the year, carrying forward £1 050, against £985 brought in. Specialisation in investment trusts, whose directors possessed an intimate knowledge of particular industries, was gradually spreading. In the case of their own company, which had been giving particular attention to the great telephone and cable industries and services connected with communications generally, they had sought to maintain a distribution of their interests over the various kinds of securities in the various countries throughout the world. The directors felt that a firm foundation had been laid on which their company could build, and they looked forward to the future with considerable confidence. The report and accounts were adopted.

NIGERIAN ELECTRICITY SUPPLY CORPORATION, LTD.—A statutory meeting of this company was held on May 10th, the Hon. Lionel Holland (chairman), presiding. This company was formed to acquire and complete the constructon and equipment of a hydro-electric installation at the Kurra Falls, on the Nigerian tin plateau. The company's programme provides for an initial installation of three units of 2 000 H.P. capacity each, so as to maintain 4 000 H.P. in permanent operation with a standby unit of 2 000 H.P., and subsequently for additional plant to bring the generating capacity up to 6 000 H.P., rising to 10 000 H.P. during the rainy season. The cost of the scheme is estimated to be £370 000. The plant is on order and constructional work well advanced. It is anticipated that the storage reservoir, with a capacity of nearly 3 000 million gallons, will be completed by the end of March, 1931, but that before then, by making use of the flow of the river for generation purposes, a considerable revenue will be earned from the supply of power.

INTERNATIONAL TELEPHONE AND TELEGRAPH CO.—At a special meeting of stockholders in Baltimore, on May 8th, the recommendations of the directors for an amendment to the charter of the corporation was approved, as follows: "To change the shares of capital stock of the corporation from shares each of a par value of $100 to shares without par value and to increase the authorised capital stock of the corporation from 2 500 000 shares of a par value of $100 each to 15 000 000 shares without par value and to change the number of issued shares of capital stock of the corporation to three times such number." It was announced that the amendment to the charter of the corporation would be filed with the State of Maryland on May 9th, making that date the effective date of the change. The directors, on May 9th, announced that they had authorised the issue of common stock without par value at an issue price of $50 per share and the offer of such stock to the stockholders for subscription in the ratio of one share for each 10 shares of no par value stock, or their equivalent, standing on the transfer books on May 24th.

BRITISH THOMSON-HOUSTON CO., LTD.—At the meeting on May 8th, Mr. H. C. Levis, chairman, said the profits for the past year, after deducting all expenses and charges other than interest on dividends and loans, were £422 729, to which was added the amount brought forward, £200 512. Interest on debentures and loans required £152 244, which was £27 500 less than the previous year, and the directors recommended



TOWARDS the end of last year the 10 000 kW two-cylinder turbo-alternator set, shown in the right-hand picture, was put into service at Ocker Hill, in the West Midlands Electricity District. The erection of the set and its condensing plant was completed by the English Electric Co., and we understand that in 3½ months' running on day load—8 a.m. to 5.30 p.m.—it has generated 6½ millions kWh without adjustments. In contrast to this modern plant are the two 1 500 kW reaction type turbo sets shown on the left, which were installed by the same company in 1906. After generating nearly 50 million kWh in the first six years these machines were still giving service during peak loads last winter, twenty-two years after their installation.

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that there should be appropriated for depreciation £119 950. They then deducted the dividends paid on the preference shares during the year at the rate of 7% per annum, and recommended the payment of a dividend on the ordinary shares at the rate of 4% per annum, less tax, leaving £203 066 to carry forward. The amount of loans had been reduced from £1 310 000 to £335 000. They were enabled to make this reduction from the payments received for the Ediswan and Ferguson Pailin shares which the company owned. The holdings of the ordinary shares of that company by the International General Electric Co. of New York, together with the other ordinary shares of the company, had now all been acquired by Associated Electrical Industries, Ltd., but they could never speak too highly of the help and assistance which had been rendered to that company in the past, in both technical and financial directions, and which had been so instrumental in helping to build up that great business. The report and accounts were adopted and the dividends approved.

JOHNSON AND PHILLIPS, LTD.—Mr. John Macgregor presided at the meeting on May 9th. In consequence of the fact that he still felt some effect of the motor accident which happened to him last year, Mr. G. L. Wates read his speech, in which he said: The profits of the year, after making provision for bad debts and charging to revenue upwards of £15 000 for maintenance of buildings, plant, etc., mount to £106 417, to which is added £85 072 brought forward. Trading during 1928 was difficult and the expected revival in the demand for electrical apparatus did not mature during that year. The directors recommend the payment of a final dividend of 5%, less income tax, making a total of 10% for the year, leaving to be carried forward £80 903. The falling off in business which occurred towards the end of the year has passed, and there are now more orders going through the works than at this time last year. The demand for electrical plant has not yet caught up with the productive capacity of the industry. The low price of copper ruling during 1928 affected the value of the turnover and the ratio of profit. The exceptionally large contracts now being placed by the Central Electricity Board are bound to have a beneficial effect on our business in the future. The electrification of the rest of our railways in heavy traffic areas is a certainty of the near future. The results shown by those electrified already in operation have put this beyond doubt. The extension of our telephone system is a programme to which all political parties are committed; so is the development of our Crown Colonies, in connection with which we have already secured much valuable business. The expansion of our business in South Africa has resulted in our forming a subsidiary company in that Colony known as Johnson and Phillips (Pty.), Ltd., the whole of the share capital of which belongs to this company, and which South African company will be utilised for the purpose of our future business in the Colony. The report and accounts were adopted and the dividend was approved.

New Companies.

DUAL MOTORS, LTD.—Cap., £20 000. Manufacturers, importers, and exporters of and dealers in electrical and other motors for gramophones or otherwise, etc. Reg. office: 86, New Bond Street London, W.

SOUTHEND AND DISTRICT ELECTRIC SUPPLY CO., LTD.—Cap., £100. To acquire the business formerly carried on at 17, Commercial Street, London, E.1, as "H. Goldman," and to carry on business of dealers in and factors and suppliers of electrical and wireless appliances, etc. Solicitors: Appelbe and Morrison, 17, Commercial Street, London, E.1.

WESTERN ELECTRIC CO., LTD.—Cap., £20 000. Manufacturers and sellers of equipment and apparatus for reproduction, transmission, amplification or recording of sound by electrical or other means, independent of, or in connection or synchronism with or as incidental to the exhibition of motion pictures or for the transmission of pictures or images, etc. Solicitors: Johnson, Jecks and Colclough, 24, Austin Friars, London, E.C.

THE BRUSH ELECTRICAL ENGINEERING CO., LTD.

Problem of Excessive Competition—Electrical Industry on High Level of Activity—Volumes of Work, but Meagre Net Profits.

THE 40th general meeting of the Brush Electrical Engineering Co., Ltd., was held at the Holborn Restaurant, London, W.C., on Monday.

Mr. E. Garcke (chairman) said that he hoped that shareholders would agree that the present financial and industrial position of the company was satisfactory. It was right, however, that he should not attempt to gloss over the present situation, namely, that the prospects of maintaining the position was not altogether unclouded. The electrical industry as a whole had never in his experience been on a higher level of activity, or possessed a more favourable outlook of capacity to render service to the community than at present. However, the activity which characterised their industry was not shared by other important and kindred industries in this country. Those general clouds were now threatening to overshadow their own industry. To state it quite plainly, the industrial position of the country was not satisfactory. The problem with which they were confronted was the existence of excessive competition out of all proportion to the merits of emulation and efforts to improve the results of enterprise. It seemed ridiculous that the large capital now invested in the industry should be the means of producing huge volumes of work of a highly technical character with such meagre results in net profits. Where the bad general situation hit them in particular was that during the past year they had to sell about 25% more output in order to obtain the same profit. Such a situation could not continue for long.

The fact that the Brush Company had enjoyed a moderate measure of success since the War was due largely to special circumstances, for they had deliberately adopted the policy of concentrating their activities on three or four special lines, such as the Ljungstrom turbine, transformers and rolling stock for transport undertakings. Further, they had specialised in the relatively small sizes of the Ljungstrom turbine and had left the larger sizes of other turbines to be made by other firms.

Latterly, the Electricity Commissioners, in pursuance of the Electricity Act of 1926, had decided to discourage—he might say prevent—the extension of plant at many of the smaller electricity supply stations in the country, in order to concentrate the generating of electricity at relatively few "selected" super-stations. That was a development o which they must not complain, but they had had every reason to hope that the supersession of the smaller generating stations in favour of the concentration at the larger stations would be a more gradual process than appeared probable. The directors were confident that the Commissioners had every desire to promote the interests of the manufacturing industry consistently with those of the general community and hoped that the Commissioners would be able to carry out the change from small to large stations by evolutionary steps, with due regard to the dangers and detriment of undue haste in the nature of revolutionary measures.

With regard to the results of the year, the gross profit amounted to £153 857, being £6 800 more than in the preceding year. After allowing for various debits, placing £6 000 to reserve, and paying a 10% dividend, there was a net surplus of £11 700, or nearly £1 000 more than in 1927. Of that surplus £9 800 was payable to the co-partners and £1 900 to the shareholders in accordance with the co-partnership deed. With regard to that surplus, it had been the intention of the scheme that the proportion belonging to the shareholders should be distributed annually, but the amount had not been sufficiently large to justify a distribution. The aggregate now admitted of a distribution of 1% on the share capital, and the directors had decided to make that distribution this year as an addition to the standard dividend of 10%. The directors proposed that the shares of the company should be converted into stock, which would facilitate the distribution of amounts of small denomination. They were anxious to put the co-partnership scheme in a thoroughly satisfactory position of fairness all round, and as soon as the formalities had been completed in connection with the conversion into stock the stock holders would have the option of receiving that 1% either in cash or in fully paid stock at par. The co-partnership scheme had now been in operation for about three years. It was difficult to say how much of the increased profits earned was attributable to the operation of the scheme, but he was certain that all the men appreciated what had been done.

The report and accounts were unanimously adopted, and a resolution was passed converting the share capital of the company into stock.

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COMMERCIAL INFORMATION.

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debt. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

ALLENBY, Mr. G. A., 30, Salisbury Street, Hull, electrical contractor. £10 19s. 6d. April 5th.

ARTHUR, Mr. H., 16, Cheetham Street, Rochdale, radio engineer. £26 19s. 4d. March 13th.

CARRUTHERS, Thomas, Excel Store, Eden Street, Silloth, wireless dealer. £19 13s. 8d. March 22nd.

CHARTERS ELECTRIC SUPPLIES CO., LTD., 25, King Street, Warrington, electrical contractors. £20 17s. 6d. March 11th.

ERA ELECTRICAL RADIO SOCIETY, 331A, Romford Road, Forest Gate, wireless dealers. £19 0s. 9d. March 4th.

FORBES (P. N.), LTD., 33, Archway Road, Highgate, electrical engineers. £21 4s. 11d. March 18th.

GIFFEN, Mr. S., 18, Heston Park Road, Hounslow, wireless dealer. £20 19s. 6d. March 13th.

KEMP, Mr. R. J. A., 57A, Briggate, Leeds, wireless dealer. £20 12s. 10d. March 25th.

RINTOUL, William, Imperial Buildings, 28, Bond Street, Leeds, electrical contractor. £14 8s. 4d. April 13th.

SHORTHOUSE, Mr. F. A., 922, Stratford Road, Sparkhill, wireless dealer. £22 5s. 11d. March 19th.

THORNTON (HUGH) AND SONS, 74, Manchester Road, Burnley, wireless dealers. £13 18s. 7d. March 28th.

YATES (J. E.) AND SON, 7, Kingsway Avenue, Whitkirk, radio engineers. £18 0s. 1d. March 13th.

Bills of Sale.

BAWTREE, Donald Wells, Bendoran, Salisbury Court Road, Banstead, wireless dealer. Dated May 11th, filed May 13th. £85.

DAVIES, James John Leopold, 9, Hillside, Gelli, Ystrad Rhondda, electrical engineer. Dated May 4th, filed May 9th. £120.

Deed of Arrangement.

FINNIGAN, Thomas, and POLLOCK, George, trading at 47, North Bridge Street, Sunderland, as FINNIGAN AND POLLOCK, electrical engineers and electrical contractors. Dated May 4th, filed May 10th. Trustee, F. Thompson, the younger, 46, John Street, Sunderland, C.A. Liabilities unsecured, £1 905; assets, less secured claims, £309.

Mortgages.

[NOTE.—*The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—allowed by the date of the Summary, but such total may have been reduced.*]

BADMAN (V.), LTD., Southall, wireless manufacturers.—Registered May 6th, £25 debentures, part of £200; general charge. *£1,025. December 1st, 1928.

THOMPSON RITCHIE AND CO., LTD., London, S.W., electrical engineers.—Registered May 2nd, £500 debentures, part of £4,000; general charge. *£2,251. January 13th, 1927.

London Gazette, etc.

Winding-up Petition.

EARLSDON RADIO SUPPLIES, LTD. A creditors' petition for winding-up has been presented by Burgoyne Wireless, Ltd., 34A, York Road, King's Cross, London, wireless factors, and is to be heard at St. Peter's Gate, Nottingham, on Thursday, June 20th, at 11 a.m.

Company Winding-up Voluntarily.

YOUNG ACCUMULATOR CO., LTD. By Special Resolution, April 4th, confirmed May 3rd. E. J. Bettson, C.A., 274, Gresham House, Old Broad Street, London, appointed as liquidator. Meeting of creditors at the offices of the liquidator, on Tuesday, May 21st, at 12 noon. (All creditors have been, or will be, paid in full.)

Bankruptcy Information.

HARRISON, Ernest Edward, 27, School Lane, Heaton Chapel, Lancashire, electrician. Receiving order, May 8th. Debtor's petition. First meeting, May 24th, 12 noon, Official Receivers' Offices, Byrom Street, Manchester. Public examination, June 28th, 10.30 a.m., Court House, Vernon Street, Stockport.

McBEAN, John Horace, trading as H. W. D. BATTERY CO., 29, Bradford Road, Batley Carr, Yorks, electrical engineer. First meeting, May 23rd, 11 a.m., Official Receiver's Office, 12, Duke Street, Bradford. Public examination, June 6th, 10.45 a.m., County Court House, Dewsbury.

MARSDEN, Charles Bertie, rear of 60, Pisgah Street, Kenfig Hill, electrical engineer. (R.O., 17/5/29.) Receiving order, May 11th. Debtor's petition.

PEOVER, Harry, electrical apparatus and tool merchant, Market Lane, Newcastle-upon-Tyne. Receiving order, May 6th. Debtor's Petition.

STIRZAKER, John, Tanyfynwent, Llanfairfechan, Caernarvon, electrical engineer. First meeting, May 23rd, 3 p.m., Official Receiver's Office, St. Peter's Churchyard, The Cross, Chester. Public examination, May 31st, 11.15 a.m., Court House, Bangor.

Notices of Dividends.

PERKINS, Sydney, 1, Lodge Lane, Beeston, Leeds, wireless dealer. First and final dividend, 1s. 9d. per £, payable May 24th, Official Receiver's Office, 24, Lower Bond Street, Leeds.

WILSHAW, George Marshall, and SHARPE, George, trading as WILSHAW AND SHARPE, 320, Padiham Road, Burnley, electrical dealers. First and final dividend, 2s. 6½d. per £, payable May 23rd, Official Receiver's Office, District Bank Chambers, Blackburn.

Notice of Intended Dividend.

SAVORY, Harvey, 7A, Hill Street, Shaw, Lancashire, electrical engineer. Last day for receiving proofs, May 25th. Trustee, J. D. Turner, Byrom Street, Manchester, Official Receiver.

METAL AND CHEMICAL PRICES.

TUESDAY, May 14th.

		Price.	Inc.	Dec.
Copper—				
Best Selected ..	per ton	£77 15 0	—	£2 15 0
Electro Wirebars	,,	£84 15 0	—	—
H.C. Wires, basis	per lb.	11 11/16d.	—	—
Sheet	,,	1s. 0d.	—	—
Phosphor Bronze—				
Wire (Telephone) basis	per lb.	1s. 2 11/16d.	—	—
Brass 60/40—				
Rod, basis ..	per lb.	9d.	—	—
Sheet ,, ..	,,	10 1/2d.	—	—
Wire ,, ..	,,	11 1/2d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£3 11 0	—	—
Galvanised Steel Wire, basis 8.S.W.G. ..	,,	£14 15 0	—	—
Lead Pig—				
English	per ton	£25 10 0	—	10s. 0d.
Foreign or Colonial	,,	£24 2 6	—	7s. 6d.
Tin—				
Ingot	per ton	£199 5 0	£1 12 6	—
Wire, basis ..	per lb.	2s. 7 1/2d.	—	—
Aluminium Ingots	per ton	£95 0 0	—	—
Spelter	,,	£26 15 0	5s. 0d.	—
Mercury	per bottle	£22 5 0	—	—

Sulphur—Flowers, Ton £12 0 0 *Sulphuric Acid*—
,, Roll ,, £10 10 0 (Pyrites, 168°) Ton £6 15 0
Copper Sulphate ,, £25 to £25 10 0 *Sodium Chlorate* per lb. 2½d.
Boric Acid (Crystals),, £30 0 0 *Sodium Bichromate* per lb. 3½d.
Rubber—Para fine, 11½d.; plantation, 1st latex, 11¼d.

∴ **The metal prices are supplied by British Insulated Cables Ltd.**

THE LEAD MARKET.

Quiet conditions have again prevailed in the market, and according to James Forster and Co., prices for forward lead have scarcely moved, but the May position, owing to declarations of American lead, has been a trifle easier. The American price remains unchanged at 7 cents.

Closing prices on May 10th were £24 5s. for May, £24 3s. 9d. for June, £24 2s. 6d. for July, and £24 1s. 3d. for August, 3s. 9d. down to unchanged on the week.

PARTRIDGE, WILSON AND CO., 217, Loughborough Road, Leicester, have issued a second edition of the booklet entitled "Commercial Accumulator Charging and the Efficiency of A.C. Rectifying Equipment."

ADAM HILGER, LTD., of 24, Rochester Road, London, N.W.1, have published a special booklet dealing with Prof. Coker's lateral extensometer and recording device for the measurement of stress distribution in materials, determination of Poissons ratio, etc. The same firm has also published a booklet on photo-elastic apparatus for determining the distribution of stress in structural and machine members.

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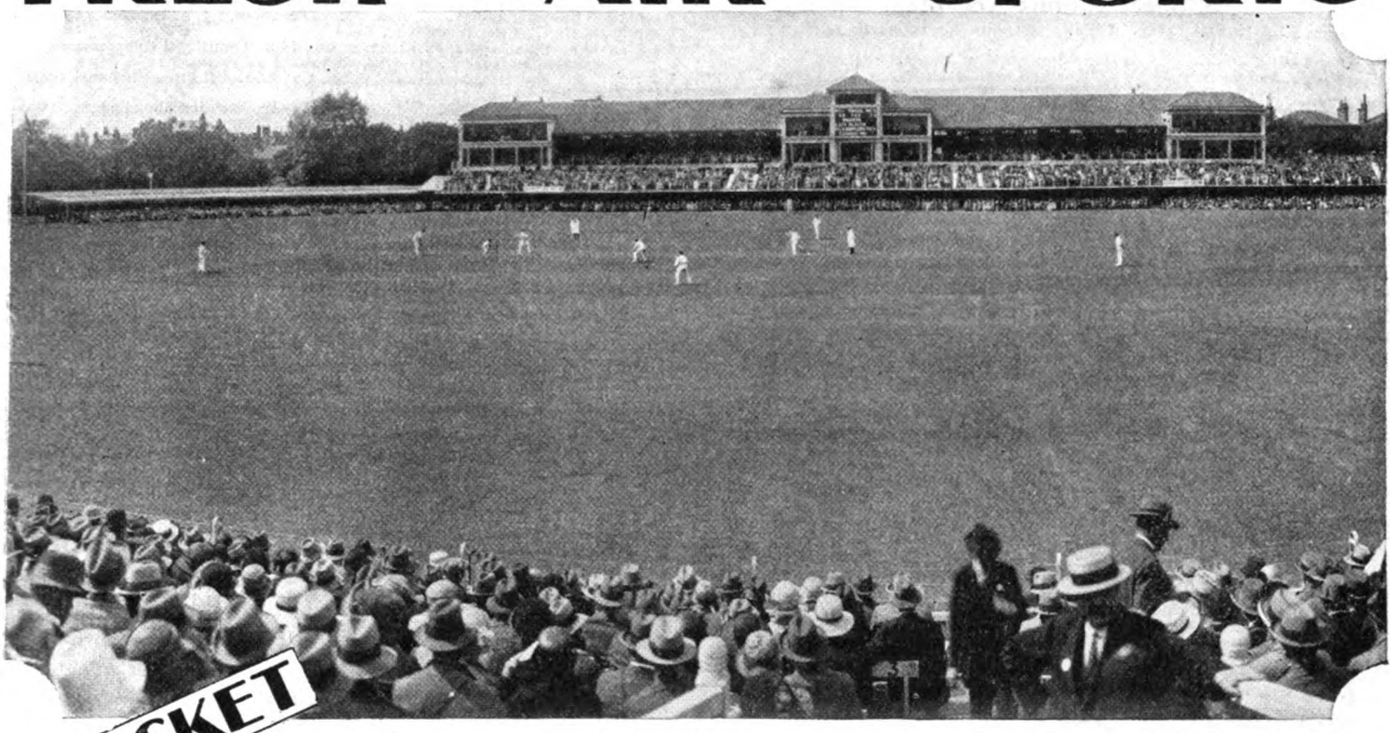
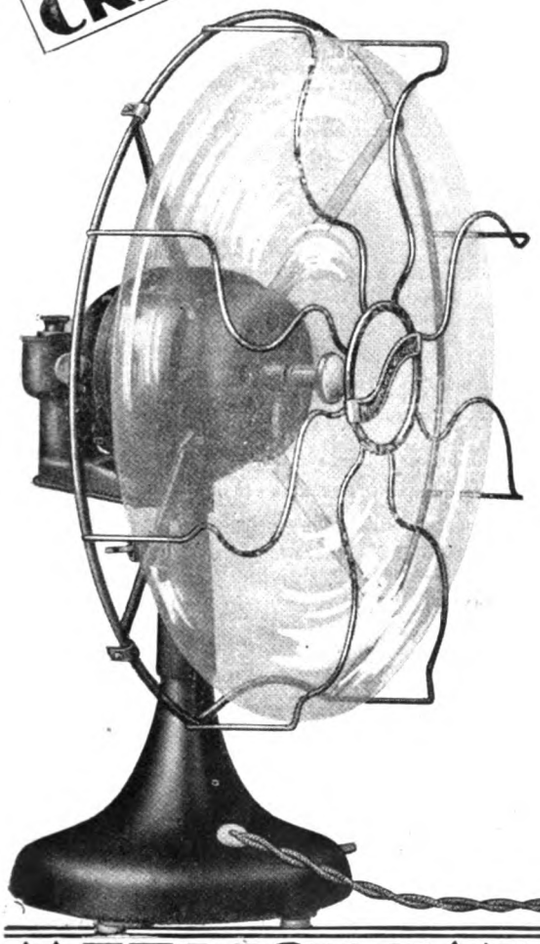
FRESH AIR SPORTS



Cricket at Lords (*Sport and General Press Agency Ltd.*)



THE NATURAL URGE

Summer Sports such as Cricket, either in the playing or merely in the watching, are expressions of that desire everyone feels, to participate in the health giving properties of the open fresh air.

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PATENT RECORD.

The following information is prepared from the Illustrated Official Journal (Patents) by permission of the Controller of H.M. Stationery Office. Printed copies of full Patent Specifications, when accepted, may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at 1s. each.

Specifications Accepted.

308 385 C. A. SCHIERWATER. Dialling apparatus for automatic telephone instruments. (2/1/28.)
308 388 W. J. JOHN and H. WRIGHT JUN. Electric fuses. (6/1/28.)
308 401 SMITH METERS, LTD., E. W. SMITH, and H. E. AND A. W. ANGOLD. Coin freed prepayment mechanism for electricity meters. (19/1/28.)
308 393 J. E. POLLAK (HERMSDORF SCHOMBURG ISOLATOREN GES.). Electrical insulators. (10/1/28.)
308 398 SIEMENS BROS. AND CO., LTD., E. A. PETITHORY, and E. R. GARROD. Electric current interrupters. (18/1/28.)
308 400 BRIGHTON LIGHTING AND ELECTRICAL ENGINEERING CO., LTD., and E. HEAPS. Signalling devices for traffic controlling purposes. (19/1/28.)
308 406 BRITISH THOMSON-HOUSTON CO., LTD., and J. G. WELLINGS. Electric transformers. (27/1/28.)
284 630 BRITISH THOMSON-HOUSTON CO., LTD. Safety devices for electrical apparatus. (1/2/27.)
308 413 J. MCCULLUM. Lead sheathed electric cables. (3/2/28.)
308 416 BRITISH THOMSON-HOUSTON CO., LTD., A. A. POLLOCK, J. HUTT, and A. G. SALISBURY. Electric motors. (4/2/28.)
308 425 M. BING. Electrical plug and socket coupling with longitudinally divided sockets. (14/2/28.)
308 432 BRITISH THOMSON-HOUSTON CO., LTD., and L. GRIFFITHS. Magneto-electric machines. (21/2/28.)
308 440 GENERAL ELECTRIC CO., LTD., and N. C. SMART. Electrical signalling systems. (28/2/28.)
286 693 BRITISH THOMSON-HOUSTON CO., LTD. Systems of protection and control for electrical distribution systems. (9/3/27.)
308 448 MULLARD RADIO VALVE CO., LTD., and C. F. M. HAYES. Telephone instruments. (8/3/28.)
308 449 MULLARD RADIO VALVE CO., LTD., and C. F. M. HAYES. Telephone instruments. (8/3/28.)
287 484 MARCONI'S WIRELESS TELEGRAPH CO., LTD. Piezo-electric devices. (21/3/27.)
308 475 QUASI-ARC CO., LTD., and A. P. STROHMENGER. Electrodes for use in electric arc welding. (27/3/28.)
308 476 HARBEN'S (VISCOSE SILK MANUFACTURERS), LTD., and W. E. SHARPLES. Electric switches. (27/3/28.)
308 478 BROWN BROS. AND CO., LTD., and W. WALLACE. Ram and connecting rod fitted particularly for electro hydraulic steering gears. (29/3/28.)
288 302 J. CHATWIN (MERANO GES. OPTIK-FEINMECHANIK). Hand magnifying glass with electric illumination between the lenses. (4/4/28.)
308 493 P. E. MCIVER. Wireless telegraphy and/or telephony. (14/4/28.)
308 494 R. P. A. ANDERSON. Electric incandescent lamp fittings. (14/4/28.)
308 497 STERLING TELEPHONE AND ELECTRIC CO., LTD., and R. E. MILES. Cases for electric condensers and other electrical components. (18/4/28.)
292 461 SIEMENS AND HALSKE AKT.-GES. Circuit arrangements for intermediate amplifiers in two-wire lines. (18/6/27.)
308 505 I. LITVINCHEV. Device for directing or guiding tramway or other cars at rail junctions. (2/5/28.)
290 165 BRITISH THOMSON-HOUSTON CO., LTD. Methods of and apparatus for making electric incandescent lamps and similar articles. (7/5/27.)
291 436 C. DUPUIS. Electric call apparatus. (3/6/27.)
308 508 J. Y. JOHNSON (I.G. FARBENINDUSTRIE AKT.-GES). Insulation and securing of coil windings of lacquered wire. (9/5/28.)
308 521 W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., and E. E. JUDGE. Lead covering of electric cables and the like by extrusion. (2/6/28.)
294 168 BRITISH THOMSON-HOUSTON CO., LTD. Thermionic apparatus. (19/7/27.)
294 145 C. BATY. Holders for electric lamps. (18/7/27.)
293 831 ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI. Testing arrangements for electric networks. (13/7/27.)
299 697 TELEPHON-APPARATIK-FABRIK E. ZWIETUSCH AND CO., GES. Impregnation material for use in electrical condensers. (29/10/27.)
298 131 N. KOOMANS. Directive aerials. (3/10/27.)
298 904 E. W. C. RUSSELL. Piezo-electric devices. (14/10/27.)
308 557 SMITH METERS, LTD., E. W. SMITH, H. E. ANGOLD, and A. W. ANGOLD. Coin-freed prepayments mechanism for electricity meters. (19/1/28.)
308 558 SMITH METERS, LTD., E. W. SMITH, H. E. ANGOLD, and A. W. ANGOLD. Coin-freed prepayment mechanism for electricity meters. (19/1/28.)
299 465 BRITISH THOMSON-HOUSTON CO., LTD. Voltage balancing for systems of electrical distribution. (27/10/27.)
301 326 TELEFUNKEN GES. FUR DRAHTLOSE TELEGRAPHIE. Radio transmitters. (24/11/27.)
303 150 TELEFUNKEN GES. FUR DRAHTLOSE TELEGRAPHIE. High frequency circuit arrangements, thermionic valve transmitters, and the like. (29/12/27.)
308 241 C. A. TURNER, Rotary electric switches. (15/11/27.)
308 625 A. F. BERRY. Apparatus for diffusion of light, heat and like radiant energy. (22/9/29.)
308 629 COMPAGNIE INDUSTRIELLE ET COMMERCIALE DU CYCLE ET DE L'AUTOMOBILE, and L. CHOLLET. Electrically-operated horns. (23/11/27.)
308 669 W. A. BURNS. Illumination and working of advertising-signs. (24/11/27.)
308 630 SIEMENS BROS. AND CO., LTD. and G. F. DUTTON. Microphones. (24/11/27.)
308 701 W. O. LITTLEBURY and IMPERIAL CHEMICAL INDUSTRIES, LTD. Electric blasting fuses and detonators. (24/11/27.)
308 638 A. J. ALDRIDGE, E. J. BARNES and E. FOULGER. Telephone transmitters. (23/12/27.)

Applications for Patents.

February 27th.

6 397 MACINTOSH CABLE CO., LTD., D. R. F. MILNER and J. G. ROBINSON. Fire proofing cable coverings, etc.
6 433 J. E. POLLAK (HERMSDORF-SCHOMBURG ISOLATOREN GES.). Arc guards for insulators or insulator chains.
6 393 POSTAL TELEGRAPH CABLE CO. Reproducing optical images at a distance. (29/2/28, U.S.)
6 454 TELEFONAKTIEBOLAGET L. M. ERICSSON. Selector contact bands. (28/2/28, Sweden.)
6 436 G. VIARD. Devices for maintenance of telegraph, etc., lines. (8/3/28, France.)
6 428 WESTINGHOUSE ELECTRIC AND MANUFACTURING CO. Electrode material for vacuum tube devices. (3/5/28, U.S.)

February 28th.

6 475 W. AITKEN. Automatic telephone systems.
6 567 ALLGEMEINE ELEKTRICITATS GES. Electricity meters. (29/2/28, Sweden.)
6 595 ASSOCIATED TELEPHONE AND TELEGRAPH CO. Remote control systems. (2/4/28, U.S.)
6 499 P. C. BARTON. Insulator mounting arms.
6 550 R. W. BLADES and BRITISH INSULATED CABLES, LTD. Arrangements for connecting electric cables.
6 549 L. G. BRAZIER and CALLENDER'S CABLE AND CONSTRUCTION CO., LTD. Apparatus for measurement of electrostatic capacity.
6 546 BRITISH THOMSON-HOUSTON CO., LTD. High frequency signalling systems (27/3/28, U.S.)
6 548 BRITISH THOMSON-HOUSTON CO., LTD., H. DE B. KNIGHT and G. S. C. LUCAS. Apparatus embodying light sensitive devices.
6 547 BRITISH THOMSON-HOUSTON CO., LTD. (Victor X-Ray Corporation). X-ray apparatus.
6 536 H. J. CAMP. Inductance coils.
6 599 H. C. CHANNON, J. H. DEAN and H. J. GARNETT. Insulating materials. (14/11/28.)
6 496 H. M. DUDGEON and T. C. E. ROWLAND. Current collectors for tramcars, etc.
6 539 A. EIDINOW and HEWITTIC ELECTRIC CO., LTD.—Radiant energy generating apparatus.
6 587 FABRIQUE D'APPAREILS ELECTRIQUES.—PAVARGER SOC. ANON. Apparatus for transmitting varying quotations of stocks, etc. (1/3/28, U.S.)
6 596 H. J. GARNETT and W. S. SMITH. Magnetic alloys. J. A. Holden.
6 497 W. E. GUY. Electric lamps and fuses.
6 545 INTERNATIONAL GENERAL ELECTRIC CO., INC. Centrifugal compressors with intermediate cooling. (1/3/28, Germany.)
6 611 B. KROL and MULLARD RADIO VALVE CO., LTD. Electron discharge tubes, etc.
6 531 V. J. D. LAWRENCE. Method of tracking needle of electrical pick-up.
6 607 T. G. MAIR and OLDHAM AND SONS, LTD. Galvanic batteries.
6 589 A. J. MARTIN and PLESSEY CO., LTD. Apparatus for reception of electrically transmitted pictures.
6 609 A. J. NEWMAN and F. H. STEPHENS. Electric switches.
6 524 A. H. RICE. Adjustable stand and electric heater for arc lamp.
6 525 A. H. RICE. Micrometer adjustment for arc lamp carbons.
6 616 G. VIARD. Devices for maintenance of telegraph lines, etc. (18/10/28, France.)
6 536 C. WATSON. Inductance coils.
6 604 R. N. WEBB. Electric condensers.

March 1st.

6 727 R. S. C. BALL and H. HEATHER. Slow speed electrical mechanism.
6 778 W. F. BEARDSHAW and S. H. KYNASTON. Picture telegraphy, etc.
6 683 D. M. B. BEAUMONT. Electric switches.
6 720 BRITISH THOMSON-HOUSTON CO., LTD. Electric furnaces. (1/3/28, U.S.)
6 722 BRITISH THOMSON-HOUSTON CO., LTD. Film controlled contact devices. (5/3/28, U.S.)
6 785 G. F. CLARK and GRAMOPHONE CO., LTD. Frames for electric motors of talking machines.
6 660 J. A. CRABTREE. Mounting electric switches.
6 787 R. T. DIXON and W. J. SILVESTER. Electric lamp holders for vehicles.
6 748 ELECTROACOUSTIC GES. Subaqueous sound transmitters. (10/3/28, Germany.)
6 784 GRAMOPHONE CO., LTD. and E. KNIGHT. Electric motors for talking machines.
6 781 J. HANSSON and N. KJELLSON. Burglar, etc., alarms.
6 659 T. R. HOLLIS and F. SHRIMPTON. Suspension chains for electroliers, etc.
6 755 A. E. HONEY and J. STONE AND CO., LTD. Electric regulators.
6 633 B. LOEWE. Arrangement for scattering auxiliary substance in vacuum valves. (1/3/28, Germany.)
6 712 G. C. AND P. A. LUNDBERG, A. P. LUNDBERG AND SONS, LTD. and G. PEGG. Electric switches.
6 711 G. MARR. Electric switches.
6 719 E. W. C. RUSSELL. Method of cutting piezo-electric crystals.
6 719 SCHUCKHARDT BERLINER FERNSPRECK UND TELEGRAPHENWERK A.G. Electromagnetic couplings. (28/12/28, Germany.)
6 761 A. E. WHITE (CENTRAL ELECTRIC TOOL CO.). Reciprocating motors. (13/4/28.)

March 2nd.

6 800 J. H. ASDELL. Illuminated signs.
6 870 ASSOCIATED ELECTRICAL INDUSTRIES, LTD. Photo-electric cells. (3/3/28, U.S.)
6 791 C. R. BAGGETT. Device for connecting dry cell batteries.
6 790 A. V. BOWATER. Locks, etc., for electric lampholders.
6 858 BRITISH THOMSON-HOUSTON CO., LTD. Resonant units. (2/3/28, U.S.)
6 832 O. E. BUCKLEY. Submarine cables.
6 863 J. N. CHAVIARA and J. F. GILL. Regulation, etc., of electric currents.
6 838 H. E. HUMPHRIES and SIEMENS BROS. AND CO., LTD. Electric selectors.
6 823 B. D. LEVY (R. A. BROWN). Portable electric light combination.
6 841 J. SALOMON. Electric motors (19/2/29, Germany.)
6 835 F. E. A. B. SEWELL. Wireless receiving circuits, etc.
6 878 SIEMENS AND HALSKE A.G. Incandescent lamps. (12/4/28, Germany.)

March 4th.

6 973 ACCUMULATOREN-FABRIK A.G. Sealing cover for cells of lead accumulators. (2/3/28, Germany.)
6 917 J. ANDERSON and G. ELLISON. Alternating current interrupters.
6 995 ASSOCIATED ELECTRICAL INDUSTRIES, LTD. Electric protective arrangements.
6 978 BRANDES, LTD. Contact terminals for electron tubes.
7 005 A. AND G. BRAY AND G. BRAY AND CO., LTD. Electrical connecting devices.
6 977 BRITISH THOMSON-HOUSTON CO., LTD. High frequency amplifier circuits. (2/3/28, U.S.)
6 968, 6 971 S. G. S. DICKER (N. V. PHILIPS' GLOELAMPENFABRIEKEN). Resistances.
6 969, 6 972 S. G. S. DICKER (N. V. PHILIPS' GLOELAMPENFABRIEKEN). Transmission of wireless signals.
6 979 S. DUNLOP (FU'LD AND CO. TELEPHON UND TELEGRAPHENWERKE A.G.) Telephone instruments.
7 032 ELECTRIC FURNACE CO., LTD. Annealing metal strips. (4/6/28, Germany.)
6 917 G. ELLISON. Alternating current interrupters.
7 040 GENERAL ELECTRIC CO., LTD., and W. WILSON. Electrical protective arrangements.
6 952 J. P. HAWORTH. Accumulators.
6 950 H. E. HUMPHRIES and SIEMENS BROS AND CO., LTD. Registering apparatus employing thermionic valves, etc.
6 961 G. C. AND P. A. LUNDBERG, A. P. LUNDBERG AND SONS, LTD., and G. PEGG. Electrical adaptors.
6 962 G. C. AND P. A. LUNDBERG, A. P. LUNDBERG AND SONS, LTD., and G. PEGG. Electric switches.
7 024 E. SCHARPENBERG. Sockets for electric cables.
6 933 F. SCHINDLER. Controlling apparatus for electricity supply systems.
6 974 SIEMENS AND HALSKE A.G. Electrical separation of rubber from latex. (12/3/28, Germany.)
6 981 SIEMENS AND HALSKE A.G. Electrical separation of rubber from latex. (18/4/28, Germany.)
6 983 SIEMENS AND HALSKE A.G. Electrical separation of rubber from latex. (10/11/28, Germany.)
6 991 SIEMENS AND HALSKE A.G. Electrical separation of rubber from latex. (17/3/29, Germany.)
6 890 W. A. STEVENS. Device for controlling regeneration in electrically propelled vehicles.

COMING EVENTS.

Friday, May 17th-Thursday, May 23rd.

WORLD POWER CONFERENCE.—Barcelona, Spain. Sectional meeting on "Complete Utilisation of Water Power Resources." Official visits follow from May 24th to June 4th.

Saturday, May 18th.

ASSOCIATION OF MINING ELECTRICAL ENGINEERS (SOUTH WALES BRANCH).—Esplanade Hotel, Porthcawl. Annual meeting. 5 *p.m.*

Friday, May 24th

INSTITUTION OF ELECTRICAL ENGINEERS (WESTERN CENTRE).—Queen's Hotel, Cheltenham. Summer meeting.

PHYSICAL SOCIETY.—Imperial College of Science, Imperial Institute Road, South Kensington. Paper by Dr. J. H. Vincent on "Experiments on Magneto-strictive Oscillations at Radio-Frequencies." 5 *p.m.*

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THE ELECTRICIAN

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Electrical Engineering, Industry, Science and Finance.

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[Closed on Saturdays in accordance with the "Five-Day Week" plan adopted by Benn Brothers, Ltd., and its associated organisations.]

No. 2660. [No. 21. Vol. CII.] Friday, May 24, 1929. Annual Subscription, 25s. Overseas, 30s.

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Current Topics.

The Battersea Project.

IT could hardly have been expected that the publication last week of Mr. FLADGATE'S apologia for the London Power Co.'s Battersea project would effectively silence criticism, though it is of definite value in so far as it indicates that the promoters of the scheme do not propose to ride roughshod over the wishes of the public without first saying why they intend to adhere to their original plan. We wish we could share the Power Co.'s optimism at the prospect of the early discovery of means which will render it "practically possible to render innocuous the fumes which arise in the process of generation." While we say this in the hope that our pessimism may soon be shown to be unfounded, we cannot overlook the fact that one who is probably the country's greatest expert on similar problems in other industries has frankly expressed doubt that a workable commercial process can be evolved. If the London Power Co. considers such doubts as casting "an unmerited slur on the present state of advancement of the arts of engineering and chemical science" it should, according to its own statement, soon be in a position to make the one effective reply to that aspersion. Meanwhile we note that even the determination of the sulphur content of flue gases—let alone its elimination—involves difficulties of no mean order. The general practice of sampling the fuel bed refuse, determining its sulphur content, and then estimating that going to the stack by difference is easy but inexact, but the direct measurement of the sulphur in the flue gases is more difficult. In an investigation made by the U.S. Bureau of Mines, Pittsburgh coal was burned in the furnace of a small power boiler, and measurements were made for eight-hour periods of the total sulphur in the refuse, in the gases beyond the bridge wall, and in the flue gases, in the attempt to account for the total sulphur in the coal. With the greatest care, the total sulphur as measured invariably averaged less than that in the coal. The measurements as reported show that from 3·2 to 4% of the total sulphur was found in the refuse; from 82·2 to 93·3% in the gases at the bridge wall; and from 75·4 to 83·4% in the flue gases. At the bridge wall, therefore, the percentage of unaccounted sulphur varied from 3·5 to 13·8%, while the missing percentages in the stack ranged from 12·6 to 21·4. Some of these figures are of doubtful interest in the investigation of the Battersea problem, but even when allowance is made for the different classes of coal employed, consideration of the figure representing the residuary sulphur content discharged to the surrounding air emphasises the magnitude and urgency of the problem with which the Power Co. is faced; other very pertinent points were raised by Prof. M. W. TRAVERS in a letter to the "Times" on Wednesday.

An Alternative Site.

THE other main point in Mr. FLADGATE'S statement is the argument adduced against the various suggestions that have been made, notably by Sir BASIL BLACKETT, that apart from nuisance considerations, the Battersea project is uneconomic. It is difficult to form a definite opinion on this aspect of the matter without fuller knowledge of the basis on which Mr. FLADGATE'S figures are founded, but on the whole we feel that the alternatives fully deserve the most careful and unbiased consideration. The contractual obligations are resolutely put forward as an insuperable obstacle to a modification of the present plan, but if everyone were permitted to carry such a reason to its logical conclusion life in this country would be insupportable. Before there is any talk of prior commitments it should be clearly established, either that the sulphur problem is definitely solved, or that the present scheme is economically better than the alternatives. Decision on these points would be greatly facilitated by holding an independent inquiry without further delay.

Utility Advertising.

ONCE again the columns of the daily papers find themselves adorned with delightfully produced large-scale advertisements of gas, with particular reference to domestic water heaters, but there is a remarkable lack of counter-publicity for electricity. Though we have raised the point times out of number we feel we must repeat that the electrical industry's timid essays in co-operative advertising are pitiful compared with the publicity activities of the rival industry. We attach no blame to the Electrical Development Association, which is responsible for the electrical advertising, for the Association obviously makes the best possible use of a very limited appropriation. The industry as a whole is the real culprit for failing to provide the money for sustained publicity on a large scale. If every electrical undertaking and firm would subscribe each

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year only 0·1 per cent. of its annual revenue, the E.D.A. would have the wherewithal to make a much better showing. There are still to be found people who daily derive benefit in one way or another from the work of the E.D.A., but withhold the practical support to which it is entitled, and most of us have come to think of this co-operative publicity in a small way, which is quite inadequate for an industry of enormous potential size and importance. Let us envisage this industry-publicity in a really big way and each contribute our small quota of the cost.

An Electrical Luncheon Club.

AT various times we have heard electrical engineers voice the desirability of having a sort of Electrical Luncheon Club, similar to the gatherings of the Rotary movement, in that there would be at each meeting only one speech, and that in the form of a short address by some notable man, possibly engaged in another, but related, sphere of activity. There is much to be said for the usefulness of such gatherings, as distinguished from the usual luncheons at which a number of speakers address themselves to a toast list, and the increasing popularity of the periodical luncheons of the Batti-Wallahs Society suggests that the idea is capable of development. From small beginnings, deriving its membership mainly from a definitely restricted circle, the Society has greatly extended its interests and influence, and is now at a stage when it is, in fact, if not in name, a well-attended Electrical Luncheon Club. It therefore seems to us not altogether impossible that a scheme may ultimately be evolved which, while maintaining the traditions and exclusiveness of the dwindling band of authentic Batti-Wallahs, will make provision for official participation in the Society's proceedings by those mere landlubbers who at present must consider themselves, both literally and metaphorically, as stowaways.

A Fishy Story.

A NEW use of electricity is envisaged for the coming whale-hunting season in the Antarctic. Ordinary harpooning methods are both cruel and uneconomic because of the whale's great loss of blood before death, so electrocution is to be tried. According to the " Observer," the harpoon will be attached to a wire along which a strong current will be sent when the harpoon is safely lodged in its objective. But while electricity is destined to play a lethal part in the whaling fields it will provide the latest amenities of civilisation in another part of the fishy world, the Farrar River, where, according to the Grampian Electricity Supply Bill (recently before the House of Commons), an electric lift will be installed to hoist salmon over a 100 ft. high waterfall.

Rural Development.

IN choosing a rural area for the purpose of his attempt to see what results may be expected from the development of electricity supply in such areas, the Minister of Transport has done well to pick upon a portion of the Bedford Corporation's supply area, as this is a district in which notable progress has already been made without any outside assistance. But unless it is understood at the outset that the experiment is not being made upon virgin territory there is a danger that some unduly optimistic conclusions may be drawn concerning the time needed to bring such developments to fruition and commercial success. So long ago as 1927, when Mr. R. W. L. PHILLIPS, Bedford's borough electrical engineer, was President of the I.M.E.A., we were able to report that in addition to supplying a number of outlying industrial establishments the undertaking was giving supplies to adjacent villages, and had in hand schemes to extend this service to several other villages in its area. Special efforts were being made to encourage electric cooking, and a picture, showing its employment in a typical small country inn, was reproduced in these columns to show that the development was not confined to the well-to-do residential population. There is, therefore, every reason to expect that Col. ASHLEY's much talked-of experiment will be an unqualified success, but we hope that other undertakings which are in a position to undertake rural development will press forward with the work as and when possible without waiting to hear the results of the Bedford demonstration.

Apprenticeship in the Electrical Industry.

WE recently referred to the excellent progress that has been made by the Electrical Contractors' Association in the training of apprentices for the installation trade, and we are glad to have further information regarding the wider scheme, designed to cover all branches of the industry, which was put forward by the Association of Supervising Electrical Engineers last October. The main principle of the A.S.E.E. scheme, it may be recalled, was the appointment of a Central Apprenticeship Board, representative of the various interests in the electrical industry, which was to be responsible, through Local Committees, for the general management of the scheme, including the regulation of the number of apprentices coming into the industry, and the formation of machinery to deal with the many points which would naturally arise

Practical and Technical Training.

AN important part of the A.S.E.E. scheme was that which provided for a linking-up of practical and technical training. The boys were to be allowed certain time off during the working day for attendance at technical schools, and this was to be dovetailed into a scheme of practical training which would give the boy an all-round industrial experience. For instance, a boy, who was to receive training for contracting and installation work, would get an insight into workshop and power station practice, with the result that, when he had finished his apprenticeship, he would become a skilled worker in the true sense of the term. It was pointed out, at the time the details were published, that it would be necessary for many conversations to take place between the promoters and those organisations in the industry which would ultimately control the scheme, and whose co-operation was so essential to make co-ordinated apprenticeship a success. We are, therefore, glad to learn that a number of the organisations have expressed interest in the fundamentals of the scheme, and that meetings are being arranged with those who have not yet arrived at a definite decision. It will be remembered that the particular organisations in the industry directly affected were six in number, and the Committee of the A.S.E.E. has progressed so far that 50% of those organisations have signified their favourable interest. It was to be expected, however, in view of the many schemes which are already in operation, that difficulty would be experienced in finding common ground for the linking-up of the ideas underlying present schemes, with the new suggestions. It is gratifying to record that headway has been made, and, if all interests are prepared to sink their individual outlook for the good of the industry, there is no reason why a scheme should not be evolved from the suggestions put forward by the A.S.E.E. which should guarantee for the future a supply of fully-qualified men for the electrical industry.

An Economist on Hire-Purchase.

THOSE who are interested in the economics of hire-purchase trading will have the opportunity of hearing the views of a distinguished economist when PROF. SELIGMAN, of Columbia University, New York, addresses the Individualist luncheon on June 19th. PROF. SELIGMAN was chairman of the committee which was set up in America to investigate the possibilities of hire-purchase, and the Seligman Report undoubtedly put the business on a sound basis. Subsequently he published " The Economics of Instalment Selling," which is, and will probably remain the standard work on this subject. Prof. SELIGMAN is responsible for the view that instalment buying is not, as many people think, a mere trading device, but is, in fact, the beginning of a complete new banking system.

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PRACTICAL USE OF CONCRETE POLES.

Test Reports on Overhead Systems in the U.S.A.—Causes of Deterioration—The Question of Cost—The Factor of Safety Problem—Employment of Colouring Matter.

AT a meeting of the Overhead Lines Association, on April 24th, Mr. W. Fennell (the president) read a paper on "Practical Uses and Tests of Concrete Poles in U.S.A.," which was based on a report of the Overhead Systems Committee of the N.E.L.A.

Mr. Fennell said the position of anyone writing a paper on ferro-concrete poles in England was similar to that of the writer of the mythical book on "Snakes in Ireland." We were, therefore, forced to go abroad for our experience. Much had been heard about concrete poles in France, but there was a strange shortage of data. One could not, in England, obtain a quotation for poles to resist any particular stress. A committee had been formed by the British Electrical and Allied Industries Research Association charged with the duty of testing ferro-concrete poles. The O.L.A. had appointed Mr. Swarbrick as representative on this committee—but no one seemed to know quite how to commence this British investigation.

Turning to America, the report of the Overhead Systems Committee of the National Electric Light Association stated that the electric railway companies had made considerable use of these poles, but there had been relatively little use of them by power companies. Shortage of timber of suitable size had now made the subject a live one. Over 300 questionnaires were sent out, and 202 replies were received. The following was a summary of the results :—

Fig. 1.—Combination steel and concrete poles made of two channels with concrete between, at Adelaide, Australia. A 36 ft. pole supports 11 000 V, 7 000 V and 400 V lines.

Thirty-three companies use concrete poles; 169 do not. Of the 33 companies, 11 make their own, and 5 purchase them, for line poles, while the remainder use them for street lighting standards. There are thus 16 cases of line poles, subject to stress, and most are made where used, because of the weight and difficulty in shipping them. All information furnished seemed to indicate a tendency to use concrete poles for fairly low voltages (600 V).

This, said Mr. Fennell, appeared to be due to the reliance in the U.S.A. upon the pole itself to assist the insulator, so that in the U.S.A. earthing of metal-work was not usual, and a conducting pole was avoided for high pressure work. As we must earth the insulator pins and must also be prepared to earth the ferro-concrete pole at pressures above 600 V, its conducting qualities were no disadvantage.

After giving a good deal of detailed information on the construction of various types of pole, Mr. Fennell then dealt with the important question of deterioration. Twenty users reported on deterioration experienced with various kinds of concrete poles. Thirteen users reported poles satisfactory, showing no deterioration in from five to seventeen years. Two poles were reported in Schenectady which were 30 years old and still in good condition. Seven users reported some deterioration, the causes being :—

1. Steel reinforcing too close to the surface, i.e., less than ¾ in.
2. Porous concrete, due to the use of too much water at time of mixing.
3. Voids in concrete due to insufficient working or puddling of concrete after placing in forms.
4. Improper curing, i.e., allowing poles to dry instead of keeping them wet for the first ten days after manufacture.

Fig. 2.—A 40 ft. strain type concrete pole at Richmond, Virginia.

5. Overloading, which is shown up by the appearance of evenly distributed cracks across the pole on the tension side, usually at or slightly above the ground line.

The first four items all caused spalling or cracking of concrete away from the reinforcing. When cracking had commenced, frost action caused progressive deterioration.

The remedies for these causes appeared to be :—

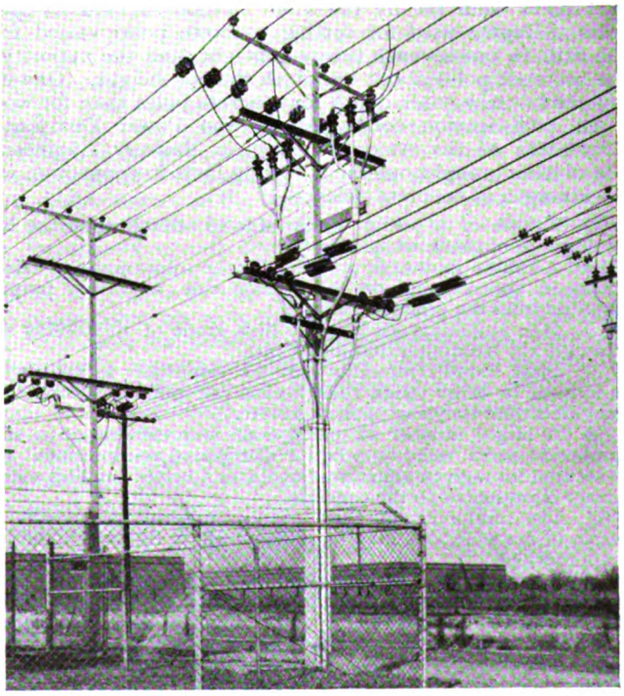

Fig. 3.—Another example at Richmond, showing terminal arrangement on concrete poles.

1. Steel should be at least ¾ in. below the surface, preferably 1 in.
2. Concrete mixture should be waterproof, i.e., by designing the mix for a compressive strength of 3 000 lb. per sq. in.

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3. Concrete should be worked and puddled after placing in forms, to prevent voids.

4. Poles should be cured damp or wet for at least 10 days after initial set; this alone strengthens the concrete 75% over dry unprotected curing.

5. Poles should not be loaded beyond the strength for which they are designed.

With regard to methods of transportation and setting,

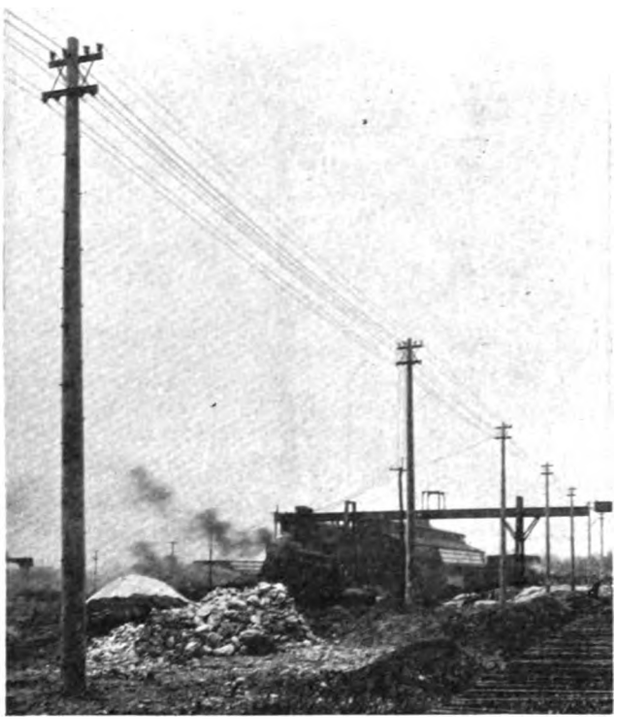

Fig. 4.—Westinghouse hollowspun concrete poles at a steel works.

concrete poles were generally transported on trailers, similar to wood poles. Long poles might have a stiff, wooden member placed between trailer and truck to prevent excessive deflection. Eight of the users reported that poles were set by using a gin pole or derrick. Five of the users reported that poles were set by the same method as used for wood poles. Depths used for setting concrete poles varied from one-fifth to one-seventh the pole height, and the majority of the users set poles about one-sixth the pole height. One user reported 6 in. greater depth for concrete poles than for wood.

An investigation conducted by the Power Distribution Committee of the American Electric Railway Engineering Association brought out the following facts in connection with the strength of concrete poles:—

(1) Failure of a pole is always due to stretching of the reinforcing rods of the tension side.

(2) A failure is always preceded by the appearance of hairline cracks in the concrete on the tension side, at rather frequent intervals from the ground line up.

(3) It is advantageous to use a high grade of reinforcing steel to secure the maximum tensile strength.

(4) Plain round reinforcing rods are essentially as satisfactory as twisted or other rough rods, because, in general, the rods will elongate before they slip in the concrete.

(5) A larger number of small rods is preferable to a small number of large rods, as a better distributed reinforcement may be secured for a given amount of steel and a better bending contact surface is presented to the concrete.

(6) The reinforcement need not be uniform throughout the length of the pole, but may be snapped off as the top of the pole is approached.

(7) A pole with uniform reinforcement will break at the ground line, while one with tapered reinforcement will break at some point above the ground, depending upon the taper of the reinforcement.

(8) A concrete pole has an element of safety in it, as a failure of the pole will not, in general, allow it to fall to the ground. It is difficult at times to pull over a pole after failure, even though it is inclined at a large angle from the vertical.

Coming to the question of cost, the lecturer said that concrete poles appeared to cost one-and-a-half to three times as much as wood poles. One user reported the cost as 30 dollars more than wood poles, another reported from three to fifteen times the cost of wood poles. Westinghouse hollowspun poles were reported to cost approximately the same as tubular steel poles.

Continuing, Mr. Fennell said the question arose: Could we afford the luxury of concrete poles over here? Making full allowance for the slightly higher cost of wood poles over here as compared with U.S.A., due chiefly to our more elaborate creosoting, it was clear that for equal strength and height they were dear, especially in the smaller sizes. They began to come in, as did steel, for long spans and heavier stresses, but never seemed to approach the wood pole for any but heavy or "town" work." We were not, and never would be, allowed to run heavy lines along over medium-sized town streets, the tendency here being to reserve overhead work for outer suburbs and rural areas, so that unless a ferro-concrete pole was offered at about 1½ times the cost of a similar "medium" wood pole, delivered on site, there was every reason why it should not be used. Its hypothetical extra life might be worth that extra cost. There was nothing in his mind to warrant asking for a factor of safety of 2½, that allowed for steel, based upon the combined tensile strength of steel and concrete, unless someone could produce a design in which the concrete and steel combined took the tension stress, and it could be proved that we had a pole as safe and reliable as steel.

According to his judgment the ferro-concrete pole would not enter into our rural schemes. Its weight and cost of handling must be heavy, and the total cost prohibitive; moreover, its surface weathered in a rather disagreeable way. Its finish was associated with that of "artificial" stone. It did not blend well into the landscape of England, as did a light brown creosoted pole, nor was it suitable for a country town. It might be acceptable in a housing scheme or at a new seaside watering place, or along a railway or in a power station yard, and in the vicinity of concrete fencing posts.

THE DISCUSSION.

Major T. Rich considered it unfortunate that the President should have examined the subject of concrete poles in relation to a country—the U.S.A.—which, in this respect, was now in the position reached by some of the Continental countries about fifteen years ago. A concrete pole, if properly designed,

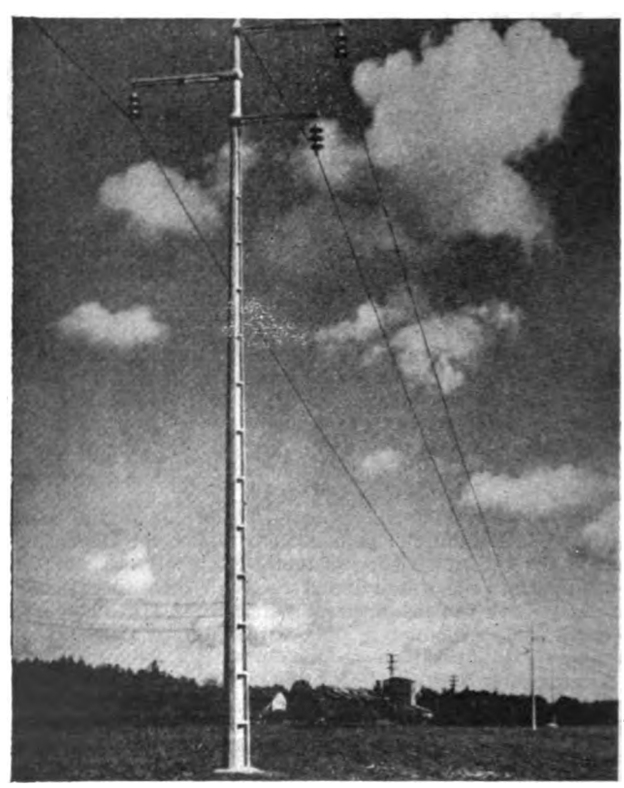

Fig. 5.—A Kiese pole in service on a 50 kV transmission line. The top of this pole is approximately 50 ft. above ground.

was not necessarily exceedingly heavy; when one bore in mind that there were 750 000 concrete poles in use in France—a country with a very material amount of timber available—one would come to the conclusion that there must be something wrong with the suggestion that concrete poles were impracticable. The reason why there were so many of these

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poles in France was that they were properly designed as structures. Centrifugally made concrete poles as high as 90 ft. had been made; centrifugal posts were used in Italy for 240 000 V transmission. Messrs. Dyckerhoff and Widmann were about the earliest makers of centrifugal concrete posts, and they were making such posts from 60 ft. to 70 ft. long.

The PRESIDENT said the makers of the Kisse poles were making them up to 40 ft. long. We did not want 90 ft. poles.

Major RICH, discussing the manufacture of the centrifugally made concrete poles, said that if the concrete were used in the form of a "pudding" there was no necessity for a core at all. The method of the Westinghouse Co. seemed distinctly crude as compared with the German method. With regard to the weights of concrete posts, he said there were some concrete posts used in France for h.t. light rural lines, having a height of about 10 metres (33 ft.) and weighing about half a ton. If we in this country were allowed to adopt the same factors of safety as had been found to be satisfactory in other countries, he saw no reason why we should not obtain concrete poles in this country at a cost of less than one-and-a-half times that of the foreign wooden poles.

With regard to factors of safety, he said that in England it was 2½ or 3½, based on the elastic limit, and it was the same for wood as for concrete. Wood had practically no reserve of strength beyond the elastic limit; concrete had a big reserve beyond that elastic limit, but it was given no credit for that in the factor of safety adopted. Discussing the question of the development of cracks in concrete, he said he believed it was the policy of some German makers to test every pole before it was despatched from the works. With regard to curing, he had seen posts made with aluminous cement concrete taken out of the moulds seven hours after casting; in summer time a high-class Portland cement was used, and the poles were taken out regularly once a day.

Mr. W. A. TURNBULL expressed himself as being in agreement with the President throughout. Commenting on the President's remark that the steel in reinforced concrete poles did not get a chance of taking the strain, he suggested subjecting the rods to initial stress.

Mr. F. SWARBRICK, who declared himself to be an enthusiast in regard to concrete poles, said that one important aspect of the development of these poles was the possibility of the establishment of a new industry in this country. In his opinion the Continental concrete pole was of very much better appearance than the creosoted wooden pole. He agreed with the remarks of Major Rich with regard to the light concrete pole. The prices mentioned by the President were certainly prohibitive, and not comparable with the prices of the French poles. Before the end of the present summer there would be in operation in this country an experimental line constructed on the Continental basis, with concrete poles. As a country we could not afford so conservative a factor of safety as 3½, when we had evidence that on the Continent a factor of safety of 2½ or less filled the bill.

A South Wales Example.

Mr. H. W. GRIMMETT said that in South Wales there was a very good double-circuit line on concrete poles, erected in about 1919. The cost of the poles at that time was about five times the cost of wooden poles to-day. The concrete poles used had bevelled corners, there being reinforcing rods at each corner. They were made locally and carted to the points at which they were erected.

Mr. MOLLE confirmed Major Rich's remarks as to the enormous number of concrete poles used in France. When he was at Grenoble University about eight years ago a long course of instruction had been given on the manufacture of concrete poles. Five or six years ago concrete signal poles were used on the railways in India, but they had not much pull imposed upon them when used for that purpose; they were used widely on the railways in this country to-day. He asked if anyone had had experience of the Marriott pole, which was invented by a railway engineer in this country. The pole consisted of a series of hollow sections, each section being cast separately, as drain pipes were cast. In the walls of the pole there were holes running throughout the whole length, at intervals round the circumference, and through these holes reinforcing rods were threaded. Each section of the pole could be carried to the site on a bar held by two men; the reinforcing rods were threaded through the sections, to make the complete pole, and were bolted up at each end, so that the complete pole was a hollow tube held together by half a dozen or so reinforcing rods.

Mr. MINTON asked if consideration had been given to the problem of adding colouring matter to the concrete. Green was about the cheapest colouring matter. Experiments showed that 1 lb. would be sufficient for about 2 cwt. of concrete.

Major RICH said that several of the Continental firms producing concrete posts were also making concrete candelabra for streets. They decorated them by making rings or decorations of coloured concrete on the outside.

Mr. H. NAPIER PRENTICE said he could not help feeling that there was a great future for ferro-concrete poles. This country was not yet electrified; we did not yet know where the loads would be and where the lines were going. We ought to give every consideration to ferro-concrete poles for the future, but we ought to develop the country on wooden pole lines, and build up a load which would enable us to afford the expenditure on the more permanent and possibly more beautiful ferro-concrete pole lines.

Mr. Fennell's Reply.

The PRESIDENT, replying to the discussion, said he wished we could obtain figures and information as to the French construction methods and the results of tests on the French poles. In his heart he agreed with a good deal of what Major Rich had stated, but he had considered the problem from the point of view of a body of Electricity Commissioners, and bearing in mind the factors of safety that were specified. The details of proposed schemes had to be "quizzed" by the Commissioners, and stress diagrams had to be produced. It must be shown that on the tension side the loads which would be applied by hypothetical gales and hypothetical ice would be well below the breaking stress or elastic limit. That was the basis we had to work to; we might discredit that basis by showing that it did not allow us in this country to do what was done in others with apparent safety. In regard to underground lines, leading principles were laid down, and the responsibility was left to the engineer concerned, and if that were done in regard to overhead work we should be able to make more progress. In connection with underground lines, one was an engineer, and one accepted the risks and responsibilities; in overhead work one was not allowed to be an engineer, notwithstanding one's training, and one had to do what one was told to do. Perhaps it was not fair to blame the Commissioners, at the present stage, and one of the principal objects in investigating these matters was to demonstrate that in regard to overhead lines engineers could be treated as they were in regard to underground lines, and that they were men who knew their jobs. While they did not object to a factor of safety of 2½ in the case of a steel pole, they could not expect to be allowed a lower factor of safety for a ferro-concrete pole.

Major RICH said that a concrete pole was stronger than a steel pole in compression. The PRESIDENT replied that one must demonstrate that. Mr. NAPIER PRENTICE pointed out that in the ferro-concrete pole the steel was protected from corrosion. The PRESIDENT replied that, under the regulations, the steelwork must be painted regularly. The factor of safety of 2½ was demanded not merely when the pole was new, but always. Major RICH said the factor of safety for ferro-concrete was 3½, compared with 2½ for steel. It should be the other way.

The PRESIDENT agreed that the higher factor of safety for ferro-concrete was a handicap, and that was what he had wanted to emphasise in the paper. With regard to centrifugally-made poles, his view was that they should be spun so quickly that some real action was exerted by centrifugal force, and not merely by compression of the concrete in the early stages of setting. Referring to the very light pole, weighing less than half a ton, mentioned by Major Rich, he said that would not meet the requirements with regard to factor of safety. A 33-ft. pole weighing half a ton would break during the first ordinary gale, according to the calculations.

The point made by Mr. Swarbrick with regard to the establishment of a new industry in this country was an important one. If anyone could show him a ferro-concrete pole made in this country, even though it were 50% more expensive than an imported wooden pole, he would think about it very seriously.

With regard to the high cost of the concrete pole line in South Wales, referred to by Mr. Grimmett, he said the installation was probably much stronger than it need be, and the high cost was due to that fact. Those who erected the line were pioneers, and were anxious to ensure that it would not fail.

He would be glad to have some further information with regard to the Marriott pole. The trouble with regard to the use of colouring matter in concrete was that it would fade when exposed to sunlight.

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ELECTRICITY IN RURAL AREAS.

Discussion at National Conference on Agriculture—Farmers' Proposals for Expediting Development—Practical Aspects of the Problem.

SOME idea of the interest which British agriculturists are taking in the possibilities of rural electrification may be gained from the fact that the recent National Conference on Agriculture devoted a considerable amount of time to discussion of a resolution by the Rural Reconstruction Association:

"That in order to secure the economic reconstruction of rural England it is essential that there should be an immediate and widespread development of electricity in rural areas, and as such development must depend upon the co-operation of the user and the supplier it is desirable that the local branches of the National Farmers' Union and other agricultural organisations should meet the local electricity supply undertakings in conference to discuss the possibilities of supply in each area, and that copies of this resolution be forwarded to the Ministries of Transport and Agriculture, the Electricity Commissioners, the Central Electricity Board, the British Electrical Development Association, the National Farmers' Union and other agricultural organisations concerned."

Mr. R. Borlase Matthews, in moving the resolution, said its object was to give the interested parties an opportunity to inaugurate an era of co-operation. Rural electrification was a national matter, and no effort towards the economic reconstruction of rural England could be successful unless an immediate supply of electricity was available. It had long been recognised in industrial areas that electricity provided the cheapest and most convenient form of power. Why should not the rest of the country partake of its advantages? Until the farmer and the rural worker were in a position to obtain a supply they must be handicapped in any effort to reduce the cost of production.

Electricity was no new thing for the farmer. More than a million farmers in the world were using electricity as an aid to their work. In England alone over two thousand were employing it. Electricity could be supplied to the farmer more cheaply than any other form of power. People asked, "How about the oil question?" But they mostly meant the cost of the oil, which was but a fraction of the whole matter. Horse-power cost the farmer the equivalent of about two shillings per unit. A man's labour cost about ten shillings per unit. A progressive electric supply undertaking providing current on the modern telephone tariff system at, say, one penny per unit offered a very valuable proposition. He had found the Continental farmer only too thankful to pay fourpence per unit, for the simple reason that it paid him better than other methods.

The main advantages to be obtained from the use of electricity were: First, the substitution of electricity for horse and manual labour lowered the cost of production. Secondly, the application of electricity to agriculture had a direct bearing on the production of the farm worker.

Typical Farm Costs.

Dealing with a typical farm of seventy acres where electricity was installed, not completely, but for a few general purposes, Mr. Matthews said the cost of lighting for twelve months was £5, whereas the previous cost, when fifty gallons of oil were consumed, was £2 10s., but it took one hundred and fifty hours of labour to clean, trim, and fill the lamps. Putting that at the low figure of 6d. an hour, it amounted to £3 15s., so that the cost for lighting by oil was really £6 5s., as compared with £5 for electric light.

The farmer had a milking machine which cost him £4 3s. 4d. a year for current. The milking machine required looking after, and that cost nearly £16. His hand milking had cost him £31 a year.

His cream separating by electricity, apparently a trivial job, cost him £1 4s. for current and £1 for labour. When done by hand, at the low rate of 6d. per hour, it cost him £8 a year. Pumping water electrically cost £1 1s. a year, whereas pumping by hand, again taking labour at 6d. an hour, occupied three hundred hours a year and cost £7 10s. Chaff cutting cost 18s. when done electrically, as against £2 10s. when done by hand. Under the electrical method all those operations cost him nearly £12 for current and nearly £18 for labour, a total of £29, whereas under his former methods those operations cost him £56. The capital cost of putting in the installation was about £120. Allowing for interest and depreciation at a good rate, say, 15%, there remained a net profit of nearly £9. That was typical of many cases.

Then, in connection with the farmhouse, there was the pumping, which meant a lot of work during the year. Then, too, the farmer's wife used an electric iron instead of an ordinary iron. It was found that a woman ironing at a table only 5 ft. from the fireplace at which she heated the iron had to walk a quarter of a mile during a given period simply in getting hot irons. She would have been saved that had she had an electric iron.

Another illustration which applied to the farm was in regard to oil lamps. A weekly record was kept of the time spent by a woman in cleaning and filling oil lamps, and it was found that during forty years she had spent no less than one year working twelve hours a day in carrying out that menial task.

Electrified Rural Industries.

A farmer had to be associated with rural industries, because they worked in as part and parcel of his undertaking. There were a number of people who said that such industries must be added to the ordinary work. He had come across a number of farms, more especially on the Continent, which ran auxiliary rural industries, such as brewing, the manufacture of sugar from sugar beet, and other things, which worked in very well with farming operations. More electricity in the country would attract a number of minor industries from the towns, which would give the farmer more labour to draw from and remove a great deal of overcrowding in the towns. There were also rural industries such as those carried on at brickworks, in potteries and wheelwrights' workshops, and there electricity enabled the country dweller to produce what was really worth while.

The question arose, "It is all very well to talk about these advantages of electricity, but what about finance? You cannot instal new machinery without somebody finding the capital." The return on capital for the electrification of farm machinery was so good that it greatly facilitated finance. The amount saved on labour in one year in operating an electrical cream separating machine would buy a motor. In many farm operations it was possible to recover the cost or its equivalent in about three years. The average industrial manufacturer was very well satisfied if he could recover capital expended on new machinery in ten years.

There were two main methods of obtaining this extra capital. One was taking advantage of the facilities provided by the electricity supply undertakings and other associations for the hire and hire purchase of apparatus. As far as agriculturists were concerned, there were the facilities offered, under the Agricultural Credits Act, 1928, by the Agricultural Mortgage Corporation for long term loans at a low rate of interest, and the scheme of the Ministry of Agriculture. When the returns were good, it became easy to obtain money.

There were certain difficulties to be overcome, and that was why he put forward the idea that there must be a little more co-operation between the parties concerned.

Over 53% of the rural area of England and Wales, containing upwards of 69% of the population, came within the area of supply companies; but he would be ashamed to say how many of the 69% of the population could really obtain a supply of electricity to-day, because only a small percentage of the undertakings that had exclusive powers for supplying those areas were making any serious effort to do so. The people residing in those areas were in the unfortunate position of being wedded to undertakings who refused to maintain them, and from whom they were unable to obtain a separation. In such cases the Electricity Commissioners should see that those undertakings met their responsibilities. No authorised undertakers who were indifferent to the needs of the rural population would ever supply electricity at an attractive price, but an attractive price was necessary for the success of an undertaking as well as for those who were going to use the current.

The electricity supply undertakings had also a case. At present the farmers did not to any serious extent ask for supplies of electricity, and so we were at a deadlock. Electricity companies also complained that they were hampered by obsolete legislation and antiquated rules. Obviously they must be modified in accordance with modern needs.

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Before any alterations of existing legislation and methods could be made, there should be conferences representative of the electricity supply undertakings, the National Farmers' Union, and other agricultural and electrical engineering organisations, so that those who were familiar with the practical problems and difficulties of rural electrification could discuss them in the light of present-day experience. Such a meeting should produce sufficient evidence to convince the powers that be as to the alterations that were required. The farmers, the suppliers, and the legislature should all work together to arouse interest, so that difficulties might be removed. The difficulties had been removed in parts of this country and in many parts of the Continent.

Col. Crompton's Views.

COL. R. E. B. CROMPTON, who seconded the resolution, said that if, as was intended by Mr. Baldwin, when he so strongly advocated the new Electricity Act, facilities were given for a cheap supply of electricity in the rural districts we could transform those districts. In other countries they had already been transformed. Anybody who travelled in Lombardy, the South of France, parts of Switzerland, Sweden, Denmark, and elsewhere could see the marvellous things that a proper electricity supply had done.

A Central Board with enormous powers was formed under the Act of 1928. Its powers were almost dictatorial. It had not to refer back to Parliament, and it could carry out anything that was recommended with a reasonable probability of a return to the Commission. We should be doing yeoman service to the rural community, to the landowners, and the farmers and labourers on the land of England if we did our utmost to supply rural England at as low a rate as possible and to give that supply as early as possible. We should realise that the supply would not be given on the Fringe Orders that were already granted to large towns. The Central Board was very approachable, and if a deputation went from this Conference it would start a ball rolling which would assume gigantic proportions and would do more than anything else to make farming pay.

In his opinion a very large proportion of the arable land of England would yield four times as much food as at present, if intensively cultivated, as would be possible with electric power. Thousands of acres of land that yielded ordinary crops in rotation could be converted practically into market garden land. A great deal of the food grown intensively would be perishable. Hitherto the means for the carriage and distribution of perishable goods had been so infamously bad that it had not paid either the farmer or the cottager to produce such goods. That could be remedied under our splendid modern system of road transport.

MR. TOM THOMSON supported the resolution as a practical farmer who was anxiously awaiting the arrival of electricity in his own district, not merely for himself and his neighbours, but in order that it might recreate industry there. One of the things that farmers might anticipate from electricity was that markets would come to them instead of their having to seek them. Shropshire had been waiting for two or three years for the development of a very large scheme which seemed to hang fire in a most extraordinary fashion. He hoped that some effort would be made to encourage the authorities to take more drastic steps to further the scheme.

MR. MONTAGUE FORDHAM, speaking with regard to electricity and the position of the labourer, said that the Rural Reconstruction Association advocated the development of electricity in conjunction with a general national policy of rural development. Naturally, the first point was, what was going to be the effect on labour? The economic position of labour was fundamental from the point of view of the labour itself and of national development. They came to the conclusion, and on this they supported electrification, that electrification and the use of electrified machinery, if carried through with a good scheme of national development, meant double production and the employment of an extra million people on the land. This would be possible with electricity, and would not be inconsistent with the payment of labour at 1s. an hour. They entirely recognised the danger of the introduction of power in relation to labour; but, while they were very doubtful about the introduction of power and the rationalisation of industry, they thought that electricity in agriculture would not have the evils of a similar policy in ordinary industry.

MR. W. J. SHINGFIELD (the Workers' Union) said he had been connected with a municipal electricity supply and he was very interested to hear Mr. Borlase Matthews referring to 1d. per unit for power. He did not know how this could be done in rural England. He (Mr. Shingfield) happened to belong to a municipality that was exceedingly anxious to take its supply into the villages. Not only was it anxious, but it actually canvassed the villages. They were met by the fact, when they canvassed the farm workers, that their actual lighting expenditure had to be considered as somewhere about 10d. or 1s. a week. The farm labourer, they found out, went to bed at nine o'clock and sometimes before. So, as far as light was concerned, this was more or less cut where the labourer was concerned.

If one went further into rural England, into West Suffolk, where there were places ten miles away from a railway station, the power unit was somewhere about 8d. He was very keen on electricity, and wanted to see it developed. He wanted to see the farm worker cooking by electricity, and he wanted to see his house warmed by electricity, if necessary. But it all came back to the eternal question of finance.

So far as he could discover, we were making a dreadful mess of this electricity problem. We were handing it over to companies, who were getting powers for a number of years, and who had no intention of going out into rural England, and supplying electricity that was going to cause them financial risk.

COL. R. E. B. CROMPTON said the real reason why they were obliged to charge high prices on these Fringe Orders was because the farmhouses were considerable distances apart, and the villages few and far between, and, consequently, the overhead wiring system that must be adopted involved a difficult problem. The towns had not seen it worth while to spend money which might not yield a return for several years, whereas the large supply companies were waking up to the fact that they must develop rural England, and that they must put up with a few lean years during the first few years of supply.

The Financial Side.

He had gone very carefully into the figures, and was entirely convinced that the country villages could be supplied with light for about 30s. per annum for a cottager, and that for the first few years heating, cooking and farming processes could be carried out at 3d., and after three years that price might be reduced successively to 1d. That was a process that had been followed in our large towns, and that would have to be followed in the country. The reason why very high prices had been quoted—8d., 1s., and all that kind of thing—was because electricity was only used to a very limited extent for lighting in those places. Directly the demand for electricity during the off-peak hours arose the price would come down.

He had not mentioned the most important thing of all that was before the engineers, namely, the fixation of nitrogen. Once they hit upon a method of using electricity upon a small scale to take nitrogen from the air, it would be possible to produce the most valuable manure that they could possibly have. He had every hope that we should do that in the rural districts close to the farmer, so that he could send his motor car for a few tons of nitrate instead of having to take it from the great factories.

MR. R. BORLASE MATTHEWS said the electricity supply side, the agricultural side, and the legal side were all working separately at present, and not paying sufficient attention to each other. There was a lack of uniformity, and there was a lack of knowledge as to what could be done.

The figure he had given of 4d. per unit was the figure that the Continental farmer found would pay him in order to do his work more cheaply than he could do it with other power. The British farmer, when he got a horse to do his work, was paying 2s. a unit, and when he got a man to do his work he was paying 10s. a unit. Anything that he could get under that 10s. or that 2s. meant so much more profit.

In his scheme for the rural electrification of about 1 800 square miles in Lincolnshire the rate at which it was proposed to supply the farmer was 2s. 6d. per acre of arable land, plus 1d. per unit for all the electricity he used for any purpose. In the villages and hamlets, the initial charge would be based on so much per room plus 1d. per unit.

He was perfectly aware of the figure of £2 10s. which was all that a farm labourer paid for lighting. It was a figure which seems fairly characteristic all over the country. It was a rate at which it would pay a supply undertaking if it got the greater part of the village. It would do that when the people found it was more convenient to use electric light.

The motion was put to the meeting and carried unanimously

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ELECTRICITY SUPPLY IN LONDON AND THE HOME COUNTIES.

Acquiring Transformer and Sub-Station Sites—Distribution the Big Problem—Supply Engineers as "Juice Merchants"—Static Rectifier Improvements.

AT a recent meeting of the London Local Technical Group of the Electrical Power Engineers' Association Mr. F. W. Purse discussed the question of "Electricity Supply in London and the Home Counties." He prefaced his lecture with a survey of the legislation relating to the electricity supply industry from 1882 onwards, and pointed out the many respects in which the provisions of the various Acts had hindered electricity development in London. One of his reasons for giving this survey was that in his experience there was not a real appreciation of the duties and obligations which Parliament had from time to time placed upon the electrical industry. As one example of the provisions which had proved to be hindrances, he mentioned that which prohibited the use of electric lines above ground without the consent of the local authority, whilst another was the provision which had prohibited electricity supply authorities in the early days from supplying outside their own areas, or co-operating with neighbouring undertakings.

House-to-House Transformers.

Dealing with the conditions in the industry generally, Mr. Purse suggested that in the rural and sparsely populated areas at any rate the house-to-house transformer system was likely to be adopted; or perhaps one transformer for every three houses, or something of that order. In some other places there would be at least one transformer in each street, and he urged the necessity for securing transformer and sub-station sites now and holding them until required, in view of the increasing difficulties of obtaining such sites.

With regard to distribution, he said the 1926 Act had not interfered with the various undertakers in that respect, and so far each local authority and company had been allowed to retain its rights of distribution, though how long that state of affairs would obtain he would not like to say. He ventured to think the indications were that in perhaps 10 or 15 years' time there might be a move to combine in respect of distribution; possibly by that time there might be some standardisation of voltages.

Under the new scheme, by which generation was to be controlled by the Central Board, it could not be imagined that the super-stations would do anything but carry the base loads. Certain other stations, of course, would be used to meet the peaks. It was idle for engineers to say that they could carry on just as well with their small stations; anyone who said that he could was denying his own faith. Quite a number of the smaller stations would in a few years drop out of existence as far as generation was concerned.

Apart from the economy in coal and in generation costs generally, great economy would be effected, or it was supposed that it would be effected, by the reduction of the percentage of spare plant. He believed that at present between 50 and 60% of the plant was in the nature of spare plant, and it was hoped that that proportion would be reduced to 20 or 25%. That would raise a very interesting problem. It would present quite a new problem to have 20, 30, or 40 stations running together in parallel. He was not pessimistic enough to think that the troubles would not be overcome, however. It might be that, in order to get over the "teething" troubles, at times of full load a group of half a dozen stations might have to be split off from the rest of the group, and a connection thrown in if there were unexpected trouble in any group. Later on, of course, the number of stations would be reduced.

Generation, of course, would become highly specialised; it was becoming so already, and, with the reduction of the number of stations, the one-time chief engineers and managers, as such, would lose their interest in it. Their successors might not have any interest or any training on the generation side, and the distribution and sales men would come into their own.

The problem of generation at high voltages was an important matter to be considered, and in connection with that was the problem of getting the load out of the stations. We might be limited unless we were given facilities for bringing the energy out of the stations on overhead lines at high voltages, and that was a difficult matter in the London area.

The fact that the underground system for the grid in London was to be 66 000 V would give rise to some very interesting problems. Every station connected to the grid would have to have very special protective gear; they might have to have some very elaborate reactances and controls, and might have to renew the whole of the switching. Some of the mains engineers would probably get some jumps at the sub-stations when they had something like 300 000 or 400 000 kW of the grid trying to push in behind a fault, and there would be a few troubles in that direction.

Another problem was that of the effect of troubles at one part of the system upon the other parts, whilst still another was that of metering. He gathered that the meter makers had evolved some most interesting apparatus and instruments. There would have to be a new class of assistant—a meter-reading assistant—to take readings, as they changed from hour to hour on each particular panel. Quite a big installation would be required in some stations for dealing with meter problems, he believed.

There was no doubt that the time must arrive when electricity supply engineers would become "juice merchants," and the sooner they realised it and faced the new position, the better for their peace of mind. They would then have to concentrate upon the problems of salesmanship and distribution.

The biggest of all problems was that of distribution. What was the use of struggling to reduce the cost of generation to the very minimum when one knew that the reduction could not be reflected in the price charged to the consumers? Cost of services and standing charges to consumers must also be dealt with. The provision of more prepayment meters was necessary, because electricity was being supplied to the grade of consumer who lived from hand to mouth, and could never save enough money to pay their accounts quarterly. Experience had shown that in certain classes of property more electricity was consumed if the consumers were provided with penny-in-the-slot meters than if they were provided with shilling-in-the-slot meters, because frequently they had not a shilling to put in.

Efficient Converting Plant.

Until recently he would have said that, in view of the grid system and the decision to supply a.c., there was no practical alternative, for those undertakings at present distributing d.c., to changing over to a.c., but his views were changing as the result of the great improvements that were being effected in converting plant. He referred particularly to static rectifiers. Experience had shown that they were very reliable, they did not require constant attention, they could be shut up in their sub-stations as could the ordinary static transformers, they could be switched in by remote control, or time control, or automatically according to load. He ventured to think that, in view of the high efficiency now obtainable at comparatively low cost, many undertakers who were distributing d.c. would think twice before embarking upon a change over to a.c., particularly when they appreciated what the costs of changing over would be. The change on one system to an increased voltage had involved an expenditure of many thousands of pounds. In one district in which it was proposed to change from d.c. to a.c., the expenditure estimated in the first place was £25 000, and there were considerable other costs in addition. It was difficult to see how electricity could be supplied more cheaply under such circumstances.

The acid test of the whole matter was whether the consumer was going to benefit. Benefit would be derived by proper regulation of the load between stations, and by a very carefully thought out rearrangement of the whole of our distribution. If the position were not pushed too far, from too highly academic a point of view, there must be a substantial reduction in the cost of production which could be reflected in the charge to the consumers. It was possible, however, to push it too far.

DISCUSSION.

The CHAIRMAN (Mr. J. R. Cowie) said that, in view of the scarcity of sites suitable for large buildings on the river in London, it was not impossible to conceive that some day seaboard stations, and stations on the banks of the large inland waterways, might be the main stations for feeding London.

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Mr. GILBERT said he could hardly appreciate how a super station was going to have a base load the same at midnight as at midday, unless there was a very considerable number of other stations available to help in the distribution. With regard to the suggestion that within 10 or 15 years distribution might be taken over by some governing body, and that an endeavour would then be made to standardise distribution to one type and voltage, he said that surely, if that were contemplated, the sooner it was done, the better. If we were to wait 10 or 15 years, and if the demand increased as anticipated, it would be more difficult to convert the systems existing then than now.

Mr. WALLIS asked whether the London and Home Counties Joint Electricity Authority would take over the company undertakings in 1971 without further payment. If the sinking funds which had been arranged for were to pay for all the stations, and if those stations were supposed to be valueless in 1971, the companies might not spend further money on their undertakings during the last 20 years or so prior to 1971, but would simply allow them to become obsolete. He asked how that was to be avoided.

Mr. WALTER J. JEFFERY pointed out that one of the disadvantages suffered by the London undertakings was that London was composed of three main types of area—the manufacturing, residential, and amusement areas—and each individual undertaking supplied practically an area of one of these types. There was no doubt that because these three types of area had never been worked together, the price of electricity in certain areas had been much higher than it should have been. The problem of standardising distribution in London was at least as important as that of standardising generation. The maintenance of many different voltages and types of supply would be very disadvantageous as demand increased, and if one could buy from any store a standard electrical appliance which could be used on any supply in London it would be all to the good. It would certainly tend towards the cheapening of apparatus. He also drew attention to the fact that in some parts of London two companies were supplying in the same area, and in one case three companies were supplying in the same street. In view of the crowding of London streets, that was an anachronism, and should not be tolerated. With regard to the position of the companies, he emphasised that they were tied down completely by recent Acts of Parliament, and there was no doubt that, by reason of the sinking funds which had been instituted, the assets of the companies would be handed over to the Joint Authority in 1971 without any charge being incurred by that body.

Mr. BRETELLE emphasised, in connection with the development of large stations, that although, if costs could be reduced by a very small percentage, one could not immediately hand on that reduction to the individual domestic consumer, one could effect a reduction in charges to large power consumers. The effect of that would be cumulative; one would be able to generate on a far better scale as the result of these big supplies, and by developing the power load one would be able to reduce the cost to the domestic consumers as well. It must be borne in mind that power consumers made a big contribution towards meeting standing charges.

Domestic Load Problems.

Mr. W. J. OSWALD, referring to the development of the domestic load, indicated some of the problems to be met in this connection by reference to his experience during the severe weather experienced in February of this year. In one particular week the output was 128% above that of the corresponding week of the previous year, and the top load was 84% above that of the corresponding week of the previous year. In abnormal weather the one-shift and two-shift stations would be called upon to meet unexpected demands.

Mr. HENWOOD, commenting on Mr. Purse's reference to meters, pointed out the great importance of accuracy, and said that an error of 1% on a set of meters metering considerable quantities of power would nullify the extra efficiency obtained by the engineers in the power stations.

Mr. D. KINGSBURY, discussing the question of voltage, said it seemed to him that a number of undertakings laid out many years ago with a view to supplying electricity purely for lighting purposes would have to spend a lot of money in order to provide sufficient copper to enable them to supply at a decent voltage. That was linked up with the problem of sub-station sites, and he could not help thinking that we should have to contemplate the use of underground sub-stations at comparatively frequent intervals.

Mr. PURSE, in his reply, said that when one realised that some of the large undertakings in the country were erecting large windmills and concrete cooling towers, one appreciated that seaboard sites were perhaps not all they were claimed to be. Dealing with the problem of obtaining sub-station sites, he said that they could be purchased compulsorily, but the purchasers had to obtain a Special Order from the Commissioners and had to publish notices, and so on, and by the time the sites had been purchased one wished one had not done so. There were restrictions, of course, with regard to underground sub-stations. For instance, the maximum power supplied to any underground sub-station or street box must not, without the consent of the Commissioners, exceed 30 kW in the case of a sub-station or street box containing a single transformer, or 75 kW in the case of one containing two or more transformers. Again, sub-stations constructed below the surface of any street, to which an extra high pressure was to be given, must not contain switches or other apparatus than transformers.

Standardised Distribution Needed.

With regard to the purchase of the company undertakings in London, he said every company had to set aside a sinking fund according to a scale of depreciation, so that the assets would be liquidated within the time decided upon. In 1971 it would probably be found that new plant, machinery, etc., which had been installed during the last few years prior to that date had not been fully liquidated, and the balance would have to be paid. The company undertakings would be transferred to the Joint Authority practically debt free.

One of his criticisms of the 1926 Act had been that it had not provided for the standardisation of distribution, and that problem should have been tackled as fearlessly as that of standardisation of frequency had been tackled.

AUSTRALIAN LETTER.

Opening of the Victorian Commission's Sugarloaf Station.

By WILLIAM DAVEY (Managing Editor, "Australasian Electrical Times.")

MELBOURNE, April 3rd.

THE most interesting event of March for electrical people was the official opening of the Victorian Electricity Commission's Sugarloaf power station on the 20th. This station, which is equipped with two 9 000 H.P. Brown-Boveri units, is unique in that it will be almost entirely a summer station. It is situated on the Eildon Weir, which has been thrown across the Goulburn River at a point about 100 miles from Melbourne to impound 306 000 acre-feet of water for irrigation purposes; and this water, released during the dry months to irrigate the farms of the upper Goulburn valley, will first be employed for the generation of power in the Sugarloaf station. As a complement of this station the Commission has already opened four smaller ones, which have a combined capacity approximately equal to that of Sugarloaf, and the maximum output of which will be available in the winter months when the mountain streams are high and power will not be available on the Eildon Weir, because water storage will be taking place for the dry season.

All of these mountain streams are operated in all details, both electrical and hydraulic, by supervisory control, from a sub-station known as Rubicon A, centrally situated to the system. An interesting detail is that no overhead construction has been required for the control wires over the greater part of the system, lead-covered cable being employed and laid along the bottom of the concrete aqueducts, which carry water from station to station. At a later date the storage capacity of the Sugarloaf reservoir will probably be increased to 900 000 acre-feet.

The Institution of Engineers, Australia, carried out a novel experiment with great success on March 26th. The electrical branches of the Melbourne and Sydney divisions held a joint meeting; the former sitting in Kelvin Hall, at the Allied Society Trust Building, Melbourne (a fine building owned by the technical bodies of the State); and the latter in the P. N. Russell School of Engineering, Sydney, 600 miles distant. The two meetings had full two-way communication by means of the Sydney-Melbourne carrier-current telephone service and loud speakers. Mr. R. M. Harvey, of the Victorian Railways Department, was unanimously elected chairman, and the meeting was conducted as if all were housed under the same roof. Two short papers were read, both dealing with recent

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telephone developments. The first was delivered in Melbourne by Mr. J. M. Crawford, Chief Engineer, P.M.G.'S Department; and the second in Sydney, by Mr. Robert Lawson, State Engineer of the Department in New South Wales. A discussion followed in which participants both in Melbourne and Sydney joined freely.

The whole of the proceedings were not only heard clearly by those present at both meetings, but were broadcast and heard clearly throughout the whole of Australia.

Among English electrical people who are at present in this country are Mr. G. B. Richards, representing Higgs Motors; and Major J. M. MacLulish, director of the Baird Television Co., who will organise the marketing of his company's system in Australia.

CORRESPONDENCE.

The Editor welcomes the free expression in these columns of genuine opinion on matters of public interest, although he disclaims responsibility alike for the opinions themselves and the manner of their expression.

132 000-Volt Cables.

[To the Editor.]

Sir,—In recent correspondence on the Battersea station it seems that the risks of employing these cables are quite unduly magnified. To anybody who has got the least foresight, cables of 132 000 V must come, as surely as steam pressures and hydraulic pressures—and now, even town-gas pressures—must go up, and the sooner we get experience with them the better.

What are the risks? The Pirelli cable in Italy has been working continuously the last eight years; two 90 000 kVA transmissions—one in New York and one in Chicago—have now been working practically two years; and I have private information which shows that American cable manufacturers are tendering for, and guaranteeing performance of, other large installations in U.S.A. with these cables. Indeed, so confident are they, that one of the very foremost of them is, to my own knowledge, ready to put down such cables in London under a two-year guarantee.

However, let us consider the risks. According to "Engineering's" estimate for Battersea, it will cost £2 700 000 to run perhaps 15 miles down the river, or say, £180 000 per mile of route.

Now, the 66 000 V cables cannot cost more than £3 000 per single-core cable per mile; so that there must be at least 60 cables (20 circuits, each a complete unit).

I suppose I shall hardly be believed when I say that 300 000 kW could be transmitted by twelve 132 000 V pressure-oil-filled cables, costing, on reliable information in my possession direct from the manufacturers, not greatly over £1 000 000 even for 15 miles (I submit that ten miles, however, is amply sufficient; it would carry us down past many possible sites).

Whether this figure be accepted or not, I am prepared to demonstrate (in the right quarter) that 12 cables would do the job with the amplest possible margin for spares.

Now if a (66 000 V) cable breaks down—and they will only go down one at a time—we have 57 cables still in parallel to carry the load. Only ten years ago a certain prominent engineer was criticised for being ultra-conservative because he preferred ten small generating sets in his station to, say, three large ones and one spare. But 20 sets! How ridiculous!!

Now take the 132 000 V side. In the above 12 cables there is a provision equivalent to two large generating station sets and four full-sized spare, or standby, sets. (This may not be clear in certain quarters, but let it stand—I can justify it.) What generating station engineer would not be delighted if he could have such a standby equipment and at such a relatively low cost?

The fact that the New York and Chicago installations have now been running without any hitch for nearly two years under strenuous conditions as regards load, is conclusive proof that they are going to stand—that nothing short of the perforation of the lead sheathing or the gradual failure of the dielectric can put them permanently out of working.

In the early days of 33 000 V cables, the mistake was made of not testing the cables under heavy overloads. We have learnt our lesson, and it will not occur again.

On the question of any radical changes, developing with time in the dielectric (apart from loading), that is settled for us by the eight years of experience on the aforesaid Italian line.

If we save £1 700 000 by using pressure oil-filled cables, and if—to assume the worst case conceivable—these began to go wrong after eight years, and if we had to replace the whole lot, bit by bit, within 12 years (total), we still have that £1 700 000 (plus the saved interest and depreciation over eight years) with which to buy two complete sets of new cables, extending the equivalent life to 36 years at least.

Who is to say that 66 000 plain-impregnated cables will last longer than 36 years?

Again, quite apart from Battersea, we must face the need for crosslinking in London. They are already doing it in New York.

Only a fortnight ago came a report across that owing to a heavy thunderstorm, the load at one part of New York went up suddenly by 300 000 kW.

This cannot be met with 66 000 V cables without great expense, owing to the congestion of our streets and the annual losses in the cables. What a gain in relieved street congestion would be effected by reducing the 60 cables to 12 (spread over four different routes)!

It seems to be pretty obvious that our British cable manufacturers are now discountenancing the employment of 132 000 V cables. This, however, is a dangerous proceeding.

One of these days we shall have one of the more enterprising American cable companies—in fact they are ready now—actually offering to lay and guarantee, in London, pressure-oil-filled cables at a cost not much more than one-third of that with 66 000 V cables.

Are we going to hamper British industry and lose, annually, hundreds of thousands of pounds (it will come to this, shortly), waiting for these cables to have had two or three more years' "experience"—at somebody else's expense—while meanwhile the American and Italian manufacturers will reap the reward of that enterprise which used to be considered an exclusively British possession?

In conclusion, I commend the extract from Sir John Snell's statement before the Parliamentary Committee in 1927, quoted in the "Electrical Times" of May 16th, 1929, to your readers, as showing what we have got to face in the way of increased power loads in the West End of London.

What if the E.D.A. should succeed in its efforts to increase the loads? Even Sir John Snell's estimates might then be upset; and my case would be all the stronger.

This letter is neither a plea for, nor against, shifting the Battersea station—it is solely a plea for giving pressure-oil-filled cables a thorough trial at as early a date as possible. Reference has been made to Battersea merely as a convenient exemplification of the issues involved.

As I can claim to be the only engineer who has had made, and successfully tested (up to 720 000 V) at his own expense, a super-tension cable intended for 150 000 V working, I hope I may be considered as entitled to say something on this subject.—I am, etc.,

A. M. Taylor.

Erdington, Birmingham.
May 17th.

Battersea Power Station.

[To the Editor.]

Sir,—The long letter by Mr. W. F. Fladgate, Chairman of the London Power Company, renders it imperative, in my opinion, that a proper inquiry into the whole circumstances of this station should be held immediately, and that the electrical industries themselves, in their own interests, would be well advised to be active in the matter.

It is, of course, impossible to deal with all the points raised by Mr. Fladgate, but I hope you will allow me to consider two of them. The first concerns the Klingenberg power station in Berlin and the argument that this supports the Battersea site. The facts are that Klingenberg, generally acknowledged to be the world's finest power station, is already in difficulties with regard to coal dust flying about all over the place, due to the wind, in connection with the handling and storage dumps, quite apart from the question of sulphur from the chimneys. In addition to Klingenberg, Berlin is being partly supplied from two stations, both burning lignite, that is Tschornewitz between Bitterfeld and Wittenberg, 85 miles from Berlin, which is now nearly 300 000 kW, and one of the largest power stations in the world; and Golpa, 60 miles away, which supplies to Berlin, apart from other consumers, approximately 40 000 to 50 000 kW.

In connection with the Yallourn power station in Victoria, now having 75 000 kW installed plant, the exact distance by the overhead transmission lines to Melbourne is 110 miles, and it is late in the day indeed, to infer that the extended grid system of electrical distribution is not a practical proposition.

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Also one need, perhaps, hardly emphasise that the Manchester Corporation is already involved in serious litigation with regard to the Barton power station, which is actually outside the city area.

Secondly, Mr. Fladgate states "it is practically possible to render innocuous the fumes which arise in the process of generation," whatever this may mean exactly. Apparently, he has no room to explain to us what is this entirely new method of eliminating sulphurous and sulphuric acid from chimney gases. At the present time there is no station in the world adopting any such methods, and I suggest that this will apply also to Battersea. If not, will Mr. Fladgate give us details of the new method for which the world is waiting, and also the nett cost of the same, while, if it involves the general principle of washing the gas with sprays of water, will he tell us whether all the sulphuric acid will be discharged into the Thames?

Finally, I should like to emphasise again, most strongly, that it seems to me to be stark madness for the electrical industries, in this way, to incur the active hostility of almost every section of the community, that is, of course, its own potential customers, and sooner or later the British Government, although it has successfully evaded the question ever since the first House of Commons Committee, will be forced to take proper steps in connection with the whole subject of the pollution of the atmosphere.—I am, etc.,

DAVID BROWNLIE.

London, W.5.
May 20th.

"The Wireman's Viewpoint."

[TO THE EDITOR.]

SIR,—In reply to "Wireman" in to-day's correspondence column, I would say that his remarks as to builders, plumbers, gasfitters, etc., who are also electrical contractors, are too general. I was apprenticed as plumber and gasfitter over 40 years ago, and I, like many others at that time, had occasionally to turn to the electrical branch when required. My reply to that was to attend evening classes to make myself efficient on the theoretical side, and, as I possess City and Guilds' certificates, I consider I am qualified.

In reference to the term "electrical engineer," any wireman who has been in the trade a short time classes himself as such. I have personally come across men who have been in the trade a considerable time who do not, or cannot, calculate the amperes on a circuit, and who do not trouble to see whether a circuit or meter is overloaded. Personally, I consider the I.E.E. is to blame for this. They should have had a law passed to prevent unauthorised persons using the term.

In his references to shoddy wiring, "Wireman" is quite correct, but again the employer who does this sort of work sacrifices his name; personally, I prefer to lose a job rather than run the risk. Compulsory registration and the National Register will cure a lot of shoddy wiring, and it behoves us all to help it forward, whether employer or employed.

Again, in reference to price, I have come across many clients who want an installation done, who get perhaps three estimates and select the lowest price. They do not even read the quotation to see what is going to be done, or what they will get for their money.

Finally, a word to "Wireman." Do not sacrifice quality work for slops, and keep on pegging away. You may get the sack for being termed slow, but even then, if a firm are shorthanded they will put up with that in preference to incompetent work, and you will eventually fall in with an employer who values his name.—I am, etc.,

"CONTRACTOR."

London, E.17.
May 17th.

"Advertising Abuses."

[TO THE EDITOR.]

SIR,—May I congratulate "Advertising Manager" on his letter in your issue of May 17th? He ably weaves into his compliment to Mr. Charles Pinkham—the General Electric Co.'s representative to the Incorporated Society of British Advertisers—a crisp summing-up of the real difficulty and evil that attach to the unfair system of "Advertising under Duress," or "Camouflaged Blackmail Soliciting."

The whole subject was officially dealt with in "The British Advertiser" some short time ago, and at a recent meeting of the Executive of I.S.B.A., the following resolution was passed and forwarded to members for their guidance and strengthening in withstanding this abuse:—

That this Executive regards with apprehension the fact, indicated by complaints recently received, that the practices described in the article entitled "Advertising under Duress," in "The British Advertiser," No. 3, Vol. 1, are extending. The Executive therefore wish to place on record their disapproval of this kind of solicitation, whereby the name of an advertiser is used as a lever to persuade other firms who are customers of such an advertiser to take advertising space on a special page or in a special issue. Advertisers generally, and members of the I.S.B.A. in particular, are earnestly requested not to lend themselves to such schemes.

I would add in conclusion that my Executive are so much alive to the serious nature of this new and unfair handicap with which advertisers are being saddled, that they have arranged that it shall be the principal subject dealt with by one of our leading speakers at the I.S.B.A. Session, under the chairmanship of Mr. Angus Watson, at the Advertising Association Convention at Newcastle-on-Tyne on June 18th. "Advertising Manager" will see from this that the I.S.B.A. is already taking collective action to put an end to this coercion, and I am sure we shall have his good wishes for complete success. I hope we shall have his co-operation as well.—I am, etc.,

ALFRED H. ANGUS,
General Secretary, I.S.B.A.

Aldwych House, W.C.2.
May 21st.

[TO THE EDITOR.]

SIR,—I agree with "Advertising Manager" as to the difficulty which the small firm experiences in withstanding the advances of the advertising blackmailer. I should like to say, however, that the Incorporated Society of British Advertisers has already taken certain action to put an end to this abuse. If "Advertising Manager" cares to communicate with me, I should be pleased to give him particulars, and also my opinion, as to what it is that prevents stronger action being taken.—I am, etc.,

H. M. GOODY.

Well Lane, Chester.
May 21st.

Wiring Regulations.

[TO THE EDITOR.]

SIR,—Adverting to the article on Wiring Regulations under "Current Topics" in your last issue, it may interest you to know that the I.E.E. Wiring Regulations have been incorporated in our conditions of supply since 1925.—I am, etc.,

W. H. COOKE,
Electrical Engineer, Borough of Luton.

Luton.
May 17th.

[We are glad to add Mr. Cooke's name to the list of supply engineers who have made compliance with the I.E.E. Regulations obligatory.—ED.]

STANDARD DISTRIBUTION BOARDS.

Requirements as to Design and Construction of Cases.

BRITISH Standard Specification No. 214-1929, is a further addition to the series of British standard specifications for electrical accessories and installation materials. The specification relates to two-pole distribution fuse-boards and distribution switchboards for ordinary duty with working currents not exceeding 30 A per way, and for use in circuits the voltage of which does not exceed 250 V.

The boards are rated in terms of the largest current per way which can be carried continuously without the temperature-rise of any of the parts exceeding a specified amount. There are three standard sizes, namely 5, 15 and 30 A per way.

The specification lays down requirements as to design and construction of wood and metal cases, the performance of the switches (if any) and fusible cut-outs, and details of tests to be carried out on completed distribution boards.

Copies of this Specification (No. 214-1929) can be obtained on application to the Publications Department, British Engineering Standards Association, 28, Victoria Street, S.W.1, price 2s. 2d. post free.

We want to see every girl a household electrician.—*Miss C. Haslett.*

* * *

I like to think of the wireless-cable merger as the first great effort in the rationalisation of Imperial economics.—*Sir Basil Blackett.*

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66 kV Fuse Tests. B. M. Jones and E. H. Coxe, jr. ("Electrical World," April 20, pp. 785–786.)

The Mechanical Testing of Materials. R. W. Bailey ("Metropolitan-Vickers Gazette," April, pp. 252–256.)

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Recuperative Traction. D. Riccia and Andries. ("Bulletin de la Société Française des Electriciens," March, pp. 295–314.)

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When the Farmer Electrifies, what Equipment does he Buy First? F. J. Zink. ("Electrical Merchandising," April, pp. 84–85.)

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NEWS IN BRIEF.

Plymouth Wiring Scheme—New German Submarine Telephone Cable—Resumption of Imported Glassware Inquiry—French Hydro-Electric Project.

THE annual meeting of the Illuminating Engineering Society will be held on June 4th.

The Swedish Industries Fair will be held in Gothenburg from May 26th to June 2nd. Electrical and wireless apparatus form part of the exhibits.

Leeds Housing Committee has arranged to let to the Electricity Committee two shops in Guildford Street, adjoining the present showroom premises.

Addressing the members of the Brighton Round Table Society, on May 16th, Mr. John Christie, borough electrical engineer of Brighton, said the Corporation's electricity undertaking was an enormous asset to the borough, the revenue during the past year being £260,000. It served 30 000 consumers.

The I.E.E. Annual Conversazione will be held at the Natural History Museum, South Kensington, on July 4th.

St. Pancras (London) Electricity Committee is to instal an additional 1 000 kW rotary convertor at Grafton Road sub-station.

"Should Ironmongers Develop the Electrical Department?" was one of the questions for discussion at this week's conference of the Ironmongers' Federated Association at Cromer.

Approval has been given for the formation of a Hampshire Sub-Centre of the Institution of Electrical Engineers, which will probably hold its meetings at Portsmouth and Southampton.

Plymouth Electricity Committee has referred to a special committee the question of payment of standard rates of wages by certain contractors supplying installations under the Corporation wiring scheme.

Lowestoft Electricity Committee is to appeal against the proposal of the Assessment Committee to increase the assessment of the electricity undertaking from £800 to £2 000 per annum, contending the increase to be inequitable.

LOOKING BACKWARD.

FIFTY years ago, according to THE ELECTRICIAN *for May 24th, 1879:—*

Mr. James Adams, Edison's English representative, died in Paris.

The Cape cable was being manufactured at Greenwich by the Telegraph Construction and Maintenance Co.

Reports from Sumatra complained that frequent disturbance of telegraphic communication was caused by elephants who hid the wires and insulators in thickets.

* * *

TWENTY-FIVE years ago THE ELECTRICIAN *of May 27th, 1904, reported that:—*

The Hanover tramways were being converted from the accumulator to the overhead system.

Favourable reports were made on the efficacy of the Druitt Halpin thermal storage system at the Kensington and Knightsbridge Co.'s Wood Lane station.

Mr. L. L. Robinson issued a pamphlet providing intending consumers with a list of streets in which mains were laid, and the exact lay of the mains.

* * *

TEN years ago it was stated in THE ELECTRICIAN *of May 23rd, 1919, that:—*

The Ministry of Munitions refused to sanction power station extensions at Birkenhead.

A step was taken by the British Westinghouse Co. towards the establishment of mutual confidence between employers and employed, in the holding of a meeting at which nearly 4 000 of its workpeople were present.

About 60 delegates from Sussex, Dorset and Hants. of the District Joint Industrial Council (No. 11) and the District Joint Board (No. 11) of the South Coast Area of the Electricity Supply Industry, held their annual meeting at Brighton Royal Pavilion last week when Coun. Cochrane, of Brighton, was elected Chairman of the Council in succession to Ald. Ainger, of Aldershot.

The number of persons insured under the national unemployment insurance scheme as workers in electrical engineering numbered 79 770 in July, 1928. The percentage of such persons unemployed on April 22nd, 1929, was 4·9, an increase of 0·2 compared with April 23rd, 1928. Under electric wiring and contracting, the number insured was 15 530, and the percentage unemployed 7·1 (increase 0·6), and under electric cable, wire and lamp manufacture, insured 86 180, and unemployed 6·1% (decrease 0·1%).

According to a "Times" message, Dr. Georg Zapp, director of the Felten and Guilleaume Carlswerk A.G., has designed for telephone purposes a new submarine cable, of which the four 3.3 mm. copper lines are contained in a flexible tube made of light metal, and covered with a lead envelope. It is claimed that this construction enables rubber insulation to be superseded by ordinary paper insulation. Pupin loading coils are inserted every two kilometres. It is claimed that the cable would withstand the pressure of the sea at a depth of 6 000 metres.

The annual conference of the Electrical Trades Union opened at Blackpool on Monday. Mr. J. W. Ball, president, said the progress of the Union had been cramped by the question of finance. A strong financial position was essential if they were to obtain equitable service for their members. Mr. J. Rowan, general secretary, said there were improvements waiting for workers in the electrical trades if they would organise to get them.

A recent report in "The Times" Trade Supplement states that in British West Africa railway and tramway machinery is in request. The market for electrical machinery and equipment is of growing value. Electricity supply schemes have been developed in some of the chief towns, and electric cranes have been installed in Takoradi harbour. Experiments are being made in the development of hydro-electric power. Electrical and telegraph apparatus and scientific instruments are obtained almost entirely from the United Kingdom.

At a recent meeting of the Royal Society of Edinburgh, Mr. Geo. Redington read a paper on "The Effect of Diurnal Periodicity on Plant Growth." Electric light was used in the experiments upon which Mr. Redington reported. The periods of lighting were (1) continuous light; (2) eight hours light per day, and (3) 16 hours per day, and the 16 hours' period produced the best results. Mr. Redington said healthy plants could be grown in artificial light, and if electricity could be supplied at a sufficiently low price it could be used in greenhouse work.

Torquay Electricity Committee has received a statement from the Borough Electrical Engineer on the result of inquiries made by the I.M.E.A. from the various municipal undertakers in the country regarding the sale of fittings and apparatus. Of the 119 undertakers who replied to the questionnaire, 69 are exercising the powers conferred upon them by Section 48 of the Electricity (Supply) Act, 1926, and of these all but two sell fittings and apparatus direct to the consumer without concessions to contractors. The remaining two have working arrangements with the local contractors.

The joint summer meeting of the N.E. Coast Institution of Engineers and Shipbuilders and the Institution of Engineers and Shipbuilders in Scotland, will be held at Newcastle-on-Tyne, from June 2nd to 4th. Mr. R. P. Sloan will read a paper entitled "Developments in the Uses of Electricity."

The Standing Committee appointed by the Board of Trade will resume their inquiry as to whether imported glassware (other than lamp-blown glassware and scientific glassware) should bear an indication of origin on May 27th. The inquiry in regard to lamp-blown glassware and scientific glassware will be held on June 3rd and June 4th.

A correspondent of "The Times" states that work will begin soon in the Val des Dix, south of Sion, in the Valais, in preparation for the erection of a large hydro-electric plant. The works will include a dam across the higher part of the valley which will make it possible to form an artificial lake containing about 150 000 000 cu. ft. of water. The water will be led through pipes to the Rhône valley, where, after a fall of 5 300 ft., it will drive the turbines of a power station situated near Champsec. It is estimated that the plant will generate 120 000 kW, and the cost will be nearly £2 400 000.

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LEGAL INTELLIGENCE.

The Loewe Radio Licence—Another Marconi Appeal.

MR. Justice Luxmoore, in the Chancery Division on May 16th, began the hearing of an appeal by Marconi's Wireless Telegraph Co. from a decision of Mr. W. S. Jarratt, Comptroller-General of the Patents Office, and his assistant, Mr. H. C. Haycroft, who had decided that a licence should be granted to the respondents, the Loewe Radio Co., to manufacture in this country triple and double valves for wireless sets, on paying to the Marconi Co. a royalty of 10s. for the three-valve set and 7s. 6d. for the two-valve set.

In other forms of multiple valves the royalty was to be on the basis of 5s. for the first valve and 2s. 6d. for each additional valve. The Marconi Co. had offered to grant a licence at a royalty of £1 17s. 6d. for the three-valve set, £1 5s. for the two-valve set and £3 2s. 6d. for long range sets. The Comptroller and his assistant were of opinion that to insist on these prices meant substantially refusing to grant a licence, thereby prejudicing the establishment of a new trade and industry in this country.

Sir Duncan Kerly, K.C., and Mr. Trevor Watson were for appellants and Mr. Stafford Cripps, K.C., and Mr. E. McEwen were for the respondents, while Mr. Crossman represented the Attorney-General.

Sir Duncan Kerly said the Loewe Radio Co. was the creation of a German company, which was carrying on a business in the manufacture of these goods in Germany.

Mr. Cripps said the company concerned in this matter was English.

Sir Duncan said the Loewe Co. applied for a licence for the three-circuit patents, and the Marconi Co. replied they would be infringing other patents, in particular, the two-valve patents. The Loewe Co. then said they would like a licence for four or five valves, and the Marconi Co. said they were prepared to discuss terms. The Loewe Co. then went to the Comptroller without any further correspondence. He contended there was absolutely no case for interference by the grant of a compulsory licence on the ground that a licence had been refused. His case was that the Comptroller had proceeded on unverified if not unverifiable assumptions. He was wrong in his assumption that the grant of the licence would create a new trade and industry in this country. All it did was to give another person the opportunity of entering an existing trade in which there were over 2 000 manufacturing under various patents.

For the Respondents.

Mr. Stafford Cripps, K.C., for respondents, said this case had been wrongly represented as an attempt by a German company to "try on" something in the English market. The Loewe Co. had been for many years known to the Marconi Co., and Dr. Loewe was not a German, but an American citizen. The fundamental distinction between this case and the Brownie case was that the Loewe Co. were owners of some twelve or more British letters patent, and the Crown had granted a monopoly to them, and the basis on which that monopoly had been granted was the Statute of Monopolies. That was to say, the monopolies had been granted as a reward for the introduction into this country of new manners of manufacture. They were paying large sums in order to preserve their monopolies in this country.

It was common ground for the purposes of the present case that those monopoly rights could not be exercised in this country without a licence from the Marconi Co. The Marconi Co. did not manufacture themselves, but granted licences, but none of their existing licensees could manufacture this particular article in this country. No one could manufacture it here except the Loewe Co., and if they were not permitted to make it, this country must inevitably go without it. The Loewe Co. did not ask for 10s. to be charged for the licence. They put forward a suggestion of 10% on the wholesale price, and they were asked by the Marconi Co. to pay 37s. 6d. for the valve holder. He submitted that on the correspondence there was a refusal by the Marconi Co. to grant a licence, but that if there was not a definite refusal there was a refusal to grant a licence on reasonable terms.

The Loewe Co., concluded counsel, were quite prepared to pay a reasonable minimum royalty and were willing that the licence should be limited to the particular form of multiple valve that had been shown to the Court and to any reasonable limitation as to price.

His Lordship suggested that it might be possible for the parties to agree to a form of licence.

Sir Duncan Kerly said he was unable to do that on his present instructions, but he was authorised to say that his clients fully anticipated that there would be a licence and they were prepared to grant a licence.

Mr. Cripps said the only obstacle arose from the difficulty of getting instructions from Sir Duncan's clients.

The suggested terms of agreement were written down and handed to his Lordship, but were not disclosed.

His Lordship reserved judgment, remarking that he would give judgment in this and the Brownie case on the first day of next term.

Cooper Roller Bearings *v.* Power Plant.

Legal arguments were heard before Mr. Justice Talbot, in the King's Bench Division, on May 17th, in the action brought by the Cooper Roller Bearings Co. against the Power Plant Co., in which, on April 12th, his Lordship held that the plaintiffs had established a prima facie case for the recovery of about £800 for work done in maintaining certain friction clutches supplied at rolling and other mills at the order of the defendants.

Mr. Slade, for the plaintiffs, now asked that judgment should be entered for his clients for an amount to be determined by the Official Receiver and for the taxed costs of the action and that a counterclaim should be dismissed with costs. He also asked for liberty to apply to the Court again when the amount had been ascertained.

His Lordship acceded to this, but said that the defendants' right to appeal would not be prejudiced.

Compulsory Winding-up.

Mr. Justice Maugham, in the Companies Winding-up Court, on May 13th, heard the petition of the Albion Iron Co. (London), Ltd., for an order for the compulsory liquidation of Swinden and Co., Ltd., makers of mining and electrical plant, which is in voluntary liquidation.

His Lordship said the evidence showed that the company had a nominal capital of £500, with only £72 paid up, and it had been carrying on business on a large scale, purchases of goods amounting to £60 000 being made in three years, while debts amounting to £1 300 were incurred within four months of liquidation. These facts showed that the company had not been properly conducted and he thought it would be better liquidated with the help of the Official Receiver. He accordingly made the usual compulsory order.

THE "NEOPHONE."

Details of the New Telephone Instrument Adopted for Public Use by the Post Office.

THE illustration of the new Post Office telephone which appeared in THE ELECTRICIAN of May 10th has created considerable interest, and we are now able to give additional particulars.

The new instruments were produced by Siemens Brothers and Co., Ltd., Woolwich, in co-operation with the Post Office engineers, and consist of an immersed electrode inset transmitter which, in conjunction with a special anti-side tone circuit, is said to eliminate the howling, frying and excessive side-tone not uncommon with this type of microphone, and to maintain its efficiency irrrespective of position. The instrument is said to be superior as regards articulation and better in speech transmission efficiency than the standard solid back transmitter.

The makers point out that this development constitutes an important advance in telephone technics, the increased efficiency incidentally enabling higher resistance local lines to be employed without reducing the speech transmission efficiency, and on this account far reaching economies in line plant may be effected.

It is interesting to note that in the construction of the "Neophone," as the new telephone is called, a moulded insulating compound has been largely employed, the case, micro-telephone handle and the cradle all being made of this material.

The pattern adopted by the Post Office uses a separate bell set, but a special design of bell set which can be used as a base on which to mount the telephone piece, makes provision for a complete instrument for those who prefer the combined type. The Post Office has placed a contract with the manufacturers for 50 000 instruments.

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PERSONAL.

SIR Harry Brittain has been elected president of the Wireless Retailers' Association.

Mr. J. S. Highfield's "Cyra" raced in the Upper Thames Sailing Club's meeting at Bourne End on Tuesday.

Mr. W. G. Bedford, electrical engineer, has been elected a member of the Executive Committee of the Slough and District Chamber of Commerce.

Mr. A. C. Watts, of the Premier Electrical Co., has been elected chairman of the Sussex branch of the Electrical Contractors' and Allied Associations.

Mr. A. Brammer, general secretary of the Association of Supervising Electrical Engineers, is now back at his duties, though not yet fully recovered from his recent illness.

Mr. F. Favell, engineering assistant at Stoke-on-Trent electricity works, has been appointed power-house superintendent, in succession to Mr. G. A. Vowles, who has become engineering assistant at Hull.

Mr. H. W. Albrow, chief electrician at the works of Smeed, Dean and Co., of Murston, Sittingbourne, who is leaving the district, has been presented by the electricians and other employees with a gold watch.

Bedford Electricity Committee has appointed Mr. J. R. Blaikie as constructional engineer in connection with the preparation of plans, etc., for the erection of the proposed switch house, at a salary of £32 per month.

Miss E. L. Calligan, who is employed as a shorthand-typist by the Liverpool Branch of the General Electric Co., Ltd., won the £10 prize on May 9th offered by the "Liverpool Evening Express" and Lewis's, Ltd., in an open typing competition. She attained a speed of 71·3 words a minute.

The Committee of Award for the Commonwealth Fund Fellowships have appointed Mr. D. M. Robinson, of London University, to one of the 24 Fellowships tenable by British graduates in American Universities for the two years beginning September, 1929. These Fellowships are offered by the Commonwealth Fund of New York, of which Mr. Edward S. Harkness is president, and Mr. Robinson has been appointed to Massachusetts Institute of Technology in Electrical Engineering.

INLAND TELEGRAPH SERVICE.

Post Office Reply to Report of Hardman-Lever Committee.

THE Postmaster-General has sent to the Council of the Association of British Chambers of Commerce a letter which is a reply to the recommendations contained in the Report of the Hardman Lever Committee on the Inland Telegraph Service. The reply deals with 12 of the 17 recommendations made by the Committee, and it is stated, *inter alia*, in the Post Office reply that arrangements have been made to facilitate the more frequent adjustments of staff to traffic in the larger telegraph offices. Some alterations in the grading of work are being introduced; in regard to the "walk" system of delivery, improvements are being effected where necessary; considerable progress has been made in overcoming maintenance difficulties in connection with teleprinter (start-stop) apparatus; the replacement of Morse by teleprinter apparatus is being carried out as rapidly as possible; the question of concentration of traffic is being pursued and unnecessary circuits are being suspended; the inland telegraph tariff is not to be altered for the present; the rate for telegrams between Great Britain and the Irish Free State has been increased to a minimum of 1s. 6d. for twelve words; a Commission of Inquiry has recently made an exhaustive study of the organisation and methods of the telegraph companies operating in the United States of America; progress is being made in the concentration on fewer types of apparatus. The remaining recommendations are stated by the Post Office to be under consideration.

THE SOCIAL SIDE.

The St. Helen's Cable Co., Slough, cricket club, are among those who are founding the Slough Estate Cricket League this season.

Reading Corporation Tramways were champions of Section B, Division II, of the Reading and District Billiards League.

The Oxford Electric Co., football club wound up their season with the annual match between "married and single." The bachelors were successful by 4 goals to 2, and they received the challenge cup from the hands of the president, Ald. W. H. Perkins.

BUSINESS ITEMS.

THE DEVON RADIO AND ELECTRICAL CO. has opened a showroom at 331, Torquay Road, Paignton, under the management of Mr. E. White.

The Glasgow office of the ENGLISH ELECTRIC CO., LTD., formerly situated at 40, Wellington Street, is now removed to 200 St. Vincent Street.

The new premises which have been opened by Siemens Electric Lamps and Supplies, Ltd., at 4, Castle Boulevard, Nottingham.

Mr. Colin H. Campbell, managing director of Campbell Walker and Co., of Melbourne, Australia, who is now in this country, desires to hear from manufacturers of electrical appliances. His address is 58, Basinghall Street, London, E.C.2.

The INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, through its subsidiary, the International Standard Electric Corporation, is entering into the field of the manufacturing of electrical communication apparatus in Germany by the purchase of a substantial interest in the Ferdinand Schuchhardt Berlin telephone and telegraph works.

The "Orvieto," the "Avilla," and the "Minnewaska" have been fitted with picture-receiving apparatus, and with special sets designed by the Marconi International Marine Communication Co., Ltd., whereby typewritten lists of Stock Exchange quotations can be received by facsimile transmission. The Wireless Press, Ltd., and Wireless Pictures, Ltd., maintain the service through the Rugby station.

H. W. Young, president of the DELTA-STAR ELECTRIC CO., Chicago, Ill., advises that the CHAMPION SWITCH CO. has been purchased, and the Kenova, West Virginia plant will continue manufacturing its present lines of equipment in addition to several new designs. Manufacturing arrangements have been completed with the SOCIETE D'INSTALLATIONS ET DE CONSTRUCTIONS ELECTRIQUES ET MECANIQUES, Boulogne-sur-Seine, to manufacture and distribute "Delta-Star" equipment in France and its colonies. An interest has also been acquired in the MONARCH ELECTRIC, LTD., St. Johns, Quebec, which will soon be operated as the Monarch Delta-Star Co. At the Canadian factory will be manufactured a complete line of "Delta-Star" equipment—in addition to the present switching equipment, switchboards, oil circuit breakers and oil switches. New designs of large capacity oil breakers for voltages up to 132 kV will be added shortly. Mr. Young states that the equipment will be handled by its established sales organisation and the Kenova Champion works will be operated as a separate unit with its own sales organisation. The St. Johns factory will handle all business for Canada and the British possessions and the French factory will have its own sales organisation.

LIVERPOOL ELECTRO-HARMONICS.

Arrangements for Next Season's Concerts.

NEW rules were approved by members of the Liverpool and District Electro-Harmonic Society at the recent annual meeting, with Mr. A. T. Hillman in the chair, whereby friends of members may join the society, and members will receive a limited number of tickets for the invitation of guests to next season's concerts. These functions will be held at the Angel Hotel, Dale Street, Liverpool, on the fourth Friday in every month from October to March inclusive, and will be preceded by a dinner instead of a "hot pot" supper as in previous years.

The annual golf competition for the Allied Electrical Trades Challenge Cup will be held at Childwall on June 11th.

Mr. P. J. Robinson was re-elected president, Mr. E. G. Pulford hon. secretary, and Mr. W. A. Sloane assistant hon. secretary. Mr. L. F. S. Sington has resigned the office of hon. treasurer, and is succeeded by Mr. B. L. Myer. A committee of eighteen members was appointed.

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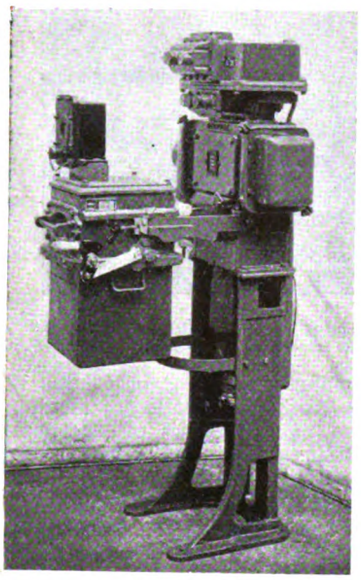
N.-E. COAST EXHIBITION.

A Brief Review of Some of the Exhibits of Electrical Interest.

AMONGST the varied exhibits which may be seen at the North-East Coast Exhibition, which opened at Newcastle-upon-Tyne on May 14th, are a number which bear upon the electrical industry. The E.L.M.A-E.D.A. stand, for instance, has been designed to indicate how the lamp of the present day, which has evolved so rapidly from Swan's first lamp, may be employed to the greatest possible advantage in every field of lighting service. The stand is divided into three interiors, consisting of two outer rooms and a central entrance hall, known as the "Hall of Light," where novel uses of electric light are displayed.



A 3 300 V, 200 A, 3-phase, flame-proof mining pillar, by A. Reyrolle and Co.

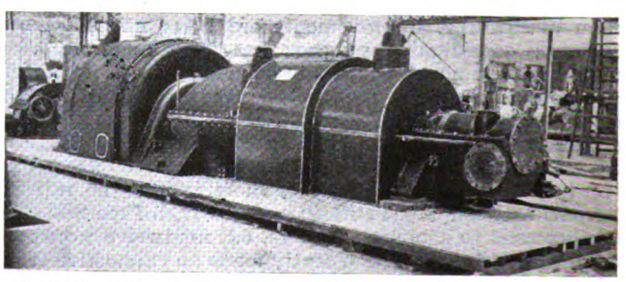
The exhibit of the BRITISH THOMSON-HOUSTON CO., LTD., is also devoted to light, including as it does some 100 fluted standards which support "Alabas" lanterns for lighting the grounds, and special globes housing floodlight projectors for the supplementary floodlighting of buildings. A "Mazdalux" fountain is another example of what can be done with electric lighting. Approaching the exhibition pavilions, there may be seen a striking effect produced by means of B.T.-H. floodlight projectors concealed at ground level in the foliage around the buildings. These projectors, 50 of which are employed, enable main buildings and towers of the Grand Court to be panelled in coloured light. The windows of the towers release beams of ultra-violet light from banks of mercury vapour lamps suspended in the centre of each tower, while above these, in the lantern tower, floodlight projectors throw moving beams of light upwards. In the club house, decorative and standard enclosing units with "Ace," "Keldon" and "Trojan" glassware are employed for interior lighting, while coloured lamps outline the pergola on top of this building. The bandstand is illuminated by means of flush ceiling units.

Amongst the exhibitors of domestic electrical apparatus and appliances may be mentioned PETTERS, LTD., who are showing a complete range of country house lighting equipments, including plants up to 3 kW capacity, while the REVO ELECTRIC CO., LTD., are showing water-tight lighting fittings, street lighting fittings, domestic fittings and appliances, cookers, fires, etc. BELLING AND CO. are exhibiting a range of electric fires, including portable designs and imitation coal fires. For industrial purposes there are totally enclosed and fireproof air warmers, pipe heaters and electric hot water radiators. A series of electric cookers is also on show, ranging from the "Baby Belling" cooker, suitable for small families, up to full size models. There are also electric water heaters suitable for fixing into existing tanks or cylinders and for use in conjunction with the ordinary domestic hot water system. Practical demonstrations are given of the new "Parmotor" relay, which is on show for the first time. This has a wide application, including the thermostatic control of water heaters, cookers, street lighting, etc.

The exhibits of FALK, STADELMANN AND CO., LTD., embrace specimens of modern lighting styles, "Efescoal" electric fires, complete ranges of "Ideal" table apparatus, "Nova" and "Efesca" switches, together with specimens of plates, and silk, nacrolac and parchment shades. The JACKSON ELECTRIC STOVE CO., LTD., is featuring a complete range of small and other domestic appliances, as well as cookers, fires, water heaters, etc.

On the industrial side, the YORKSHIRE COPPER WORKS, LTD., are exhibiting tubes of every description of interest to the industry, while for the convenience of visitors the stand of A. REYROLLE AND CO., LTD., is arranged as a lounge in its central part, with exhibits suitably disposed round its outer border. The whole of the main h.t. and l.t. switchgear required in the exhibition is of their manufacture, while included in the stand are selected examples of the smaller varieties of switchgear, such as mining switchgear, industrial switchgear, and plugs and sockets. Metal-clad switchgear, in earthed enclosures, and adequate protective systems for isolating faulty sections of an installation, are also included. The main exhibit of C. A. PARSONS AND CO., LTD., is a 3 000 r.p.m. reaction turbine, supplied with steam at 165 lb. per sq. in. absolute and coupled to a 6 250 kW alternator and exciter. The growth in turbine manufacture and design is shown by a comparison with the small set, built 44 years ago. This little machine ran at 18 000 r.p.m and developed 4 kW, and is similar in type to those which supplied current for lighting the Newcastle Exhibition in 1887. Among the exhibits is a turbine made in 1891, which generated 100 kW, running at 4 800 r.p.m. and 140 lb. per sq. in. steam pressure. Shaft adjusting gear to reduce the blade clearance to 0·01 in. and steam jacketed diaphragms for the fixed blades were, we are informed, both innovations at that time. It ran as a condensing turbine and when officially tested the consumption per kWh was 27 lb. A transformer built in 1890, and in service until a few years ago, is shown, also a section of h.t. and l.t. winding for a present-day 11 000/400 V transformer, and a tapping switch for a 20 000 V 200 A transformer. Two searchlight reflectors are also exhibited, one of 90 cm. diameter and the other of 220 cm. diameter. Various types of blades and blading, from those made for the first turbine in 1884 up to those used in present-day machines, are also displayed.

The exhibit of the NEWCASTLE-UPON-TYNE SUPPLY CO., LTD., AND ASSOCIATED COMPANIES is surrounded by a scale model of a 66 000 V overhead transmission line. The industrial heating apparatus displayed includes a 27 kW and 9 kW electric furnaces by the Birmingham Electric Furnaces, Ltd.; one 3·75 kW magnetic steel hardening furnace, by Wild-Barfield Electric Furnaces, Ltd.; a Vickers-Armstrong's hardness testing machine; and 18 kW immersion type electrical water heater for steam raising, by A. Reyrolle and Co., Ltd.; and miscellaneous heating apparatus, such as solder bolt heaters, babbitt metal pots, etc. In the colliery machinery section are shown a 2 000 g.p.m. centrifugal pump, by Mackley and Co., with direct-coupled high torque squirrel cage motor, by Veritys, Ltd., and with Ellison control apparatus; an endless rope hauler by John Wood and Sons, Ltd., incorporating worm and spur reduction gears by David Brown and Sons, Ltd., a 22½ B.H.P. slip-ring induction motor and a flame-proof mining type switch panel by the English Electric Co., Ltd., and with airbreak flame-proof drum type reversing controller with independently mounted resistances, by Allen, West and Co., Ltd.; an explosion-proof portable gate-end sub-station designed for the remote control of coal face machinery with incidental apparatus for demonstration purposes. General industrial machinery exhibits are also shown, and are seen in operation. Reference should also be made to a device which is shown and which has been given the name of the "Synchro-Vane." It consists of two motors, each fitted with a four-bladed propeller, each of which is revolving in opposite planes at a speed of 1 200 r.p.m., thereby producing a peculiar optical effect. Situated in the Tower Entrance of the Palace of Industry is a group of exhibits known as Switchcraft Corner. One stand shows in a modern setting the domestic uses of electricity; another stand is devoted to four large tableaux showing lighting effects, while a third room is designed as a rest room. Another exhibit, "Rooms of Today and Yesterday," shows how the rooms of a few years ago may be made artistic and comfortable with modern furnishings and electric fittings.



A 6 250 kW turbo-alternator and exciter, 3 000 r.p.m., steam pressure 165 lb., 11 000 V, 50 periods, 0·9 power factor, by C. A. Parsons and Co., Ltd.

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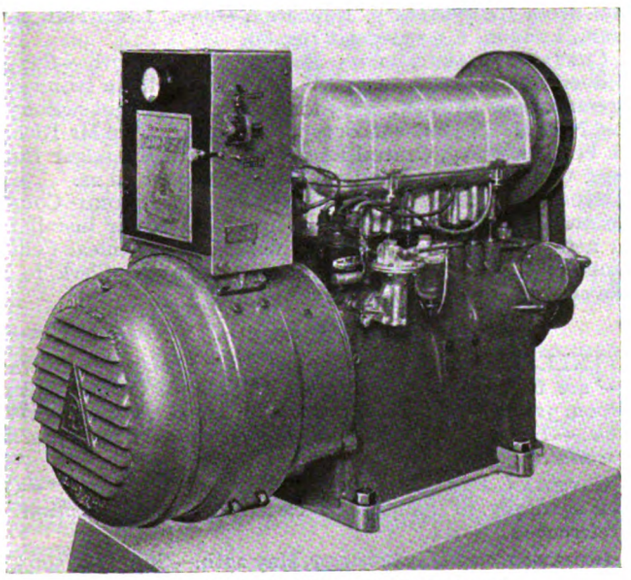
LIGHTING PLANTS.

Brief Particulars of New Lighting Plants for Country Use.

AT this season, when many of the public are considering installing small lighting plants in their summer dwellings and houseboats, it may interest contractors and others to know that several improved models are being put on the market by various firms, including R. A. LISTER AND CO., LTD., of Dursley, Gloucestershire, and 5, Tothill Street, Westminster, S.W.1, whose new lighting plant is illustrated in this column. This plant, with an output of 800 W at 110 V, has been designed to give a supply without the use of a storage battery, and will be found to meet the requirements of isolated buildings such as shooting boxes, seaside bungalows, etc., where current is generally only intermittently required. The standard equipment includes two control switches and an additional switch on the plant. The control points consist of a push button switch for starting and a tumbler switch for stopping, arranged in any convenient position. Starting is effected by a combined dynamotor and a 12 V battery of the car starting type, special provision having been made for reducing the charging rate to the battery when the latter becomes charged. A small switchboard carries the necessary meters and the switchgear, which is enclosed by a metal cover. The engine is 2-H.P. vertical water-cooled, four-stroke, with overhead valves. The fuel tank provides for 13 hours running on full load.

The "XL" patent combined lighting set produced by CAPEL AND CO., LTD., Engine Works, Dalston Lane, London, E.8, can be run on petrol, paraffin, alcohol, naphtha, methylated spirit, gas or suction gas. The chief features of the plant are that the half coupling of the dynamo is bolted to the single disc flywheel and that the carburettor is of special design. Centrifugal lubrication is used in the crank case, and sight-feeding lubricators are also given for the cylinder and gudgeon pin. The makers state that the engines are tested at the works with a full load for six hours, and run for two or three days under all conditions, records of such tests being kept for future reference. Messrs. Capel also offer the "Excelite" complete electric generating plant, which is sold to include switchboard and battery. The engine and dynamo are mounted on a common bedplate. An alternative model has a belt-driven dynamo.

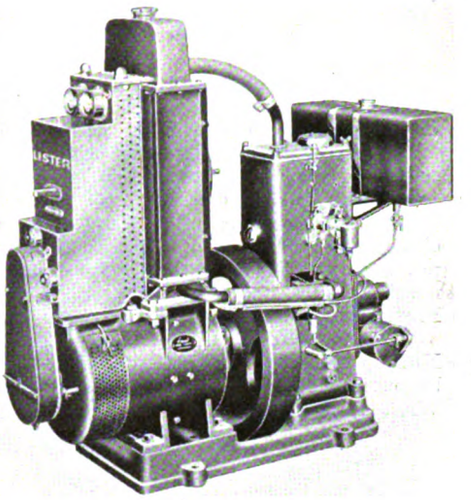


The recently developed "Delco-Light" equipment.

No new models are announced by the HEATLY-GRESHAM ENGINEERING CO., LTD., of Letchworth, Herts, and 40, Wood Street, Westminster, S.W.1, who continue to concentrate on their "Rational" vertical oil engines, applied to lighting and pumping sets, etc. They state that the latest range of "Rational" engines embraces units from small sizes up to 30-B.H.P.

PETER BROTHERHOOD, LTD., of Peterborough, and 34, Victoria Street, London, S.W.1, also manufacture home lighting sets.

FRIGIDAIRE, LTD., of Chapter Street, London, S.W.1, are marketing a new "Delco-Light" plant known as model 152. The plant is sold complete with Delco-Chloride storage battery, and is of the automatic type which operates without special control switches. When the load exceeds 300 W, the circuit through the self-starter is closed, and the engine continues to operate until the load falls below 175 W, at which point it is automatically shut down. The 16-cell battery has a capacity of 90 Ah at the ten-hour rate, and is equipped with floating hydrometers. Ordinarily this battery is automatically trickle-charged. If in exceptional circumstances current be taken at a relatively low rate for a long period, so that the engine remains inactive and therefore the battery becomes nearly discharged, an automatic cut-out opens the lighting circuit. Closing a switch on the control panel then starts the engine, and the lighting at once returns to normal, while the battery charge is brought back to a safe level. The four-stroke air-cooled engine—which is fitted with a pulley available for 3 H.P.—has four cylinders, copper-finned, one-adjustment carburettor and a.c. fuel pump. The generator is direct connected to the engine for 32 V service, the full load output being 1 500 W. The dimensions of the plant are: height, 27 in.; length, 33½ in.; width, 17 in. The floor space required for installation is 36 in. by 24 in. A further automatic feature is provided by warning of fuel shortage. Should the plant be out of fuel the cranking circuit will become disconnected after approximately one minute. Exhaustion of the battery is thus eliminated. The lubrication of the engine is effected by a combination of the positive pump and splash methods.



A new plant by R. A. Lister and Co., Ltd.

A smaller Delco-Light is model 752, also new, which has a full load capacity of 750 W. The generator is again direct connected to the shaft and gives 32 V service. This plant, which, in respects not mentioned here, is similar to model 152, has a single cylinder, five gallon petrol tank, and the splash system of lubrication. The capacity of the battery at the ten-hour rate is 60 Ah. This plant starts and stops automatically when the current requirements exceed approximately 200 W. Frigidaire, Ltd., are also offering several water pumping plants suitable for country house use and for other purposes.

In THE ELECTRICIAN of April 26th we described the new 5 kW automatically operated lighting plant manufactured by PETTERS, LTD., Yeovil, and another automatic and recently announced plant is the "Auto-Petter-Light," sold in three capacities of 700, 950 and 1 450 W. This plant is used without storage batteries and is designed for automatic control. The Petters 2-stroke water-cooled engine is used and a "Wico" magneto and fan-cooled radiators are fitted. The engine and dynamo are separate units. Mechanical lubrication is employed.

THE ROYAL INSTITUTION.

At a general meeting of members on May 6th, Sir Robert Robertson, in the chair, announced that the following had been nominated as vice-presidents for the ensuing year: Lord Blanesburgh, Sir James Crichton-Browne, Dr. W. H. Eccles, Sir Arthur Keith, Mr. C. H. Merz, Dr. G. C. Simpson, Sir Robert Robertson (Treasurer) and Major C. E. S. Philips (Secretary). The thanks of members were returned to Sir Dugald and Lady Clerk, Lady Dewar, Mr. T. H. Sowerby and Mr. A. A. Campbell-Swinton for their donations to the special fund for the alterations in the building. Sir J. J. Thomson was elected Honorary Professor, and Sir Ernest Rutherford, Professor of Natural Philosophy. Mr. C. E. R. Brocklebank and Mr. F. L. Pearson were elected members.

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BUSINESS OPENINGS.

Latest Particulars of Electrical Engineering and Wiring Installation Contracts for which Tenders are being Invited at Home and Abroad.

WE give below the latest particulars of contracts for which tenders are invited. The closing date is given, when available.

DUNDEE CORPORATION.—Electric lighting of Ashludie Sanatorium. Particulars, etc., from Mr. George Baxter, city engineer, 91, Commercial Street, Dundee.

PORTCAWL URBAN DISTRICT COUNCIL.—Transfer of Electricity Special Order to a company or persons. Forms, etc., from Mr. E. Davies, clerk to the Council; deposit £5 5s.

ST. PANCRAS (LONDON) BOROUGH COUNCIL.—Supply of electrically-driven pumps, for discharging 1 500 000 gallons per hour of gravel water for condensing purposes. Specifications, etc., from the Borough Electrical Engineer, 57, Pratt Street, London, N.W.; deposit £1.

WREXHAM TOWN COUNCIL.—Wiring of 36 houses on the Huntroyd Estate. Specifications, etc., from Mr. J. W. Williams, borough electrical engineer, Electricity Works, Willow Road, Wrexham.

Corporation House Wiring.

BOOTLE CORPORATION, May 24th.—Electrician's work in connection with erection of 122 houses, under the Northfield Road housing scheme. Specifications from the Borough Engineer, Town Hall, Bootle; deposit £2 2s.

CENTRAL ELECTRICITY BOARD, May 25th.—Supply and erection of 33 000 V metal clad switchgear, in connection with South-East England Electricity Scheme. Specification (No. S.E.E.—G.S.1) from Mr. Richard H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

EPSOM URBAN DISTRICT COUNCIL, May 25th.—Supply and erection of l.t., d.c. switchboard, with the changing over of connections, with certain instruments and gear from the existing switchboard. Specification, etc., from the Resident Electrical Engineer, Electricity Works, Depot Road, Epsom; deposit £3 3s.

MANCHESTER TOWN COUNCIL, May 28th.—Supply of electrical equipment for tramways. Form of tender, etc., from Tramways Manager, Manchester.

ECCLES CORPORATION, May 29th.—Electric lighting installation and fittings for 68 houses at Westwood Park, Manton. Forms of tender, etc., from the borough Electrical Engineer's Office, Cawdor Street, Patricroft, Eccles; deposit £1 1s. (returnable).

METROPOLITAN ASYLUMS BOARD, May 29th.—Supply of electric cables and lamps. Forms of tender, etc., from the Board's Office, Victoria Embankment, London, E.C.4.

SALFORD CORPORATION, May 29th.—Electrical installation in 76 houses in Gerald Road, Pendleton. Particulars from the City Electrical Engineer.

DONCASTER EDUCATION COMMITTEE, May 30th.—Electric light installation at Hexthorpe Infants' Schools. Particulars from Secretary, Education Offices.

GEORGE HERIOT'S SCHOOL, EDINBURGH, May 30th.—Electrical installation. Specification, etc., from Mr. John Anderson, superintendent of works, 20, York Place, Edinburgh.

MASSEREENE HOSPITAL, ANTRIM, May 30th.—Electric power plant and lighting installation for laundry. Specification D from Mr. F. D. Brown, consultant, 93, Ann Street, Belfast.

BELFAST CORPORATION, May 31st.—Electric lighting installations at York Street School, and Belvoir Hall, Donegall Road, Hillman Street, Springfield, and St. Mark's P.E.S. Schools. Specification, etc., from the Education Architect, Education Offices, Victoria Street, Belfast; deposit £2 2s.

OGMORE AND GARW URBAN COUNCIL, May 31st.—Supply, delivery and erection of (*a*) short length 11 000 V transmission line, and (*b*) l.t. overhead and underground distribution mains. Specifications, etc., from Messrs. A. Ellis and Partners, 9, Park Place, Cardiff; deposit £1 1s.

GRIMSBY TOWN COUNCIL, May 31st.—Supply of electrically-driven boiler feed pump. Forms of tender from Mr. S. R. Windle, borough electrical engineer, Electricity Works, Grimsby.

SALFORD CORPORATION, May 31st.—Four 216 kVA power transformers. Particulars from the City Electrical Engineer.

WEST RIDING ELECTRICITY COMMITTEE, May 31st.—Electric lighting of Maltby Crags and Aston Schools. Forms of tender from Mr. A. Adcock, Craigmoor, Godstone Road, Rotherham.

COMMISSIONERS OF H.M. WORKS, ETC., June 3rd.—Fuse boards and switches. Forms of tender, etc., from the Controller of Supplies, King Charles Street, Westminster, London, S.W.1.

CROYDON CORPORATION, June 3rd.—Supply and erection of (*a*) one 20/25 000 kW turbo-alternator, with condensing plant, pumps, etc.; (*b*) boiler house extensions, with two 100 000 lb. per hour boilers, stand-by coal conveyor from siding, coal-handling plant at siding, steam piping and receiver, etc.; (*c*) engine room extension, switch house, bridges, and pump house; (*d*) 6 600 V switchgear, transformers, etc. Specifications, etc., from the Engineer and Manager, "Electric House," 38, High Street, Croydon; deposit £1 1s. for each section.

THURROCK, GRAYS AND TILBURY SEWERAGE BOARD, June 4th.—Supply of a.c. motors, pumps, wiring, etc. Specifications can be obtained at the Sewerage Works, Marsh Farm, Tilbury.

ST. PANCRAS (LONDON) BOROUGH COUNCIL, June 6th.—Supply of 1 000 kW rotary convertor. Forms of tender from the Borough Electrical Engineer, 57, Pratt Street, London, N.W.; deposit £1.

HALIFAX TOWN COUNCIL, June 7th.—Electrician's work in connection with extension of Shelf Sanatorium. Forms of tender, etc., from the Borough Engineer, Halifax; deposit £1 1s.

SUTTON AND CHEAM URBAN DISTRICT COUNCIL, June 7th.—Installation of fire alarm system, connected with the fire station. Plans showing positions of fire alarm boxes, etc., from the Engineer and Surveyor.

METROPOLITAN ASYLUMS BOARD, June 12th.—Two electric passenger lifts at Colindale Hospital; fire alarm system at High Wood Hospital for Children, Brentwood; and electric bell system at Casual Ward, Swaffield Road, Wandsworth. Specifications from the Board's Office, Victoria Embankment, London, E.C.4; £1 deposit in respect of each work.

EAST HAM EDUCATION COMMITTEE, June 12th.—Electric lighting installation at the Salisbury School. Specification, etc., from the Secretary, Education Office, Town Hall, East Ham, London, E.6; deposit 10s. 6d.

CENTRAL ELECTRICITY BOARD, June 17th.—Supply, delivery and erection of 33 kV and lower voltage switchgear. Specifications (N.W.E. S.S.3 for indoor metal clad switchgear and N.W.E.S.S.4 for outdoor type switchgear), from Mr. Richard H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, Charing Cross, London, W.C.2; deposit £2 2s.

STOKE-ON-TRENT CORPORATION AND STAFFORD COUNTY COUNCIL, June 22nd.—Electric light and power installation in new buildings at North Staffordshire Technical College, Stoke-on-Trent. Further particulars from the Clerk to the Governors, Town Hall, Hanley; deposit £5 5s.

Overseas.

UNLESS otherwise stated, particulars of overseas contracts are to be had from the Department of Overseas Trade (Room 52), 35, Old Queen Street, Westminster, London, S.W.1. *Note.—An asterisk denotes that local representation is, in practice, essential.*

EGYPTIAN PRISONS ADMINISTRATIONS, May 25th.*—One year's supply of lamps and electrical articles (section 7). (Reference C. 3 022.)

INDIAN STORES DEPARTMENT, May 27th.—Supply of 500 kW, six-phase rotary convertor, starting panel, etc. (order No. N./9 736). (Reference B.X. 5 279.)

PRETORIA MUNICIPALITY, May 27th.—Supply of transformers required in connection with extensions of e.h.t. system. (Reference B.X. 5 258.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, May 28th.—Supply of telephone jacks and number plates (schedule C. 417). (Reference B.X. 5 202.)

GREAT SOUTHERN RAILWAY CO., IRELAND, May 29th.—Six months' supply of electric lamps, porous pots, cells, cables, etc. Forms of tender from the Stores Superintendent, G. S. Railways, Inchicore, Dublin.

CLUJ (ROUMANIA) MUNICIPALITY, May 30th.—Compressor for cooling plant of ammonia system, with air-cooling coils

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and a.c. motor and condenser, at the Slaughter House. (Reference A.X. 7 838.)

SOUTH AFRICAN POSTS AND TELEGRAPHS, May 30th.—Supply of telegraph materials, tubular arms, crossheads, bases, stay plates, etc. (tender No. 152). (Reference A.X. 7 767.)

SOUTH INDIAN RAILWAY CO., May 31st.—Supply of (1) spare parts for train lighting cells; (2) V.I.R. cotton and silk covered copper and galvanised iron wire. Forms of tender from the Managing Director, 91, Petty France, London, S.W.; deposits (1) 10s. and (2) 5s.

JOHANNESBURG MUNICIPALITY, June 1st.—Supply and delivery of oil switches. (Reference B.X. 5 283.)

JOHANNESBURG MUNICIPALITY, June 1st.—Supply and delivery truck type cubicles. (Reference B.X. 5 285.)

TANGANYIKA GOVERNMENT, June 1st.—Concession for utilisation of Pangani River Falls for the development of electric power. Copies of the draft concession may be obtained from the Crown Agents for the Colonies, 4, Millbank, London, S.W.1.

Electric Cranes for Valparaiso.

VALPARAISO PORT ADMINISTRATION, June 1st.—Four electric travelling cranes of portal type (capacity 3 metric tons each). (Reference A.X. 7 892.)

AUCKLAND ELECTRIC POWER BOARD, June 3rd.—Supply of cables and accessories. (Reference B.X. 5 248.)

NEW SOUTH WALES PUBLIC WORKS DEPARTMENT, June 4th.—Supply of 18 electrically-operated water level indicators (contract No. 61/1928-29 W.S. and S.). (Reference B.X. 5 233).

VICTORIAN ELECTRICITY COMMISSION, June 4th.—Supply of 22 000 V transformers and spares (specification No. 29/36). (Reference B.X. 5 216.)

HAMILTON MUNICIPALITY, June 5th.—Supply and delivery of 400 H.P. Diesel engine and a.c. generator. (Reference B.X. 5 287.)

VICTORIAN RAILWAY COMMISSIONERS, June 12th.—Supply and delivery of track reactors for power signalling. (Reference B.X. 5 302.)

ANTWERP MUNICIPALITY, June 17th.—Supply of 32 electric travelling cranes for new dock. (Reference A.X. 7 924.)

NEW ZEALAND POSTS AND TELEGRAPHS, June 18th.—Supply of telephone cords (No. P. and T. 151/1425). (Reference B.X. 5 251.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, June 18th.—Supply of switchboard cable (contract C. 427). (Reference B.X. 5 228.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, June 20th.—Two 5-ton electrically driven hoist blocks, with overhead conductors, runway girders and switches (tender No. 1 446). (Reference T/A.X. 7 867.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, June 20th.—Supply of one 10-ton and three 4-ton electric level luffing cranes (tender No. 1 437). (Reference A.X. 7 828.)

NEW SOUTH WALES PUBLIC WORKS DEPARTMENT, June 22nd.—Supply and erection of transformers, with certain spares, for Burrinjuck hydro-electric development (contract No. 29/29). (Reference B.X. 5 230.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, June 25th.—Supply of protected type telephone cable terminal boxes (schedule C. 430). (Reference B.X. 5 231.)

NEW ZEALAND GOVERNMENT RAILWAYS DEPARTMENT, June 26th.—Supply and delivery of trailing cables for portable electric machines. (Reference B.X. 5 277.)

VICTORIAN RAILWAY COMMISSION, June 26th (extended from May 15th).—Supply of geared three-phase, electric winding engine. (Reference A. 7 650.)

SOUTH AFRICAN POSTS AND TELEGRAPHS, June 27th.—Automatic wall and table pattern telephones (tender No. 158). (Reference B.X. 5 273.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, June 30th.—Supply of two 5-ton electrically driven hoist blocks, complete with overhead conductors, and switches. (Reference A.X. 7 867.)

VICTORIA STATE ELECTRICITY COMMISSION, July 1st.—Supply and delivery of 44 000 V transformers. (Reference B.X. 5 293.)

STATE ELECTRICITY WORKS, MONTEVIDEO, July 8th.—Construction and equipment of 50 000 kW power station.

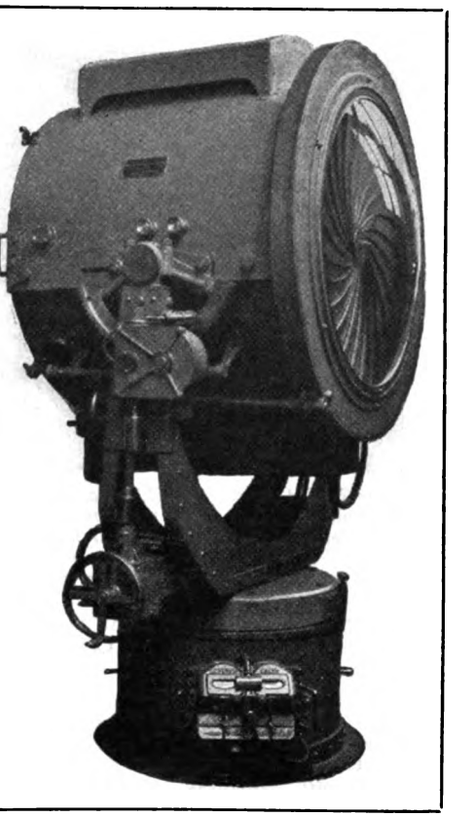
POSTMASTER - GENERAL'S DEPARTMENT, MELBOURNE, July 9th.—Resistances and reactances (schedule C. 426). (Reference B.X. 5 281.)

NEW SOUTH WALES GOVERNMENT RAILWAYS, July 10th.—One 750 kW turbo-alternator; 2 200 V ironclad switchgear; two switch operating batteries; and two motor generator sets. Specifications from the Chief Electrical Engineer, 61, Hunter Street, Sydney.

NEW ZEALAND PUBLIC WORKS DEPARTMENT, July 16th.—Supply of 250 galvanised steel transmission line towers to carry copper conductors, or 190 towers to carry steel-core aluminium conductors. (Reference A.X. 7 735.)

NEW ZEALAND POSTS AND TELEGRAPHS, July 16th.—Telephone bells (P. and T. No. 151/1 444). (Reference B.X. 5 272.)

THE general appearance of the searchlights which are being used at the N.E. Coast Exhibition. They are 36 in. diam. and of semi-portable pattern. The usual horizontal and vertical motions are fitted, to enable the searchlight to be trained and elevated, and each light is capable of being controlled electrically from a distance. The London Electric Firm were the manufacturers.



MONTEVIDEO PORT AUTHORITY, July 22nd.—Supply of 300 kilo. electro-pneumatic hammer. (Reference A.X. 7 974.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, August 6th.—Supply of 120-ton, four-motor, overhead travelling crane and runway (specification No. S.M. 358). (Reference A.X. 7 810.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, August 13th.—Water turbine driven generating sets and switchgear, for Waitaki power development (section 2). (Reference B.X. 5 278.)

NEW ZEALAND GOVERNMENT RAILWAYS, September 4th.—Supply of motor generator (specification 287). (Reference B.X. 5 308.)

Tenders Accepted.

GENERAL POST OFFICE.—Edison Swan Electric Co., Ltd., telephone switchboard lamps.

SOUTHWARK (LONDON) BOROUGH COUNCIL.—Vickers Boiler Co., Ltd., boiler repairs, £355.

PORTSMOUTH CORPORATION.—Johnson and Phillips, transmission lines to Emsworth, £25 268.

ASSAM BENGAL RAILWAY CO., LTD.—Omega Lampworks, Ltd., supply of train-lighting lamps.

EASTBOURNE CORPORATION.—British Electric Transformer Co., Ltd., supply of 20 transformers, £2 456 5s.

DEWSBURY CORPORATION.—Beaumont and Blackburn, electric light wiring of 37 houses, £221 4s. 9d.

ILFORD CORPORATION.—Crompton Parkinson, Ltd., supply of 500 kW transformer, £243. (Recommended.)

STIRLING CORPORATION.—Graham and Morton, Ltd., electrical work at houses in Burnside Street, Stirling.

LANCASTER CORPORATION.—Alton Battery Co., battery, booster and switchgear, £6 335. (Recommended.)

SOUTHEND CORPORATION.—Standard Telephones and Cables, Ltd., three fire alarm standards, £96. (Recommended.)

IRISH FREE STATE PUBLIC WORKS DEPARTMENT.—McDonald and Creswick, Ltd., one year's supply of electric fittings.

CAPE TOWN CORPORATION.—Albert Vaux, Ltd., supply of steel pillar boxes, for the electricity department, £788 2s.

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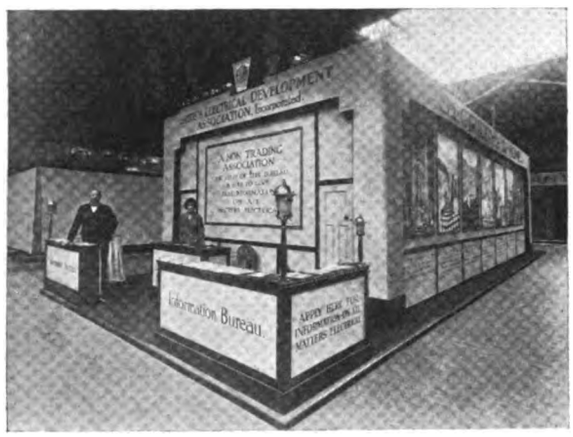
ERITH URBAN DISTRICT COUNCIL.—Dickinson and Co., electrical installation at Sheridan Road site, £180. (Recommended.)

ADMIRALTY.—Edison Swan Electric Co., Ltd., w/t combined switch and plug, switches non-w/t, steel springs and gangway reflectors.

DOUGLAS (ISLE OF MAN) CORPORATION.—New Switchgear Construction Co., Ltd., h.t. panel for Tromode Road sub-station, £96.



THE joint stand of the Electrical Development Association and the E.L.M.A. at the North-East Coast Exhibition. Brief descriptions of some of the stands are given on page 620.

METROPOLITAN ASYLUMS BOARD.—Hendon Electric Supply Co., Ltd., laying cables to Colindale Hospital, Hendon, £153 14s. 8d.

LONDON COUNTY COUNCIL.—Siemens Electric Lamps and Supplies, Ltd., supply of electric incandescent lamps for twelve months.

WIMBLEDON CORPORATION.—Siemens Brothers and Co., Ltd., supply and laying 11 000 V and pilot cables, £7 500 11s. 10d.

HASTINGS CORPORATION.—Mirrlees Watson Co., Ltd., supply of electric pumping plant at Kent Street waterworks, £2 000. (Recommended.)

CROSSLAND MOOR, HUDDERSFIELD.—W. R. Bottomley, electrician's work in connection with erection of a pair of houses at Blackmoorfoot Road, Crossland Moor, £34.

DURHAM COUNTY EDUCATION COMMITTEE.—F. Reid, Ferens and Co., electric lighting installation at the new council school, Billingham, £404 10s. (Recommended).

HULL CORPORATION.—A. Shaw and Sons, electric light and bell installation, at Hedon Road maternity home, £2,079 18s., Clark and Graham, microphone equipment for city hall, £125.

ILFORD CORPORATION.—Long and Crawford, Ltd., three panel switchboard (£170 15s.); Foster Engineering Co., Ltd., transformer (£104) for Claybury Asylum. (Both recommended.)

LUTON CORPORATION.—Braithwaite and Co., Ltd., steel construction work, £10 960; Herbert Morris, Ltd., travelling crane, £1 530; Henry Lees, coal tipper, elevator and conveyor, £4 550.

BECKENHAM URBAN DISTRICT COUNCIL.—New Switchgear Construction Co., Ltd., e.h.t. switchgear, £188 10s.; British Insulated Cables Ltd., l.t. switchgear at Eden Park sub-station, £103.

Switchgear Contracts.

EAST HAM CORPORATION.—Bertram Thomas, supply of l.t. switchgear for generating station, £309; A. Reyrolle and Co., Ltd., supply of h.t. switchgear, £1 438—revised tender. (Both recommended.)

ISLINGTON (LONDON) BOROUGH COUNCIL.—Hayward Co., electrically driven addressing machine, £203 13s. 6d.; D. P. Battery Co., Ltd., new lead battery, for electric vehicle, £189. (Both recommended.)

DARTFORD URBAN DISTRICT COUNCIL.—Johnson and Phillips, Ltd., provision of feeder pillar in Miskin Road, £71; and supply of switchgear for Lowfield Street Housing Estate sub-station, £108 (recommended).

VICTORIAN ELECTRICITY COMMISSIONERS.—Australian General Electric Co., Metropolitan-Vickers Electrical Co., Ltd., and Gibson, Battle and Co., switchgear and electric feed pumps, for Yallourn power station. Total cost, £50 000.

GLASGOW CORPORATION.—J. Kilpatrick and Son ,Ltd,. electric lighting installation at Mearnskirk sanatorium grounds, £2 991 11s. 2d.; Bolckow, Vaughan and Co., Ltd., tramway rails; British Ropes, Ltd., and Jos. Cookson, Ltd., trolley cord. (All recommended).

SMETHWICK CORPORATION.—Walker and Co., electric lighting installation at the slipper baths, Mallin Street, Smethwick, £45. Also tendered: T. Glover, £48; Carr Bros., £48; Electromobile Engineering Co. (West Bromwich), Ltd., £49; Francis, £50; Simpson, £53.

GLASGOW CORPORATION.—James Allen and Son, Ltd., 100 iron bases; Greenwich Cable Works, Ltd., and Metropolitan Electrical and Cable Construction Co., Ltd., cables; Bromford Tube Co., Ltd., 350 steel poles; British Insulated Cables, Ltd., insulated bolts; Hadfields, Ltd., for special tramway track work.

Plant, Cables and Wiring.

STOKE-ON-TRENT CORPORATION.—National Gas Engine Co., Ltd., supply of heavy oil engine electric lighting plant at Stallington Hall, £898; Overhead, Ltd., erection of overhead transmission lines for 12 months; A. Bew, erection of overhead electricity cable to laundry at Stanfield Sanatorium, £105 1s.; E. Holloway, electric wiring of 16 houses at Eaton Street, Hanley, £93 6s. 8d.

HACKNEY (LONDON) BOROUGH COUNCIL.—C. A. Parsons and Co., Ltd., supply of turbo-alternator and condensing plant and accessories, £104 052; A. Reyrolle and Co., Ltd., supply of extra high pressure switchgear, switch house crane and accessories, £62 200; Babcock and Wilcox, Ltd., boiler house alterations, £2 000 (estimated); Tudor Accumulator Co., Ltd., repairs and renewals to battery at power station, £990. (All recommended.)

CAPE TOWN CORPORATION.—A. Vaux, Ltd., supply of switchboards manufactured by A. Reyrolle and Co., Ltd., £11 391; Paul Gregson, Urquhart and Co., cable manufactured by Craigpark Electric Co., for lighting new pavilion at Muizenberg, £340 4s. 2d.; Albert Vaux, Ltd., 30 tons of bare copper wire, £110 10s. per ton; British Insulated Cables Ltd., 50 miles of insulated wire, £23 5s. per mile; Griffin Engineering Co., Ltd., half ton of binding wire, £114 6s. 8d. per ton. (All recommended.)

CROYDON CORPORATION.—British Electric Transformer Co., Ltd., supply of 1 000 kV transformer for Craven Street sub-station, and two 400 kVA transformers, £337 each; Metropolitan-Vickers Electrical Co., Ltd., extension of main switchboard at power station and supply of two new switches, £2 330 14s.; Davenport Engineering Co., Ltd., cooling tower repairs, £345; A. Reyrolle and Co., Ltd., supply of sub-station switchgear, £1 546 14s.; W. Lucy and Co., Ltd., 133 lamp brackets, 34s. each. (All recommended.)

LEEDS CORPORATION.—General Electric Co., Ltd., supply of sub-station switchgear, £7 235 5s. 3d.; Parmiter, Hope and Sugden, 30 fuse panels, £350 5s.; Park Royal Engineering Co., Ltd., 24 circuit breakers, £396; Isles, Ltd., switch house crane, £698; F. W. Brackett and Co., Ltd., four circulating water screens, £2 703. Cables: W. T. Henley's Telegraph Works Co., Ltd., £867; Enfield Cable Works, Ltd., £1 146 10s.; Macintosh Cable Co., Ltd., £215 10s.; Hackbridge Cable Co., Ltd., £1 170 15s. Transformers: British Electric Transformer Co., Ltd., ten 100 kVA and ten 200 kVA, £104 and £172 each respectively; English Electric Co., Ltd., six 100 kVA, £83 each; Hackbridge Electric Construction Co., Ltd., ten 100 kVA and twenty 200 kVA, £77 and £112 each respectively.

LONDON COUNTY COUNCIL.—Stegman and Co., electrical installation at Beaufoy Institute extension, £390; Eons Electrical Co., wiring and fittings for electric lighting at Bethnal Green Coroner's Court, £189 3s.; Premier Electric Welding Co., Ltd., and Quasi-Arc Co., Ltd., electrodes; British Insulated Cables, Ltd., copper bonds; Dyer and Young, Ltd., commutators; Metropolitan-Vickers Electrical Co., Ltd., 100, and Beardmore and Co., Ltd., 150 gear wheels; G. D. Peters and Co., Ltd., upholstered seats for 520 tramcars; Nesta, Ltd., saloon seats for 35 cars; Pickerings, Ltd., provision of electric goods lift at Hammersmith Building Trade School, £523; also tendered: E. A. Foulds, £550; R. A. Evans, £599; J. Bennie, Ltd., £695; Smith, Major and Stevens, Ltd., £698; less 2½% cash disc.; Marryat and Scott, Ltd., £700; Rawlinsons, Ltd., £702; H. Morris, Ltd., £734; Medway's Safety Lift Co., Ltd., £791.

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WORK IN PROSPECT.

AMERSHAM.—Houses. Particulars from Sherren, Ltd. (68 at Chalfont St. Peter), and Brown and Co. (10 at Holmer Green).

AMPTHILL.—Houses (62). Contractors, Mr. W. H. King, Seymour Bros. and Tookey, Mr. J. Putman, and Matthews and Welch.

AYRSHIRE.—Extensions, Whitletts and Ballantrae Schools. Particulars from Mr. W. Reid, Education Offices, Ayr.

BARNSLEY.—Mining and technical college. Particulars, Director of Education.

BEXLEY.—Houses (50). Contractors, Blackwell and Meyer.

BISHOP'S CASTLE.—Houses, for the Town Council. Particulars from Mr. P. W. Cooper.

BROMLEY (KENT).—Reconstruction, Grand Theatre, for Mr. F. C. Mitchell.—New St. Andrew's Church. Particulars from Sir Charles Nicholson.—School (250 places). Particulars from Rev. Father Cox.—Extensions, County school for boys. Particulars from Mr. H. P. Burke Downing.—Houses, Pratts Bottom. Particulars from the Surveyor.

COOKHAM.—Houses, Cookham Rise. Particulars, the surveyor, 1, Park Street, Maidenhead.

COVENTRY.—School (440 places). Briton Road. Particulars, Mr. Frederick Smith, Education Committee.

DUKINFIELD.—Houses (32), for the Town Council. Particulars, Mr. A. Tomkins, Salford.

DURHAM.—Central school, Whinney Hill. Particulars from the Director of Education.

EARLS BARTON.—Houses (24). Particulars, the Surveyor.

EDINBURGH.—Nursery school. Particulars from the Clerk. —Picture house, Laurieston Street, for the Blue Halls (Edinburgh) Co., Ltd.

FOXTON.—Village hall. Particulars, Rooke and Sons, Saffron Walden.

HARPENDEN.—Houses (30). Contractors, Messrs. Hardy and Webster.

HATFIELD.—Public offices, to cost £5 298. Particulars, Mr. W. F. Bailey.

HITCHIN.—Houses (45). Particulars, Mr. A. Carter, Luton.

HODDESDON.—Additional housing scheme, Rye Park. Particulars, Mr. W. Plumpton.—Hall, Lord Street. Particulars from Mr. H. C. Lander.—(Houses 31), Rye Road, for Homemakers, Ltd.

LLANDUDNO.—Reconstruction of Links Hotel, for Mr. W. H. Parry.

MERTHYR TYDFIL. — Smallpox Hospital. Particulars, Borough Surveyor.

MOTHERWELL.—Housing scheme (108). Particulars, Burgh Surveyor.

NEWMILNS AND GREENHOLM.—Housing scheme (17). Particulars from the Burgh Surveyor.

NORTHALLERTON.—Extensions, County Hall. Particulars, County Architect.

OAKHAM.—Houses (16). Particulars, Mr. F. W. Porter, Colsterworth.

READING.—Hall, for the Trustees of Caversham Heights Wesleyan Church. Particulars from Secretary.—Houses (22), Wendover Way, Tilehurst, for Mr. R. J. Haddock.—Houses (165), for the Town Council. Particulars from Mr. A. A. Moynihan, Theale.

REDRUTH.—Housing scheme (58), for the Urban Council. Particulars, the Surveyor.

RICCALL.—Housing scheme, Cliffe, for the Rural Council. Particulars, the Surveyor.

SOUTHEND-ON-SEA.—Church, to cost £8 500. Contractors, J. Flaxman and Sons, Ltd., Southchurch Road.

SOUTH MIMMS.—Houses (120). Particulars, Blackwell and Meyer, Bexley Heath.

ST. ALBANS.—College of housecraft, for Herts Education Committee. Particulars from Clerk.

ST. ALBANS.—Houses. Particulars, A. Ivory and Son, London Colney, and Bennett Bros., Leverstock Green.

STRATFORD-ON-AVON.—Housing scheme (100), Clopton Estate. Particulars from Borough Surveyor.

SUNBURY.—Housing scheme (32), for the Urban Council. Particulars from the Surveyor.

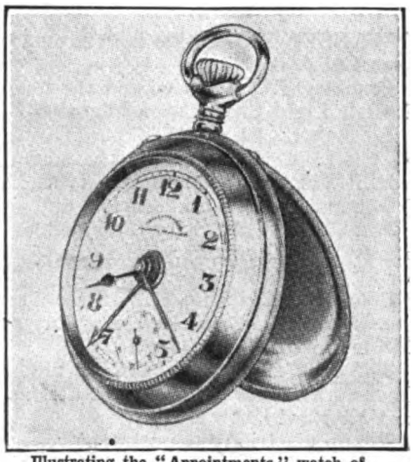
WARRINGTON.—Bus garage. Particulars, borough engineer, Mr. A. M. Ker.

WARRINGTON.—Extensions, library and museum, to cost £8 300. Particulars from the Borough Surveyor.

WARWICK.—Housing scheme (106). Particulars from Mr. R. Wormell, The Butts.

ALARM WATCHES.

ANOTHER watch just placed on the market by A. ARNOLD AND CO., of 17, Elmcroft Avenue, Golders Green, London, N.W.11, is an "Appointments" watch, the special feature of which is that it may be set to ring an alarm at any stated time to give notice, for example, that an appointment is due or that a specified period for some special manipulation has elapsed. The alarm mechanism may, of course, be put out of action when the instrument is merely in use as an ordinary timekeeper. At one winding the watch mechanism is set for 30 hours, and simultaneously the alarm mechanism for a single operation only, so that rewinding is needed for each appointment indicated. The rear cover of the watch is made to open backwards so that the watch will stand conveniently on a desk if so desired.



Illustrating the "Appointments" watch of A. Arnold and Co.

AUTOMATIC TELEPHONY.

Inauguration of New System for Cardiff Corporation.

AS announced in THE ELECTRICIAN of May 10th, the private automatic branch telephone exchange of the Cardiff Corporation was opened by the Lord Mayor, Ald. W. R. Williams, on May 8th. The exchange was installed by the Relay Automatic Telephone Co., Ltd., of Relay House, Streatham Hill, London, S.W.2, and consists of four switchboards, one at the City Hall, one at the Law Courts, and one each at the Electricity Departments, at the Hayes, and at Ninian Park Road. By this means all municipal departments are able to communicate with each other automatically in three seconds. The services of only one operator at each exchange are required as against two with ordinary manual handling.

In a speech following the opening ceremony, Mr. B. B. Johnson, chief engineer of the Relay Automatic Telephone Co., said that the exacting nature of the Post Office in relation to telephone apparatus was a blessing to those British manufacturers who were suppliers to the Post Office, in that if their products were accepted by the British authority they would meet the requirements of any other administration in the world. Equipment had been installed in India and Colonies, South America, Japan and Czecho-slovakia. There were in the latter country 80 exchanges working, which had been considered a triumph for British engineering, bearing in mind the proximity of that country to Germany. Although the first in Wales, Cardiff was the fiftieth municipal body in Britain to adopt the "Relay" system—that installed being identical with the equipment serving Manchester, Glasgow, Newcastle, Plymouth and Bristol.

AMERICAN POWER PRODUCTION.

The United States Census Bureau summaries show a continuing trend toward fewer and larger power stations and the rapid disappearance of many of the smaller, isolated plants. The following figures relate to the first 29 States reported by the Census: Total number of systems, 3 881 in 1922 and 2 632 in 1927; number of generating plants, 3 516 and 3 078; capacity of generators, 6 421 725 kW and 11 133 640 kW; average capacity of plants, 1 826 kW and 3 617 kW. Reports have also been made on six more States, and these show that in Alabama and Georgia the number of power stations has declined by 28, although their capacity has grown from 368 644 kW to 729 557 kW; in Nebraska, there has been a drop of nearly 25 % in the number of power stations, but an increase of more than 50% in their capacity; in New Mexico, the number of enterprises has decreased from 31 to 20. In Utah, the capacity has risen from 81 347 kW to 132 755 kW; and in Vermont, from 96 866 kW to 141 420 kW.

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ELECTRICITY SUPPLY.

Electric Street Lighting at Brackley—Irish National Scheme—Lancashire Rural Scheme Approved—Loans for Mains, Etc.—Meters for Shipley—Birmingham Extensions—The Experimental Supply Scheme in Bedfordshire.

SWANSEA Corporation is to extend mains to Ynystawe, at a cost of £2 000.

Brackley T.C. has accepted the tender of the Northampton Electric Light Co. for street lighting.

Birkenhead Electricity Committee has reduced charges by ½d. per kWh, the revised flat rate being 4½d.

Hull Electricity Committee is seeking sanction to borrow £100 000 for mains and services and £50 000 for sub-stations.

Dorchester Electricity Committee is seeking sanction to borrow £520 for battery renewals, £500 for services, and £250 for meters.

Colchester Housing Committee is considering asking for the substitution of electricity for gas in council houses in Irvine Road.

The first supply via Dublin under the Irish Free State Government's national electrification scheme was transmitted to Waterford last week.

Bacup electricity department reports that about 180 new consumers have been obtained within the last 12 months, bringing the total to over 1 450. An assisted wiring scheme is in force.

Peterborough T.C. has adopted a scheme of assisted wiring for small houses. A deposit of 2s. 6d. per £1 of the cost will be payable, and the balance is to be repaid by quarterly payments of 1s. 2d. per £1.

Carlisle Electricity Committee is to extend mains at a cost of £465.—An additional feeder is to be laid between Willow Holme and Holme Head Works, and sanction to borrow £3 500 to cover the cost is asked for.

The Electric Supply Corporation has informed Chelmsford T.C. that as the old street lighting equipment has been dismantled, the company is willing to supply current, leaving the Council to provide the necessary equipment.

Fulham (London) Works Committee recommends the erection of a sub-station at West Meadow, Bishop's Park.—The Electricity Committee has authorised expenditure of £2 214 for a sub-station on the Harwood Road School site.

In order to deal with the immediate requirements of the North Staffs Technical College, Stoke-on-Trent, the 30 kVA single-phase transformers in the sub-station are to be replaced by two 60 kVA transformers, at an estimated cost of £150.

Electricity was transmitted over the section of the Central Electricity Board's grid between Bedford and Little Barford last week. This is the first portion of the Board's transmission system to be used in England, and its length is about nine miles.

Newbury Board of Guardians has appointed a sub-committee to consider a report on the electric lighting installation in the institute. The recommendations involve a new 20 H.P. engine and dynamo, leaving the old engine to drive the laundry.

Chesterfield Electricity Committee is seeking sanction to borrow £43 355 for mains and services.—The Water Committee has decided to duplicate the pumping plant at Whispering Well, and an electrically driven borehole centrifugal pump is to be installed.

Schemes for extensions in rural districts near Preston which are being undertaken by the Lancashire Electric Power Co., Ltd., have been approved by the Minister of Transport. It is intended to lay cables in the areas of Preston and Chorley R.D.C., and Withnell U.D.C.

Colchester Electricity Committee has obtained sanction to borrow £4 776 for the main transmission line to Wivenhoe, switchgear, etc., and £28 670 for generating plant for the Hythe station. The Committee seeks sanction to borrow £50 000 to meet costs of prospective unspecified works of extension.

Sanction to borrow £20 000 for estimated expenditure on transformers and sub-station switchgear during the next three years has been asked for by Bradford Electricity Committee.—A further expenditure on extensions of mains, etc., up to a total of £20 000 has been sanctioned by the Committee.

South Shields Lighting Committee has received a report from the Engineer that he has reviewed the charges for public street lamps. The present charge for ordinary small street standards has been reduced from £4 6s. 2d. per standard to £3 15s. 3d., other street lighting units being reduced in proportion.

Shipley Electricity Committee has obtained sanctior to borrow £9 861 for mains.—The Committee has decided to place contracts for all-British medium size meters at the following prices: a.c. £1 5s. each, d.c. £1 15s. each. The selection of the firms with whom orders are to be placed is left with the Chairman and Engineer.

Exeter City Council has authorised the appointment of an assistant electrical engineer. Mr. A. E. Brock, chairman of the Electricity Committee, said he hoped to make an announcement shortly regarding a decision under which the Council would secure very big business, which, in a few years, would take practically half the present output of their station.

Birmingham Electricity Supply Committee estimates that it is necessary to apply for sanction to borrow £300 000 to meet the cost of extensions of the distribution system to the end of December, 1930. Approval is also sought to the financing of expenditure that has been and will have to be incurred for additional sub-station buildings, plant, switchgear, etc. These requirements need a further sum of £300 000.

Mr. A. J. Bridge, publicity and development manager of the Western Electricity Supply Co., recently addressed a meeting in the Weyland Hall, Bicester, on a scheme for supplying the town. There was no definite scheme for that district at present, as the matter was being considered in conjunction with the U.D.C. He emphasised the effect of a large and varied load in keeping prices down, and said the company had decided to quote special terms for wiring during the summer.

Mr. A. H. Shaw, borough electrical engineer, Ilford, has received applications from various cinemas for a reduction of rates. A cinema is in course of erection at Goodmayes, and the promoters have asked for terms. He recommends that the primary charge per kW of m.d. per week be reduced from 5s. to 4s. and that the secondary charge up to 20 000 kWh per quarter be 1½d. and for over 20 000 kWh, 1¼d. per kWh.—The Electricity Committee has obtained sanction for a loan of £50 000 for mains and services and £5 000 for hired wiring.

Torquay Corporation is opposing the application by Mr. W. G. Heath for a Special Order to supply the urban district of Ivybridge and certain parishes in the Kingsbridge and Totnes rural districts so far as the latter rural district is concerned. The Corporation will apply for an Order extending its area of supply so as to include the whole of the Totnes rural district. —An agreement has been arrived at between the Torquay Corporation and the Teignmouth Electric Lighting Co., for the purchase by the former, at £10 500, of the Buckfastleigh electricity undertaking, subject to the sanction of the Electricity Commissioners.

Swansea Electricity Committee recently agreed that the Corpo ration should take over the supply to the Ynystawe area, now being supplied by Messrs. John Player and Sons. Mr. Burr, borough electrical engineer, reported that he had discussed the question of a supply to Richard Thomas and Co., in respect of new plant being installed at Swansea. It would mean, he said, the consumption of some 3 000 000 kWh per annum. There was also, he indicated, a proposal to supply the existing plant with power, which would ultimately mean a consumption of 7 000 000 kWh per annum. The Committee decided to accept Mr. Burr's figures for the supply to the new plant. The question of the larger supply was left over for further negotiation.

The Minister of Transport has issued an announcement regarding the experiment to be made to ascertain what results may be expected from the development of supply in a typical rural area, if proper means of canvassing are adopted, and facilities for wiring, and for obtaining apparatus on a deferred payment system are afforded. It is stated that the district within Bedford Corporation's supply area which has been selected for the experiment is of about 100 square miles in extent, and that as a result of an application made by Bedford T.C. to the Development Commissioners, the Treasury has agreed that for a period not exceeding 10 years, advances shall be made from the Development Fund to the Town Council, of such sums (not exceeding £8 000) as may be required to meet 75 % of the actual annual deficits on the working of the scheme, if any—such advances to be subsequently repayable out of surpluses.

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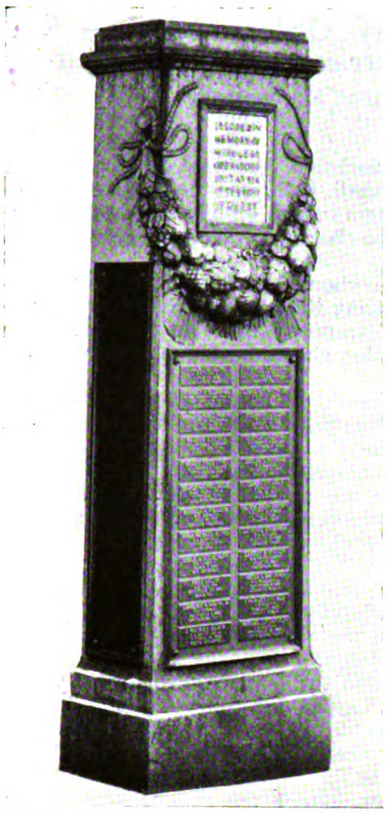
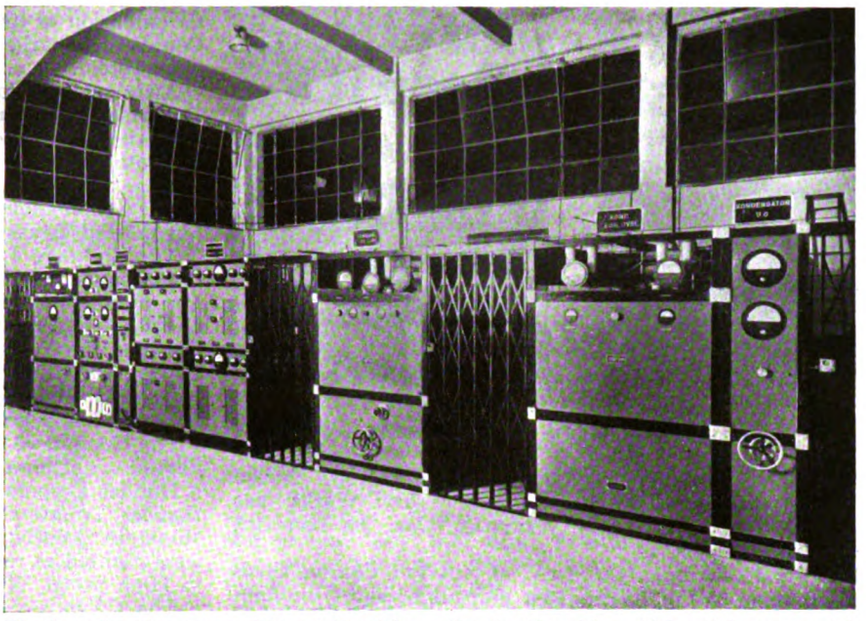
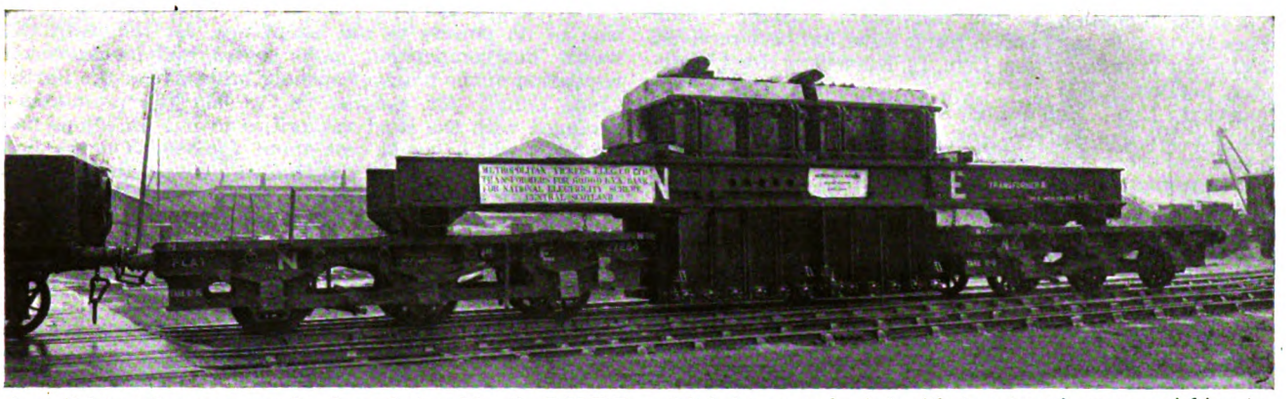
ELECTRICAL NEWS OF THE WEEK IN PICTURES.



The lettering on the memorial, in New York, perpetuating the memory of wireless operators lost at sea, has suffered very considerably from the action of the weather, and, in order that the names may be preserved, engraved bronze tablets have been added.



The broadcasting transmitter at Bratislava, Czecho-Slovakia, which, with a power of 12 kW in the aerial, may be heard in this country. The station, which works on 277·8 metres, is of Marconi design, and is intended to cover an area of 15 625 square miles. The photograph reproduced shows, left to right the rectifier and selector panels, the control board, the drive and modulator amplifier, the main amplifier, and the closed control circuits. The transmitter, we understand, is operated on the low power modulation principle.



A special transformer wagon has been designed by the L.N.E.R. and it is here seen loaded with two transformers, weighing together 64 tons, for the Central Electricity Board, on their way to Dalmarnock, Glasgow. The load was despatched from Metropolitan-Vickers works, at Trafford Park, Manchester, recently, and other similar consignments are passing periodically.

Hambledon R.D.C. has received from the Aldershot Gas, Water and Lighting Co. revised plans of the proposed electric cable to Hindhead, stating that the line would be laid underground through the village of Elstead, and that where it was overhead it would, as far as possible, be placed out of the sight of the roads. The Council decided to ask the company to place the cable underground along the proposed route in the vicinity of the Punch Bowl, Hindhead.

Torquay Electricity Committee recommends the adoption of an assisted wiring scheme submitted by the Electrical Engineer. Installations are to be limited to not less than four and not more than 10 lighting points, one cooking point being provided free for installations of 4 to 8 lighting points, and an additional heating point for installations of 9 and 10 lighting points; the work of installations is to be let to contractors at a priced schedule, to a specification to be prepared by the Engineer. The occupier is to pay £1 deposit on the signing of the agreement, and 1s. 6d. per lighting point per quarter for five years.

The Hull City Architect has estimated the cost of fixing plugs on the West Hull Estate at 30s. each. Half the cost of installing is to be borne by the Housing Committee, work to be carried out by the Corporation.—The Commissioners have sanctioned borrowing £73 618 for conversion of boilers and boiler house building, cooling tower superstructures, etc. The Commissioners have also approved of a balance in hand of £90 973 in respect of the £200 000 plant sanction of 1925 being applied towards plant under the £481 500 scheme.

Fulham (London) B.C. is to erect a sub-station in West Meadow, Bishop's Park, at a cost of £2 118, and a sub-station at premises of Peugeot (England), Ltd., Filmer Road, at a cost of £1 885. The number of units sold during 1928/29 was 18 997 575, as against 16 937 008 for 1927/28, an increase of 2 060 567. The total income for the year was £141 612, against £145 718 last year. The price reductions during the year have resulted in a saving to consumers of over £25 000. The Electricity Committee has authorised mains extensions at a cost of £1 400.

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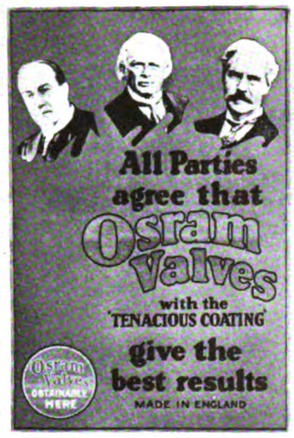
TRADE PUBLICATIONS.

WE have received from W. CHRISTIE AND GREY, LTD., 4, Lloyd's Avenue, London, E.C.3, a new leaflet dealing with the subject of vibration and its prevention.



Two topical window bills issued by the General Electric Co., Ltd

A pamphlet entitled "Swedish Lancashire Iron," issued by the Association of Swedish Lancashire Iron Works, has been received from ERNST B. WESTMAN, LTD., 39, Lombard Street, London, E.C.3.

The SUN ELECTRICAL CO., LTD., of 118–120, Charing Cross Road, London, W.C.2, has issued a gum-edged sheet, announcing the recent increase in prices of cables and flexibles, for inclusion in catalogue No. 600, to face page 151.

List 114 W.D., dealing with "M.S. Dual" temperature regulators, and list 120 W.D., dealing with "M.S. Duplex" temperature regulators, has been published by the DRAYTON REGULATOR AND INSTRUMENT CO., LTD., West Drayton, Middlesex.

A coloured mailing card, entitled "The Lights o' London," and drawing attention to the fact that "Venner" time switches are used in the London traffic signs, has been received from VENNER TIME SWITCHES, LTD., 45, Horseferry Road, Westminster, London, S.W.1.

FERRANTI, LTD., Hollinwood, Lancs, has sent us copies of lists No. Wc 412 and Wc 405, describing components for push-pull and other amplifiers. These lists enable the requisite output transformer ratio to be arrived at, in any particular instance, without loss of time, or calculation.

The NICKELOID ELECTROTYPE CO., LTD., 10, New Street Hill, London, E.C.4, has issued a number of booklets dealing with the "Wesel" final base system, the "Albert Galvano" electro, prices, etc. We have also received a copy of the current issue of "Nickeloid News." These publications give examples of the company's work, and are available to the trade.

The BRITISH ALUMINIUM CO., LTD., Adelaide House, King William Street, London, E.C.4, has published further leaflets for the handbook "Aluminium Facts and Figures." These include sheets A.73 and A.74, containing enlarged tables of the properties of stranded aluminium and steel-cored aluminium conductors, revised in conjunction with the B.E.S.A., and A.166, which is a new data sheet on expanded aluminium sheets.

The MULLARD WIRELESS SERVICE CO., LTD., Mullard House, Charing Cross Road, W.C.2, has issued leaflets V.R. 84, V.T. 34, V.T. 35, and V.M. 9, dealing with the P.M. 6, T. 22 C., S.W. 2 A, and M. 7 B, valves. In the case of V.T. 34 this replaces V.T. 15, while the valve takes the place of type T. 22. Leaflets V.R. 35/1a and V.T. 29/1a, dealing with D.F.A 6, 7 and 8, and S.W. 7 valves respectively, have been revised.

We have received from METRO-VICK SUPPLIES, Trafford Park, Manchester, a copy of a new wiring accessories catalogue. The reference for this new issue is No. 130/1, and the list cancels all previous issues. For the convenience of users, each classified heading, of which there are no less than eight, is arranged with a thumb index, while the inclusion of an alphabetical index as well, makes the finding of any particular information extremely easy. The publication, which is well illustrated, consists of over 160 pages, and is bound in strong board of a distinctive fawn colouring.

ELECTRIC TRACTION.

Scottish Tramway Orders Inquiry—Applications for Restrictions of Competition.

THE following application for Tramway Provisional Orders were considered recently by a Commission presided over by Lord Lamington :—

In presenting the Lanarkshire Tramways Co.'s application for an Order, Mr. M. Mitchell, K.C., said the company asked for an extension of its powers to run omnibuses throughout the County of Lanark, and to abandon, where necessary, the tramway system.

After evidence for the scheme had been heard, Mr. Graham Robertson, K.C., in putting the case for the opponents, said there were 28 miles of tramway route in Lanark, and the promoters claimed that they should have a monopoly over that mileage.

The Commissioners found the preamble of the Order proved, but deleted clauses dealing with restriction of competition.

The Rothesay Tramway Co. asked for powers for temporary discontinuance and permanent abandonment of tramways and for running omnibuses instead of tramcars. Mr. T. A. Gentles, K.C., for the promoters, explained that they wished to continue the tramway service in the summer and substitute buses in the winter.

Provost MacLachlan (Rothesay) said the Corporation's opposition had been withdrawn.

The Committee found the preamble of the Order proved, subject to certain restrictions.

Dundee Corporation and the Dundee, Broughty Ferry and District Tramways Co., asked for Orders to run 'buses to Monifieth jointly, in addition to tramcars. Both Orders were granted as regards the route from High Street, Dundee, to High Street, Monifieth.

The Commissioners in considering the Dunfermline and District Tramways Company's application for an Order to extend its powers of running omnibuses, and to restrict the running of rival omnibuses, found that the preamble had not been proved with respect to clauses intended to restrict the running of omnibuses in competition with tramways.

No Restriction of Competing Buses.

The Falkirk and District Tramways Co. asked for an extension of its powers to run omnibuses, for the restriction of motor 'bus competition on its routes, and for provision for regulation of the hours of opening bridges over the Forth and Clyde Canal. Mr. Gentles, K.C., said the promoters had arranged with the local authorities to put on a new fleet of tramcars which would cost about £30 000. On the Falkirk and Camelon section of the tramway routes three 'bus companies were running a three-minute service. A similar state of affairs existed on the Falkirk and Larbert route. Provost Smith, Falkirk, said it was the opinion of the Town Council that it was in the interests of the burgh that the tramway system should get reasonable protection. Evidence was given by 'bus proprietors, who said their 'buses had good support from the travelling public. The Committee found the preamble not proved as regards the part of the Order headed "Tramways and Omnibuses," the effect being that the powers sought for extension of powers for running 'buses and the restriction of competing 'buses have not been granted. The Committee recommended that the Minister of Transport be consulted as to the reduction of the hours of opening the bridges over the canal.

Bournemouth Corporation tramways undertaking is contributing £2 000 to relief of rates out of the past year's profit.

Edinburgh Transport Committee recommends the adoption of a scheme of the transport manager (Mr. F. A. Fitzpayne) for the construction and reconstruction of tramcars at an estimated cost of £80 000.

Particulars can be obtained from the Department of Overseas Trade regarding developments in connection with the proposal to replace the Kovno horse tramway service by electric tramways. (Reference A.X. 7 863.)

Glasgow Tramways Committee has fixed the following rates of depreciation for the current year: Permanent way, £1 000 per mile of single track; electric equipment of line, 5½%; power station and sub-stations plant, 10%; workshop tools and sundry plant, 5%; cars, 10%; electric equipment of cars, 15%; other rolling stock, 20%; miscellaneous equipment, 6%.

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COMPANY NEWS.

Quiet Market in Electrical Securities—The Cables and Wireless Merger—Cable Company's Increased Receipts—Sphinx Electric's Expanding Sales—Calcutta Electric Supply Co.'s Good Progress—New Companies Registered.

STOCK markets immediately before and after the Whitsun holidays have been lethargic, and few changes in quotations are shown by our usual table of electrical share prices. General Electric ordinary shares are down to 55s., and W. T. Henley's are 1s. 3d. lower at 121s. 3d. British Electric Traction preferred ordinary stock is a point to the good at 129, and Metropolitan Railway ordinary stock at 61 is also a point higher. In the supply section, Metropolitan shares are 1s. 3d. lower and County of London 1s. Eastern Telegraph ordinary stock is just a trifle weaker.

Last Annl. Divd.	Description	This Week.	Last Week.	1926 to 1928. Highest.	Lowest
	Electricity Supply.				
(d)	Brompton & Kensington Ord. ..	26/–	26/–	35/6	23/9
4	Central Elec. Sup. 4% Deb. ..	94	94	95½	88½
(a)	Charing Cross Elec. Ord. (£1) ..	26/–	26/–	51/–	24/3
4½	,, ,, ,, 4½% C.P. (£1)	17/6	17/6	18/3	16/6
(b)	Chelsea Elec. Sup. Ord.	26/6	26/6	45/3	24/–
10	City of Lond. Elec. L'ting Ord. ..	33/1½	33/1½	52/10½	26/–
6	,, ,, ,, ,, 6% C.P.	23/–	23/–	24/3	21/6
10	County Lon. Elec. Sup. Ord. ..	55/–	56/–	68/6	25/9
6	,, ,, ,, ,, 6% C.P.	23/–	23/–	24/–	21/3
(c)	Kensington & K'bridge Ord. (£1)	26/6	26/6	27/6	23/9
1/9⅜	Lon. Elec. Sup. Ord. (£1) ..	27/6	27/6	37/6	23/–
1/9⅜	Metro. Elec. Sup. Ord.	46/3	47/6	53/–	24/9
4½	,, ,, ,, 4½% C.P. ..	17/6	17/6	18/3	16/3
7½	N'castle & Dis. Elec. Ltg. Ord. ..	27/6	27/6	31/9	17/6
1/22½	N'castle-upon-Tyne Elec. Sup. Ord.	26/3	26/3	30/3	19/3
6	N. Metro. Elec. 6% C.P.	23/–	23/–	23/9	20/10
6	Notting Hill 6% C.P. (£10) ..	11	11	11½	9½
(e)	St. James & P.M. Ord (£1) ..	27/6	27/6	28/6	23/6
1/6	Shrops. Worcs. & Staffs. Power B. Ord.	48/9*	48/9	37/6	21/4
1/9½	W'minster Elec. Sup. Ord. (£1) ..	26/–	26/–	52/9	24/–
4½	,, ,, ,, 4½% C.P. (£1)	17/6	17/6	17/10½	16/7½
8	Yorks. Elec. Power Ord.	34/–	34/–	38/9	24/6
6	,, ,, ,, 6% C.P. ..	24/–	24/–	26/9	20/7
	Railways and Tramways.				
8	Brit. Elec. Trac. Pfd. Ord. Stk. ..	129	128	152	117
6	,, ,, ,, 6% Pf. Stk.	127½	127½	133	103½
4	Cent. Lon. Ry. Ord. Stk. (asstd.)	72	72	72	54
4	,, ,, ,, 4% Deb.	80	80	83	77½
4	City & S. Lon. 4% Perp. Deb. ..	78½	78½	81	76½
5	Lon. Elec. Rly. Cons. Ord. Stk. ..	73½	73½	75½	42½
4	,, ,, ,, ,, 4% Pf. Stk.	73	73	77	68
4	,, ,, ,, ,, 4% Deb. ..	80	80	83	76½
5	Lon. & Sub. Trac. A. Deb. ..	95½	95½	97½	74
4	Lon. Un. Trams. 1st Deb... ..	64	64	63	39
4½	Met. Elec. Trams, 4½% Deb. ..	72	72	73½	62
5	,, ,, ,, 5% Deb. ..	67½	67½	70½	65½
3½	Met. Rly. Cons. Ord. Stk... ..	61	60	81	54½
3½	,, ,, ,, 3½% Pf. Stk. ..	63	63	67	60½
3½	,, ,, ,, 3½% Deb. ..	70	70	73½	67½
5	Met. Dis. Rly. Ord. Stk.	76½	76½	77½	52½
4½	,, ,, ,, 4½% 1st Pref. ..	81½	81½	84	74½
6	,, ,, ,, 6% Perp. Deb. ..	116½	116½	118½	110
4	S. Met. Elec. Trams, 4% Deb. ..	70	70	70	64½
7	Underground Electric Rlys. Ord.	24/–	24/–	28/2	11/–
—	Yorks. (W.R.) Trams, Ord. ..	5/–	5/–	16/–	3/–
4½	,, ,, ,, 1st Deb. ..	59	59	78	60
	Electrical Manufacturing.				
7	Brit. Elec. Transformer 7% C.P...	13/9	13/9	19/10	4/6
15	Brit. Insulated Cables Ord. ..	75/–	75/–	86/3	56/–
6	,, ,, ,, 6% C.P. ..	22/6	22/6	23/10	21/–
7	British Thomson-Houston Pref. ..	23/9	23/9	24/9	19/7
7	,, ,, ,, 7% Deb.	103½	103½	109½	102½
10	Brush Electrical Ord.	28/9	28/9	30/9	24/–
15	Callender's Cable Ord.	87/6	87/6	91/3	66/–
6½	,, ,, 6½% C.P. ..	25/–	25/–	25/9	22/–
7½	,, ,, 7½% B. Pref. ..	27/6	27/6	28/3	25/–
8	Crompton-Parkinson 8% Cum. Pf.	25/–	25/–	27/–	14/–
6	,, ,, 6% Cum. 2nd Pf.	17/6	17/6	19/6	9/7
7½	Edison Swan Elec. 1st Pref. ..	25/7½	25/7½	13/–	7/4½
5	,, ,, ,, 1st Deb. Stk.	86½	86½	92	81½
7½	Elec. Construction Ord.	18/9	18/9	32/6	23/6
7	,, ,, 7% C.P. ..	22/6	22/6	22/9	21/–
—	English Elec. Ord.	6/3	6/3	15/9	5/–
—	,, ,, 6% C.P. ..	8/1½	8/1½	18/9	7/–
7	Ericsson Telephones 7% Pref. ..	20/–	20/–	22/7½	17/6
35	Ever Ready (Gt. Britain) Ord. ..	23/6	23/3	92/3	18/1
6	Ferranti 6% Pref.	18/–	18/–	19/4½	16/9
7	,, 7% 2nd Pref.	21/3	21/3	19/3	13/9
10	General Elec. Ord.	55/–	58/9	46/6	26/6
‡25	W. T. Henley's Ord.	121/3	122/6	120/–	69/3
12½	Johnson & Phillips Ord.	36/3	36/3	67/11	34/–
7½	Lon. Elec. Wire. & Smith's Pref...	23/9	23/9	25/–	22/3
7½	Siemens Bros. & Co. Ord. ..	27/6	27/6	36/6	24/9
10	Telegraph Const. Ord. (£12) ..	24½	24½	30½	20
	Telegraph.				
3½	Anglo-Am. Tele. Ord. Stk. ..	61½	61½	63½	56½
10	Eastern Ord. Stk.	277½	280	273	135
3½	,, 3½% Pref. Stk.	67½	67½	70½	59
4	,, 4% Deb.	78½*	78½	81½	74
10	Eastern Extension Ord. (£10) ..	28	28	27½	14
22	Gt. Northern Telegraph (£10) ..	33	33	43½	26
10	Indo-European (£25)	52½	52½	48½	30
20	Marconi's Wireless T. Ord. ..	82/6*	85/–	84/4	12/–
15	,, Int. Mar.	65/–	65/–	90/–	16/6
10	Western Tel. Ord. (£1)	28	28	27½	12½

(a) 19.14d. per share. (b) 1s. 9·3d. per share. (c) 1s. 6·949d. per share.
(d) 1s. 8·706d. per share. (e) 1s. 7·181d. per share. ‡ Including 1s. bonus.
* Ex dividend.

BELL TELEPHONE CO. OF CANADA.—Net pfts. for past year equal to 10·14% on cap. stk., agst. 9·69%.

SOCIETA GENERALE ITALIANA EDISON.—Div. 50 lire, agst. 45 lire. Par value of shs. is to be raised from 375 lire to 500 lire, by capitalisatn. of reserves.

WESTERN TELEGRAPH CO., LTD.—Mtg. to consider alteratns. in articles of associatn. necessitated by merger of interests in ord. shs. with Cables and Wireless, Ltd., will be held on May 29.

MONTREAL TRAMWAYS CO.—Receipts for 1928, $14 938 678. Operatg., maintenance and renewal exes., $10 455 838, fixed charges, $3 435 363. Total paid to City of Montreal, $10 730 048.

INDIAN BROADCASTING CO.—Accts. for past year show loss of Rs. 215 000, total loss to date being Rs. 382 000. Directors attribute loss partly to the use of unlicensed wireless sets by listeners and to inability to collect all the amts. due as a 10% tax on wireless imports.

ILLINOIS POWER CO.—Gross earngs. for 1928, $2 732 116, agst. $2 637 187, net income $564 164, agst. $423 615. Div. on pfd. stk. $228 246; to retiremt. res., $150 000; blce. $185 917, agst. $44 877. Ratio of operatg. exes. and taxes to gross earngs., 65·19%, agst. 68·96%.

CALGARY POWER CO.—Gross earngs. for 1928, $949 422, agst. $494 908. Net operatg. rev. $517 173, agst. $336 219. Net income $251 198, agst. $129 594. Pfd. div. required $25 000, and common stk. div. $102 500. Total pft. and loss surplus for 1928, $622 096, agst. $689 894.

PENNSYLVANIA WATER AND POWER CO.—Gross earngs. for past year, $4 388 087, net earngs., $2 853 060. To equalisatn. res. acct., $300 000; to res. and depreciatn., $595 573, agst. $543 143. Divs. $2½ p. sh. of no par value, equal to 10% on old $100 shs. Surplus $350 918, agst. $23 051.

NEW YORK TELEPHONE CO.—Operating revs. for 1928, $180 908 591, agst. $186 495 378; net income $29 169 020, agst. $28 312 787. Pfd. stk. divs. absorb $1 625 000 and common stk. divs. (8%) $22 448 000 (both the same as last year). Blce. to surplus $5 096 020, agst. $4 239 787.

CENTRAL STATES ELECTRIC CORPORATION.—Earngs. for 1928, $8 877 907. Regular cash divs. at rate of $1 p. sh. p.a. have been paid, plus special stk. divs. at rate of 2½% for each of the last three quarters of the year. Directors propose special bonus div. of 100% on common stk., payable in common stk.

ABITIBI POWER AND PAPER CO., MONTREAL.—Net earngs. for 1928, $7 380 964, agst. $4 213 490, after deductg. income tax, special allowances, etc., after provisn. for net int. on debt, amt. available was $4 562 855, agst. $2 904 574. Pfd. stk. div. of $1 529 325 and common stk. divs. of $2 434 852 were declared and paid.

QUEBEC POWER CO.—Gross earngs. for 1928, $3 198 487, operatg. and maintenance cost $1 228 183, int. absorbed $620 580, and depreciatn. required $150 000, leaving net rev. $1 199 724, plus blce. brt. in, makg. $1 452 683. Divs. of $2 p. sh. amtd. to $901 985. To res. $300 000. Surplus, subject to tax, $250 698.

SHAWINIGAN WATER AND POWER CO.—Gross rev. for 1928, $11 562 331, agst. $93 62 828. Exes., $4 463 807, int. charges, $2 025 000, and other int. (on acct. still due to Laurentide Co.), $225 000, deprcn., $800 000. Net rev., $4 048 523, agst. $2 894 783. Divs. paid during year amtd. to $2 861 428. To res., $196 089; surplus, $1 928 344.

EASTERN TELEGRAPH CO., LTD.—Rev. for three mths. ended March 31st, 1928, £789 957; ord. exes., £571 710. After provisn. for income tax payable in England, int. on mtge. deb. stk. and divs. on pref. stk., blce. is £149 673, plus £525 765, makg. available blce. £675 437. Div. of 2½%, tax free. Blce. £550 437, transferred to gen. res. fund.

COMMONWEALTH POWER CORPORATION.—Earngs. of co. and subsidiaries for Jan., 1929, $5 548 084, compared with $5 025 241 in Jan., 1928. Earngs. for year to Jan. 31, 1929, $59 026 966, agst. $53 550 307. Applicable to div., after provisn. for retirement res., $12 510 310, equal to $25·02 p. sh. on 6% pfd. stk., and $5·78 p. sh. on common stk.

CENTRAL ILLINOIS LIGHT CO.—Gross earngs. for 1928. $4 765 844, agst. $4 391 161. After provisn. for operatg,

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exes., taxes, int., amortisatn. of debt., etc., net income was $1 587, agst. $1 325 009. Divs. on pfd. stk. absorbed $408 837, agst. $413 462, and provisn. for retiremt. res., $304 800, agst. $256 800, leavg. surplus $874 221, agst. $654 747.

ALLIED POWER AND LIGHT CORPORATION.—First rpt. states that for period from May 5, 1928, to Feb. 28, 1929, divs. and int. received totalled $1 686 664, plus pft. on sales, fees, commissions, etc., $2 069 518. Exes., includg. taxes, etc., absorbed $1 043 931, divs. paid on $5 1st pfd. stk., $579 623 and on $3 pref. stk., $237 289. Blce. carried to surplus $1 895 238.

LANCASHIRE ELECTRIC LIGHT AND POWER CO.—Pft. for 1928, £238 515, agst. £203 734, plus £3 000 brt. in. Income tax, £13 927; depreciatn. and renewals, £50 000; paid to holdg. co., £174 401. Accts. of holdg. co. show blce. £150 885, agst. £143 621, after providg. deb. int. Additional div. of ½% on 7% pref. shs., makg. 7½% for year. Ord. div. 7½%. Fwd., £3 308.

TENNESSEE ELECTRIC POWER CO.—Operatns. of the co. and subsidiaries for 1928 resulted in gross earngs. $13 453 842, agst. $12 515 759. After provisn. for exes. and taxes, gross income was $6 488 489, agst. $5 743 393. Deductg. int., etc., left net income $4 309 844, agst. $3 520 390. Divs. on pfd. stk., $1 340 940, agst. $1 241 881; retiremt. res., $975 534, agst. £950 429. Blce. $1 993 369, agst. $1 328 078.

CONSOLIDATED GAS, ELECTRIC LIGHT AND POWER CO. OF BALTIMORE.—Operatg. rev., $26 126 194, agst. $24 657 001; net operatg. rev. $8 785 045, agst. $7 899 975. After addg. other rev. and deductg. fixed charges, net income was $6 173 640, agst. $5 177 370. Common stk. divs. were at annual rate of $2·50 p. sh. to Sept. 30, 1927, and $3 p. sh. after that date. After providg. for divs. on pfd. and common stk., and charging deductns. amtg. to $2 139 770, accumulated surplus is $11 421 464.

SIEMENS BROTHERS AND CO., LTD.—Pft. for 1928, £335 758; int. on and redemptn. of 4½% deb. stk., £67 439; div. for year on 10% cum. pref. shs. required £55 000, and intm. div. of 2½% on ord. shs., £50 000. Fin. div. of 5%, makg. 7½% less tax, for year. Blce. of pft., £63 319, plus £250 041 brt. in, makg. credit to pft. and loss acct. £313 360, wh. is carried fwd. Turnover, altho. below capacity, was well maintained. Slight fallg. off in pfts. attributed to increased proportn. of overseas business for wh. lower prices had to be taken than those for home orders.

NORTH AMERICAN CO.—The consolidated income statemt. of this co., which controls through stock ownership five main groups of electric supply, electric traction and gas undertakings in the United States, shows that in 1928 gross earngs. were $155 551 899 and total net income was $68 690 188. After deductg. int. charges, pfd. divs. of subsidiaries and minority interests, blce. was $38 677 417, agst. $31 736 580. To depreciatn. res. $14 274 664, divs. on North American pfd. stk., $1 820 032, divs. on North American common stk., $4 806 550; to surplus $17 776 172, agst. $13 092 854.

COMMONWEALTH POWER CORPORATION.—Gross earngs. of the Commonwealth Power Corporation and subsidiaries for 1928 were $58 504 122, agst. $53 172 976. After provisn. for operatg. exes., gross income was $28 440 059, agst. $24 741 603. Fixed charges, includg. int., pfd. divs., etc., absorbed $12 143 587, leavg. net income $16 296 471, agst. $12 413 628. Regular qrtrly. divs. of 1½% were paid on 6% cum. pfd. stk., div. of 62½ cents. p. sh. was paid on Feb. 1, 1928, on common stk., and similar paymt., with extra div. of 50 cents. p. sh., on May 1. On Aug. 1 qrtrly. div. on common stk. was increased to 75 cents. p. sh. and a like paymt. was made on Nov. 1.

MONTREAL LIGHT, HEAT AND POWER CONSOLIDATED.—Gross rev. for 1928, $21 235 991, compared with $20 314 902 in 1927 and $18 907 382 in 1926. Deductn. of operatn. exes, $7 059 911, and taxes, $2 123 599, left net rev. $10 794 978. Fixed charges $2 928 516, net income, $7 866 462. Deductn. of divs., $4 354 650, left surplus for year, $3 511 812, agst. $2 977 672 in 1927. Pensn. fund required $20 000 and contingent fund $465 997. Blce. $3 025 814 transferred to cap. and surplus. Net income was equal to $3·85 p. sh. on cap. stk., agst. $3·37. Net workg. cap. $19 480 590, compared with $14 717 487. Assets $102 967 792, compared with $97 087 627. Total cap. and surplus $66 485 108, against $97 087 637.

THE CABLES AND WIRELESS MERGER.—Circulars were issued on May 17th, to the ord. stk. and shholdrs. in the Eastern and Associated Telegraph Cos., and the pref. and ord. shhldrs. in Marconi's Wireless Telegraph Co., inviting them to exchange their securities for shs. in the merger co.—Cables and Wireless, Ltd. Accompanying the offer was a copy of the plan for merging the interests of the cos. in conformity with the rpt. of the Imperial Wireless and Cable Conference.—The Commee. representg. the £1 shhldrs. of Marconi's Wireless Telegraph Co. issued a circular on the same date, again urging £1 shhldrs. not to exchange their holdgs. for shs. in Cables and Wireless, Ltd., and statg. that the arrangemts. for the issue of units agst. the deposit of shs. with the Prudential Assurance Co., Ltd., have now been practically completed, and the necessary documents will shortly be issued.

Company Meetings.

PENARTH ELECTRIC LIGHTING CO., LTD.—The general meeting was held on May 14th, when it was decided to pay a dividend of 7% for the year on the preference shares and at the rate of 7½% on the ordinary shares. The report and accounts were adopted.

MERTHYR ELECTRIC TRACTION AND LIGHTING CO., LTD.—Mr. C. G. Tegetmeier (chairman) and Mr. C. H. Dade, the retiring directors, were re-elected at the thirty-second ordinary general meeting on May 14th. The directors' report and the statement of accounts were adopted.

WESTON-SUPER-MARE AND DISTRICT ELECTRIC SUPPLY CO., LTD.—The ordinary general meeting was held on May 14th, the chairman, Mr. C. G. Tegetmeier, presiding. The directors' report, recommending a dividend of 10% for the year on the ordinary shares, in addition to the payment of the dividend on the 6% preference shares, was adopted.

BARCELONA TRACTION, LIGHT AND POWER CO., LTD.—Mr. Miller Lash, presiding at the meeting in Toronto on May 16th, said owing to the increased demand for power, the consumption for the first four months of the current year showed an increase of 15 % over the corresponding period of last year and the prospects for the remaining months of the year were excellent. The work on the San Lorenzo plant was progressing satisfactorily.

DUNDEE, BROUGHTY FERRY AND DISTRICT TRAMWAYS CO., LTD.—Mr. G. Balfour, presiding at the meeting on May 18th, said no dividend could be paid at this stage, on either the pref. or ord. shs. During the 17 months under review, the number of passengers carried, 3 083 107, was the highest since the boom period of 1919–20, but fares had been reduced below, an economical level, and traffic receipts had fallen. The report showed pft. for the 17 months to December 31st, 1928, £2 780, including £495 brought forwd. Interest absorbed £1 611, and £1 168 was carried forwd.

SIMMS MOTOR UNITS, LTD.—Mr. F. R. Simms, presiding at the meeting on May 9th, said the net profit for the past year was £42 946, against £38 566 last year. The directors had pleasure in recommending a final dividend at the rate of 10%, making 15% for the year, less tax. Their Simms products and electric service throughout Great Britain, as well as overseas, continued to be highly appreciated. The Standard Insulation Co., Ltd., had proved an excellent investment. During the year they opened fully equipped branches in Aberdeen, Liverpool, Johannesburg, and Cape Town, making 20 in all. The report and accounts were adopted.

AEONIC RADIO, LTD.—An extraordinary general meeting was held on May 14th, for the purpose of submitting resolutions increasing the capital of the company to £450 000 by the creation of 2 250 000 additional Ordinary shares of 2s. each. Ald. Sir William Kay (chairman) said that the company's factory was producing over 1 000 sets per week, and with the addition of the new machinery that figure would be increased to 2 500. The anticipated profit from this manufacture would be easily reached, and the directors anticipated a figure in the neighbourhood of £200 000 as a result of the first full year's working. The company had secured the Kramolin factory in Berlin, which was capable of producing 1 000 wireless receivers per day. They had also acquired seventy-one English, German, and American patents, including one relating to an entirely new kind of wireless receiver. The German acquisition gave the company the right to manufacture and sell their portable receivers on the Continent.

ANGLO-AMERICAN TELEGRAPH CO., LTD.—Presiding at the ordinary general meeting on May 14th, Lord Cochrane of Cults referred to the death of Mr. Robert H. Benson, who had been associated with the company for thirty-two years and was chairman for the past three years, and said that his son, Major Reginald Benson, had been elected to fill the vacant position on the board. After reviewing the items of the

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balance sheet, the chairman said their relationship with the Western Union Company continued to be harmonious. The past year had been one of great activity in the cable world, notably the merger of wireless and cables. Wireless telegraphy, he said, would never entirely supersede cable telegraphy. In support of that theory he pointed out that the cable receipts of the Western Union had increased during the past year, while the volume of traffic handled was greater than that of any other year.

SPHINX ELECTRIC, LTD.—Presiding at the statutory meeting on May 14th, the chairman, Sir A. Cecil T. Beck, said the progress made was in excess of the programme outlined in the prospectus. Sales for the week ending May 4th showed an increase over the preceding week of 33⅓., 150% over the corresponding week of 1928, and 52% over 1927, while for week ending May 11th the increase was 45% over the corresponding week of 1928. Negotiations had reached an advanced stage for the acquisition of a large provincial electrical manufacturing house, with a factory in Birmingham and branches in important industrial centres. The company was also in treaty for a controlling share interest in two associated companies manufacturing and selling patented electrical equipment, contracts now being negotiated in respect of which amounted to several hundreds of thousands of pounds. Should negotiations for the absorption of these additional businesses be satisfactorily completed, an increase in the share capitalisation will be necessitated.

CALCUTTA ELECTRIC SUPPLY CORPORATION, LTD.—Lord Meston, presiding at the meeting on May 8th, said the development of generating power and of the distribution network continued. The fourth 6 000 kW unit in the southern station took up its duties in July last, and one of the old Oerlikon sets at Cossipore was replaced by a 10 000 kW (rated at 12 500 kW) set. They had sold 148 000 000 kWh, compared with 127 000 000 in 1927. The divisible profit was nearly £261 000, against, roughly, £240 000. The board recommended, as a regular policy, a balance between a 12% dividend and a 3 anna domestic flat rate. If a bonus were added to the standard dividend some bonus, rebate or discount should be given to the consumer. While they proposed adding a bonus of 4d. per ordinary share to the dividend of 12%, they proposed to reserve an equivalent amount, £22 550, to give a special rebate or discount to domestic consumers before the end of the current year. They also proposed to reduce the kilowatt charges to large power consumers by roughly 10% all round. An increase of the share capital from 3 000 000 to 4 000 000 shares of £1 each was authorised by the shareholders.

BRITISH ELECTRIC TRANSFORMER CO., LTD.—Mr. A. F. Berry, presiding at the meeting on Tuesday, said there was a decrease of about £30 292 in the gross profit on trading, due to difficulties and price-cutting encountered during the year. It had been decided to postpone consideration of the payment of the preference dividend pending the sale of some of the company's properties. It was a matter of regret that there was no possibility of considering payment of an ordinary dividend. The balance carried forward would be £11 095, against £10 855. In the past three years they had each year turned out apparatus capable of dealing with more horse-power. In the past year they had done a great deal of additional work for a very poor return. Shareholders would, he hoped, find that the step back which they were now taking might prove to be one preliminary to making the biggest jump forward in years to come that they had ever known. They were steadily equipping themselves in their various lines of business to play a prominent part, and one worthy of their long and healthy past. The manufacture of special lamps for sunray "Tricity" radiators had been made necessary by the growing popularity of that section of the business. Consequently they now controlled an electric lamp business, in addition to their older established transformer, heating and cooking businesses. Incidentally, the manufacture of electric lamps had proved most profitable generally—so profitable in some cases that manufacturers of popular lamps had been able to invade the transformer business and cut prices seriously. He saw definite signs which led him to believe that years of great promise lay ahead of them. Their tremendous additional orders were of themselves an indication of great national activity, and they might expect in the next year to begin to share in that national prosperity which should come to the electrical and allied trades. The report and accounts were adopted.

URBAN ELECTRIC SUPPLY CO., LTD.—At the meeting on May 9th, Mr. P. D. Tuckett, chairman, said the total income of past year amounted to £154 323, a decrease of £4 431, which was more than accounted for by the loss, by compulsory purchase, of their Walton undertaking. In practically all their undertakings reductions in price had been made within a period which affected the results for 1928. The balance available in the net profit and loss account was £100 832, an increase of £2 083. The dividend recommended on the ordinary shares was the same as last year, 4% final, making 7% for the year. They proposed to carry forward £22 953, against £22 219 brought in. At the moment it appeared that no sale of their Godalming undertaking to the Aldershot Gas, Water and District Lighting Co. would take place. The Newquay Co. was in a satisfactory condition. It had paid 7% for 1928, and held a substantial balance of undistributed profits invested in Trustee securities. The Cornwall Power Co., in which they had a large interest, had had a setback owing to the shutting down of two large mines, and, although they thought it would recover from this setback, for a year or two it was likely to pay a smaller dividend than in previous years. The additional payment for rates in their undertakings would, under the new assessments, exceed £13 000 per annum. It meant that their profits would be £13 000 less on the business as it existed to-day. They hoped that the normal expansion of their business would in time offset this burden. They had received notice of the compulsory purchase of their Stamford undertaking and of part of the undertakings of the Twickenham Co. They would no doubt receive a satisfactory price for these undertakings, but it must result in a decrease of profits for some years. They did not doubt their ability to maintain their 7% ordinary dividend, but only their ability to increase it in the near future. The report was adopted and the dividend approved.

New Companies.

R. S. BROOKMAN, LTD.—Cap., £1 000. Electrical and genera engineers, etc. Solicitors: Slater, Brunton, Straw and Pearce Loughborough.

ELECTRIC SWEEPERS, LTD.—Cap., £10 000. Agents for and dealers in mechanical appliances, etc. Reg. Office: 405, Oxford Street, London, W.1.

FRANK WALL AND CO., LTD.—Cap., £1 000. Electricians, electrical engineers, suppliers of electricity, etc. Reg. Office: 25, Unino Street, Oldham.

JAMES MITCHELL AND SON (GREENOCK), LTD.—Cap., £15 000. Lighting, heating and electrical engineers, etc. Reg. Office: 7, West Stewart Street, Greenock.

ELECTRIC SUPPLIES AND REPAIRS, LTD.—Cap., £500. Electrical and radio engineers, etc. A director: C. V. Stead, 46, Cavendish Road, West Didsbury, Manchester.

EVERETT'S INTERNATIONAL ACCUMULATORS, LTD.—Cap., £1 000. To acquire and experiment with patents, etc. Reg. Office: Ulster Chambers, 168, Regent Street, London, W.1.

EASTNOR ELECTRIC CO., LTD.—Cap., £500. Electrical and radio engineers, specialists in tramway equipment, switchgear, patent trolley bushes, etc. Reg. Office: 11B, Eastnor Street, Old Trafford, Manchester.

ELECTRO-VORTEX, LTD.—Cap., £5 000. Patentees or manufacturers of plant relating to domestic laundry equipment, dealers in electrical appliances, etc. Solicitors: Sedgley, Caldecott and Co., Knutsford.

GOULD, HARPER AND CO., LTD.—Cap., £2 000. To acquire business of manufacturers of wireless and electrical apparatus now carried on by C. H. Gould and T. Harper at Tatnam Road, Poole, Dorset, as "Gould, Harper and Co."

STONE MANUFACTURING CO., LTD.—Cap., £1 000. Manufacturers and repairers of and dealers in electric batteries, electric lamps and torches, electrical instruments and novelties, etc. Reg. Office: 108/109, Great Saffron Hill, London, E.C.1.

TRI-SIGNS, LTD.—Cap., £600. Manufacturers of and dealers in electric illuminated and other devices, etc. A subscriber: R. E. Haykin, 64, Lower Hastings Street, Leicester, advertising specialist (permanent managing director and chairman).

ELECTRODE WELDING CO., LTD.—Cap., £500. Manufacturers and suppliers of and dealers in all raw materials for electric valve and lamp making industry, including supply of welded electrodes, etc. Reg. Office: 8, Regent Street, London, S.W.1.

CHROMO PROCESS SYNDICATE, LTD.—Cap., £3 000. To adopt agreement with A. A. Postnikow, to acquire patents relating to methods of electrolytically depositing chromium, etc. Solicitors: Arthur Veasey and Co., Aldwych House, Aldwych, London, W.C.2.

ECLIPSE AUTOMATIC DEVICES, LTD.—Cap., £50 000. Manufacturers of and dealers in plant, machines, appliances and apparatus, electrical and general engineers, electricians. Reg. office: Balfour House, Finsbury Pavement, London, E.C. (London Public Co.)

THORNBURY AND DISTRICT ELECTRICITY CO., LTD.—Cap., £15 000. To acquire business of an electricity undertaking carried on by F. H. Grace at Thornbury, Glos, and his rights under the Thornbury and District Electricity Special Order, and to carry on the business of an electric light company. Solicitors: Crossman and Co., Thornbury Glos. (Public co.)

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COMMERCIAL INFORMATION.

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debt. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

AVON ELECTRICAL CO., 313, Aigburth Road, Liverpool, dealers. £10 19s. 4d. April 5th.

FOOT, K., 26, New Road, South Chingford, wireless manufacturers. £42 4s. 7d. February 27th.

HERMANN RADIO SUPPLIES, 2A, Willesley Road, Wanstead. £34 17s. 7d. February 21st.

PERRIN, Mr. J., 23, Welderton Road, Stamford Hill, wireless dealer. £21 0s. 2d. March 8th.

RUDD, A. E., Long Ashton, electrical contractor. £16 13s. 6d. April 9th.

WHITEHEAD, Mr. B. J., 4, Queen's Terrace, St. Leonard's, Exeter, wireless dealer. £30 18s. March 11th.

WING, Mr., Radio Charging Depot, Dingwall Road, Croydon, wireless dealer. £38 9s. 7d. March 27th.

Deed of Arrangement.

JONES, Clarence Lionel Frederick, Colwyn Avenue, Rhos-on-Sea, and 14, Mostyn Street, Llandudno, electrical and wireless engineer. Dated May 13th, filed May 14th. Trustee, J. Sandford, Rhos Road, Rhos-on-Sea, accountant. Liabilities unsecured, £708; assets, less secured claims, £235.

Mortgages.

[NOTE.—*The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—allowed by the date of the Summary, but such total may have been reduced.*]

BOWER ELECTRIC (1926), LTD., London, W. Registered May 2nd, by order on terms, £19 992 debentures (secured by Trust Deed dated February 23rd, 1929), present issue £294; charged on certain signs, etc., also general charge. *£750. March 30th, 1929.

CLEETHORPES RADIO SUPPLY, LTD. Registered May 8th. £200 debentures balance of £500; general charge. *£300. June 22nd, 1928.

LISKEARD GAS AND ELECTRICITY CO., LTD. Registered May 9th, series of £6 000 debentures present issue £300; general charge (subject to 1st debentures). *£8 000. November 22nd, 1928.

Satisfactions.

RINGWOOD ELECTRIC SUPPLY CO., LTD. Satisfactions registered May 8th, £15 000 (not ex.) and £15 000 (not ex.), both registered March 10th, 1925, and July 17th, 1926.

TYCHE, LTD., London, S.W., electrical engineers. Satisfaction registered May 10th, £200 registered September 2nd, 1927.

Private Meetings, etc.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

F. E. INDUSTRIALS, LTD., electrical appliance manufacturers, London and Glasgow. The statutory meeting of creditors in this voluntary winding up was held recently in Glasgow, when Mr. J. M'Connell, the liquidator, reported that the liabilities were £8 628 5s. 11d., made up as follows: Trade creditors, £2 611; cash claims, £3 095; and bank overdraft, £2 922. In addition there was a contingent claim to the extent of £1 000, which was not expected to rank. The assets were estimated to realise £3 314, from which had to be deducted £373 for preferential claims, leaving net assets of £2 941, or a deficiency of £5 687. The assets included stock at Glasgow, £901; stock in London, £1 008; book debts at Glasgow, £796, estimated to realise £630; London debts, £651, valued at £480; office furniture, £433, expected to produce £190; and patent rights £100.

It was reported that the company was formed rather more than a year ago for the purpose of selling washing machines and vacuum cleaners. It was further stated that the company purchased the patent rights of a certain machine, and that efforts were made to sell the continental rights to a German company, but the matter fell through. The company had agreed to pay £2 000 for the continental patent rights. Of that amount £1 000 only had been paid. A sales manager was appointed, but when he submitted his scheme to the directors, there were not sufficient funds to carry it through. Negotiations for the sale of certain rights took place, but they proved abortive, and liquidation took place. It was pointed out that the issued capital was £6 500, and the deficiency as regarded the shareholders of £12 187 was accounted for by the following items: Written off stock, £1 000; bad debts, £340; depreciation of office furniture, £250; loss on patent rights, £1 400; preliminary expenses, £260; cost of negotiations in Germany, £750; and loss on trading, £8 187. A resolution was passed confirming the voluntary liquidation of the company, Mr. T. D. Galbraith, accountant, of Glasgow, being appointed to act as joint liquidator.

London Gazette, etc.

Winding-up Petition.

TELEPHONES AND ACCESSORIES, LTD. A creditors' petition for winding-up has been presented by the Erewash Electric Wire Co., Ltd., Bennett Street, Long Eaton, Derby, and is to be heard at the Royal Courts of Justice, Strand, London, on June 4.

Company Winding-up.

WHITFIELD ELECTRICAL CO., LTD. Meetings, of creditors, May 27th, 2.30 p.m.; and contributories, May 27th, 3 p.m., 29, Russell Square, London, W.C.1.

Company Winding-up Voluntarily.

WORMIT ELECTRIC LIGHT CO., LTD.—By special Resolutions, April 25th, confirmed May 15th. W. Anderson and J. F. Fleming appointed as joint liquidators. Meeting of creditors, Newburgh Road, Wormit, Friday, May 31st, at 7.45 p.m.

Bankruptcy Information.

JOHN, Daniel Blodaufryn, trading as D. B. JOHN AND BROTHERS, 8, Commercial Place, Pontycymmer, and at the Nanthir Stores, Nanthir Road, Blaengarw, electrical engineer. Receiving order, May 13th. Debtor's petition. First meeting, May 30th, 12 noon, 34, Park Place, Cardiff. Public examination, June 20th, 11.30 a.m., County Court, Wyndham Street, Bridgend.

MARSDEN, Charles Bertie, rear of 60, Pisgah Street, Kenfig Hill, electrical engineer. First meeting, May 30th, 11.30 a.m., 34, Park Place, Cardiff. Public examination, June 20th, 11.30 a.m., County Court, Wyndham Street, Bridgend.

METAL AND CHEMICAL PRICES.

TUESDAY, May 21st.

		Price.	Inc.	Dec.
Copper—				
Best Selected ..	per ton	£76 0 0	—	£1 15 0
Electro Wirebars	,,	£84 12 6	—	2s. 6d.
H.C. Wires, basis	per lb.	11 11/16d.	—	—
Sheet	,,	1s. 0d.	—	—
Phosphor Bronze—				
Wire (Telephone) basis	per lb.	1s. 2 11/16d.	—	—
Brass 60/40—				
Rod, basis ..	per lb.	9d.	—	—
Sheet ,, ..	,,	10 1/4d.	—	—
Wire ,, ..	,,	11 1/4d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£3 12 6	1s. 6d.	—
Galvanised Steel Wire, basis 8.S.W.G. ..	,,	£14 15 0	—	—
Lead Pig—				
English	per ton	£25 5 0	—	5s. 0d
Foreign or Colonial	,,	£23 17 6	—	5s. 0d.
Tin—				
Ingot	per ton	£196 15 0	—	£2 10 0
Wire, basis ..	per lb.	2s. 7 1/2d.	—	—
Aluminium Ingots	per ton	£95 0 0	—	—
Spelter	,,	£26 15 0	—	—
Mercury	per bottle	£22 5 0	—	—

Sulphur—Flowers, Ton £12 0 0 *Sulphuric Acid*—
,, Roll ,, £10 10 0 (Pyrites, 168°) Ton £6 15 0
Copper Sulphate ,, £25 to £25 10 0 *Sodium Chlorate* per lb. 2 1/2d.
Boric Acid (Crystals) ,, £30 0 0 *Sodium Bichromate* per lb. 3 1/2d.
Rubber—Para fine, 11 1/2d.; plantation, 1st latex, 11 1/2d.

∴ The metal prices are supplied by British Insulated Cables Ltd., and the rubber prices by W. T. Henley's Telegraph Works Co., Ltd.

THE LEAD MARKET.

The market opened with an easier tone last week, but on Tuesday, according to James Forster and Co., prices fell 8s. 9d. per ton for May, and 6s. 3d. for forward, to £23 13s. 9d. for all positions, since when a small recovery has set in.

American market dull. Price unchanged at 7 cents per lb.

Closing prices on May 17th were £23 16s. 3d. for May, £23 16s. 3d. for June, £23 15s. for July, and £23 15s. for August, or 8s. 9d. to 6s. 3d. lower on the week.

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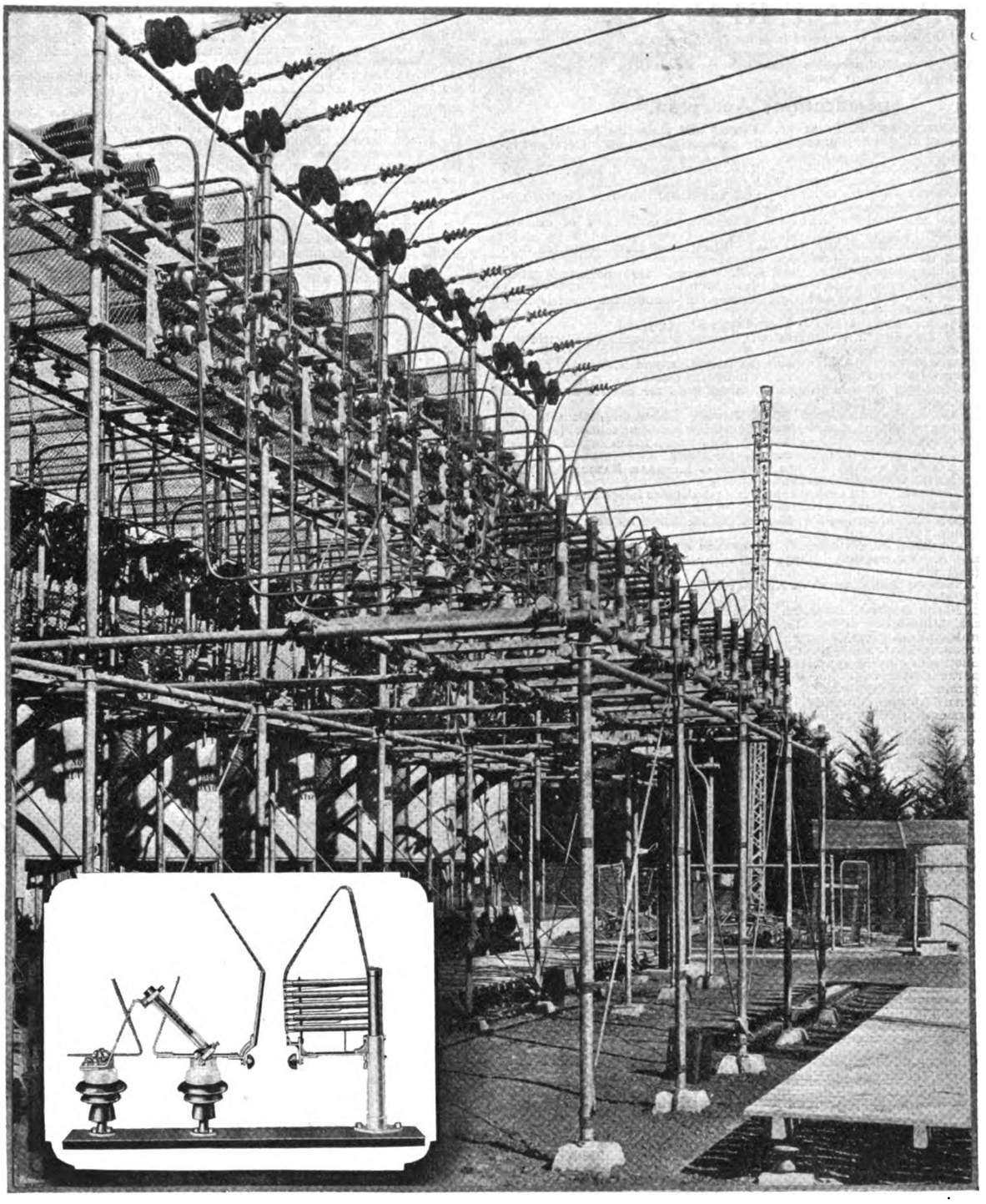

"EMPIRE" Lightning Arrestors allow a high rate of discharge, thus dissipating the abnormal conditions in the minimum time while the power current finally broken is reduced to such a low value as to prevent any secondary disturbance—two of the most important points in the design of the Lightning Arrestor. These Lightning Arrestors are suitable for voltages from 6,600 volts to 66,000 volts.

ELECTRIC CONTROL

LIMITED, BRIGHTON.

EMPIRE ELECTRIC CONTROL

Raymond

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PATENT RECORD.

The following information is prepared from the Illustrated Official Journal (Patents) by permission of the Controller of H.M. Stationery Office. Printed copies of full Patent Specifications, when accepted, may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at 1s. each.

Specifications Accepted.

308 641 H. Griffiths and E. Passburg. Process and apparatus for drying and impregnating in vacuo, particularly applicable to the manufacture of insulating-materials. (23/12/27.)
308 672 Creed and Co., Ltd., F. G. Creed, R. D. Salmon and S. E. Kirk. Electric telegraphic receiving-apparatus. (24/12/27.)
308 744 A. Reyrolle and Co., Ltd., N. Cooke and B. H. Leeson. Electric protective arrangements. (28/12/27.)
283 893 Siemens and Halske Akt-Ges. Luminous reproductions of circuits. (19/1/27.)
284 325 Siemens-Schuckertwerke Akt.-Ges. Electric bell installations fed from small transformers. (28/1/27.)
308 856 Igranic Electric Co., Ltd., and S. R. Wright. Slow-motion adjusting-devices for wireless instruments. (26/1/28.)
299 295 Siemens and Halske Akt.-Ges. System of connections for telephone installations. (22/10/27.)
308 876 H. Froger. Electrical remote-control systems. (1/3/28.)
308 879 S. G. S. Dicker (N. V. Philips' Gloeilampenfabrieken). Electric discharge tubes. (5/3/28.)
297 311 Hirsch Kupfer- und Messing-werke Akt.-Ges. and M. Tama. Electric furnace for heating strip metal by induction currents. (17/9/27.)
308 888 P. R. Shackel and Ranton, Ltd. Cord grips for electric fittings and appliances. (16/3/28.)
308 892 Gramophone Co., Ltd. and E. M. Payne. Electromagnetic vibratory devices for use, for example, in reproducing or recording sound. (21/3/28.)
308 895 J. E. Brown, E. G. Anness and W. Meacher. Indicating or warning devices for excess electric currents. (27/3/28.)
308 902 E. H. Newman and M. Baynes (trading as Langham Radio) and V. S. Knight. Wireless apparatus. (5/4/28.)
290 157 N. V. Philips' Gloeilampenfabrieken. Resistance lamps and rectifying-installations embodying such lamps. (7/5/27.)
308 908 Best and Lloyd, Ltd. and W. Morris. Shade fittings for electric and other lamps. (21/4/28.)
308 910 A. Andersson, K. Ohlsson, G. Sanderson and B. Sanderson (trading as A. Sandersons Linjeringsmaskinfabrik). Electric flasher. (24/4/28.)
308 913 R. Amberton and Electrical Apparatus Co., Ltd. Electric resistances. (28/4/28.)
289 781 Soc. Belge Radio-Electrique. Variable electric condensers. (30/4/27.)
293 378 West Manufacturing Co. Test-sets for locating faults in electric transmission lines. (5/7/27.)
308 933 Automatic Telephone Manufacturing Co., Ltd. and G. W. Simister. Suction or blowing apparatus. (29/6/28.)
294 959 Electroacustic Ges. Sub-aqueous sound transmitting or receiving apparatus. (2/8/27.)
295 719 British Thomson-Houston Co., Ltd. Machines for forming rings of segmental pieces. (19/8/27.)
298 614 Telefunken Ges. fur Drahtlose Telegraphie. Frequency-changers for use in picture and other high-speed telegraph systems. (12/10/27.)
308 951 A. C. Wynne. Electric switches. (21/1/28.)
308 473 A. E. O'Dell (Deutsche Telephonwerke und Kabelindustrie Akt.-Ges.). Apparatus for electrically transmitting to a distance the indications of a measuring-instrument or the like. (24/10/27.)

Applications for Patents.

March 4th.

6 993 Telefonaktiebolaget L. M. Ericsson. Telephone exchange systems. (6/3/28, Sweden.)
7 034 Telefunken Ges. fur Drahtlose Telegraphie. Picture transmission systems, etc. (3/3/28, Germany.)
7 035 Telefunken Ges. fur Drahtlose Telegraphie. Radio transmitters, etc. (3/3/28, Germany.)
7 057 C. H. Verity. Electrical pick-up mountings. (22/10/28.)
7 058 C. H. Verity. Device for controlling speed of electric motors. (22/10/28.)
7 059 C. H. Verity. Synchronisation of wireless sounds and kinematograph films. (5/6/28.)
7 060 C. H. Verity. Synchronisation of wireless sounds and kinematograph films. (19/6/28.)
7 061 C. H. Verity. Synchronisation of wireless sounds and kinematograph films. (13/8/28.)

March 5th.

7 192 Associated Telephone and Telegraph Co. Electric remote control systems (3/8/27, U.S.)
7 146 H. Atkins, A. E. Frearson and Ormond Engineering Co., Ltd. Sound reproducing instruments.
7 147 H. Atkins, A. E. Frearson and Ormond Engineering Co., Ltd. Electric switches.
7 205 British Thomson-Houston Co., Ltd., and H. Dreghorn. Electric motors.
7 206 British Thomson-Houston Co., Ltd., and C. G. Mayo. Electric protective apparatus.
7 207 British Thomson-Houston Co., Ltd., C. G. Mayo and J. G. Wellings. Transformers.
7 208 British Thomson-Houston Co., Ltd., C. G. Mayo and J. G. Wellings. Transformers.
7 200 W. F. S. Debenham and General Electric Co., Ltd. Mounting studio lighting lamps.
7 201 W. F. S. Debenham and General Electric Co., Ltd. Portable stands for electric lamps.
7 190 S. G. S. Dicker (N. V. Philips' Gloeilampenfabrieken). Means for synchronising movements of devices.
7 183 J. J. Drumm. Storage battery.
7 200 General Electric Co., Ltd., and E. L. Randall. Mounting studio lighting lamps, etc.
7 156 Hercules Powder Co. Compound for impregnation of cable insulation. (24/12/28, U.S.)
7 071 H. Hodges and A. Price. Electro deposition of metals.
7 166 Igranic Electric Co., Ltd. Electric phonographs. (11/4/28, U.S.)
7 159 F. Lahant. Loading systems for telephone lines.
7 138 Presslicht-Patenverwertungs Ges. and E. Wist. Converting electric arc into elongated flame.
7 201 E. L. Randall. Portable stands for electric lamps.

March 6th.

7 372 Associated Electrical Industries, Ltd., and H. Pearse. Electrical power distribution systems.
7 308 British Thomson-Houston Co., Ltd., L. Griffiths and C. J. Morton. Devices for securing cables to magneto distributors, etc.
7 340 F. Z. Chalmers. Control of electric circuits.
7 288 Domestic Electrification, Ltd., and J. J. McKenna. Electric hot plates, etc.
7 361 H. J. Dowsing, A. L. Melson, C. W. Slark and F. M. Steele. Safety devices for electrically heated water vessels.
7 353 Elektro-Physikalische Ges., and E. Kassner. Method of rendering visible electromagnetic oscillations.
7 299 S. A. G. Emms, General Electric Co., Ltd., C. W. Sanders and H. W. Wilson. Electric motor control systems.
7 319 Fitzgibbon and Murray, Ltd., and H. A. Murray. Electric switches, etc.
7 378 H. Geffcken, H. Richter and Silectra Ges. Alternating current metallic vapour lamps.
7 313 W. O. Heyne and Plessy Co., Ltd. Cabinet wireless receiving sets.
7 309 International General Electric Co., Inc. Ignition devices. (8/3/28, Germany.)
7 275 J. Paterson and J. Shirley. Electrode holders for electric welding.
7 252 J. W. G. Pearson. Heating elements for electric stoves, etc.
7 314 M. de Saivre. Radio communication systems. (3/4/28, France.)
7 347 Siemens-Schuckertwerke A.G. Rubber covered cable. (7/3/28, Germany.)
7 357 Siemens-Schuckertwerke A.G. Electric conductors. (28/6/28, Germany.)
7 310 D. S. S. Stewart. Telephones.

March 7th.

7 492 Associated Electrical Industries, Ltd., and E. H. M. Langley. Control systems for electric motors.
7 527 C. E. G. Bailey and Gramophone Co., Ltd. Wireless circuits.
7 409 S. O. Bowker. Electric junction boxes, etc.
7 469 A. C. Brockies and A. Graham and Co., Ltd. Water tight electric bells.
7 494 H. E. Clarke. Galvanic batteries.
7 426 Electrical Research Products, Inc. Electric wave transmission systems. (26/5/28, U.S.)
7 748 General Electric Co., Ltd. Luminous electric discharge tubes. (14/7/28, Germany.)
7 470 W. Hamilton and H. C. Turner. Induction electrical instruments.
7 483, 7 484 B. Hesketh. Tuning circuits for wireless receiving systems.
7 465 H. F. Joel. Secondary batteries, etc.
7 508 P. Kapitza and G. V. Lomanossoff. Electromagnets. (20/12/27.)
7 440 J. P. Laker. Wiring radio receivers, etc.
7 450 L. V. McKenzie. Device for controlling electric motors.
7 496 D. and S. Montague. Case for cabinets of portable wireless sets.
7 512 N. V. Philips' Gloeilampenfabrieken. Cathodes for electron discharge tubes. (25/9/28, Holland.)
7 513 N. V. Philips' Gloeilampenfabrieken. Electron discharge tubes, etc. (4/12/28, Holland.)
7 494 Oldham and Son, Ltd., and W. D. Wilde. Galvanic batteries.
7 431 E. Phillips. Device for transmitting scenes for television.
7 501 A. Preen. Variable condensers.
7 531 E. Reisz. Manufacture of membranes for electrostatic loud speakers. (13/3/28, Germany.)
7 491 J. H. T. Roberts. Electrical apparatus.
7 591 R. E. Schnorf. Means for protecting leading in tubes in electrical gas purifiers.
7 432 D. S. S. Stewart. Apparatus for production of sound from vibrating diaphragms.
7 164 C. J. R. H. von Wedel. Discharge tubes. (7/3/28, U.S.)

March 8th.

7 674 Automatic Telephone Manufacturing Co., Ltd., and T. H. Turney. Filters for electrical networks.
7 675 Automatic Telephone Manufacturing Co., Ltd., and T. H. Turney. Impulse repeaters for telephone systems, etc.
7 592 G. G. Blake. Connecting, etc., alternating currents of high frequency with unidirectional currents, etc.
7 561 R. S. Brailsford. Conduit systems for wiring.
7 625 British Thomson-Houston Co., Ltd. Supervisory control systems. (8/3/28, U.S.)
7 627 British Thomson-Houston Co., Ltd., and R. D. Parry. Vibrating electric regulators.
7 682 S. G. Brown. Electromotors for driving gyroscopes.
7 693 Electrical Research Products, Inc. Electric welding. (10/3/28, U.S.)
7 694 Electrical Research Products, Inc. Signalling systems. (2/6/28, U.S.)
7 695 Electrical Research Products, Inc. Voltage discriminating systems. (31/3/28, U.S.)
7 575 S. B. Hamilton. Electric torch.
7 602 W. O. Heyne and Plessey Co., Ltd. Controls for variable condensers, etc.
7 626 International General Electric Co., Inc. Electric motor control. (8/3/28, Germany.)
7 647 L. Mellersh-Jackson (Siemens-Schuckertwerke A.G.). Domestic electric installations.
7 651 J. Oldham, and Oldham and Son, Ltd. Galvanic batteries.
7 641 Siemens-Schuckertwerke A.-G. Dry metal rectifier cells. (21/3/28, Germany.)

March 9th.

7 749 A. E. Angold and General Electric Co., Ltd. Operation of electric switches.
7 751 A. E. Angold and General Electric Co., Ltd. Control apparatus for electric power devices.
7 753 F. J. Brislee and British Insulated Cables, Ltd. Insulation of electric wires, etc.
7 746 British Thomson-Houston Co., Ltd. Electric switches. (10/3/28, U.S.)
7 766 G. N. Cadbury, M. J. Pattison and R. W. Purdie. Electrical contact fingers.
7 792 Celestion, Ltd., and C. French. Telephone instruments, etc.
7 760 W. C. Fisher. Device for switching on electric lamps.

COMING EVENTS.

Friday, May 24th.

Institution of Electrical Engineers (Western Centre).—Queen's Hotel' Cheltenham. Summer meeting.

Physical Society.—Imperial College of Science, Imperial Institute Road, South Kensington. Paper by Dr. J. H. Vincent on "Experiments on Magneto-strictive Oscillations at Radio-Frequencies." 5 *p.m.*

Monday, May 27th.

Electrical Contractors' Association (Ealing Sub-Branch).—Ordinary meeting.

Tuesday, May 28th.

Electrical Contractors' Association (Chesterfield Sub-Branch).—Falcon Café. Ordinary meeting.

Wednesday, May 29th.

Electrical Contractors' Association (Croydon Sub-Branch.)—Ordinary meeting.

Electrical Association for Women.—Model Electric Kitchen, 46, Kensington Court, London. Lecture demonstration with a thermal storage electric cooker, by Mrs. H. Dover. 3 *p.m.*

Electrical Contractors' Association (Belfast Branch).—5, Bedford Street. Ordinary meeting. 3.30 *p.m.*

Polytechnic School of Engineering.—307–311, Regent Street, London. Lecture III (Course of six lectures) on "Thermionic Valves," by Mr. W. H. Date. 6.30 *p.m.*

Thursday, May 30th.

Batti-Wallahs' Society.—Hotel Cecil, Strand, London. Luncheon. Speaker, Mr. H. S. Horne on "A Layman's View of the Electrical Industry." 1 *p.m.*

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THE ELECTRICIAN

Established 1861. The Oldest Weekly Illustrated Journal of

Electrical Engineering, Industry, Science and Finance.

Bouverie House, 154, Fleet Street, London, E.C.4. Telegrams: "Benbrotric, Fleet, London." Telephone: City 0244 (Ten lines).

[*Closed on Saturdays in accordance with the "Five-Day Week" plan adopted by Benn Brothers, Ltd., and its associated organisations.*]

No. 2661. [No. 22. Vol. CII.] **Friday, May 31, 1929.** Annual Subscription, 25s. Overseas, 30s.

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Current Topics.

The I.M.E.A. Convention.

NEXT week ushers in the Electrical Conference Month. Delegates to the thirty-fourth annual Convention of the Incorporated Municipal Electrical Association will assemble at Torquay, during Monday and the programme for the week clearly points to another very instructive and enjoyable conference. It would be difficult to imagine a more attractive centre for such a gathering, and a large attendance is definitely assured. With one exception, the papers for discussion are not strictly related to the engineering side of electricity supply, and may therefore be expected to prove of unusual interest to the chairmen and other representatives of Electricity Committees who, in some other years, have felt rather out of their element at the I.M.E.A. meetings. Mention of this fact should not be taken to mean that the subjects should not be of equal interest to the engineer-delegates, but rather that the discussions will be brought on to ground of more common interest to technical and non-technical men. Looking critically at the programme, we think there should have been at least one paper dealing with the distribution problem, than which there is none more important to supply authorities at the present time, but otherwise the subjects seem to be well chosen. Probably the paper most likely to be provocative of vigorous discussion will be that on "Standardisation of Methods of Charge," a matter which we believe to be only inferior in importance to distribution and salesmanship. The social side of the Convention is, if anything, stronger than usual, and the only feature we could wish to see altered is the policy of excluding manufacturers' representatives from full participation in the proceedings. Later pages of this issue contain articles relating to the President's undertaking, which the delegates will not see, and to the Torquay enterprise which will be officially open for inspection on the final day of the Convention. Next week, as is customary, we shall publish a very full and specially illustrated report of the entire Convention, including an account of all the discussions. Copies of this complete report will be available in Torquay **next Friday.**

The Torquay Exhibition.

FROM the advance information sent to us by manufacturers who are showing at the I.M.E.A. exhibition which opens at Torquay on Monday, it is apparent that this exhibition grows in popularity each year. Next week's exhibition will introduce a number of new lines in the way of heavy and domestic equipment, but what is still more pleasing is the fact that the list of exhibitors contains several names which have not appeared at this exhibition before. Of these may be mentioned one in particular which, though new to the electrical world, attaches such importance to the I.M.E.A. Exhibition, that Torquay will be the scene of its electrical debut. Domestic appliances will again constitute the bulk of the exhibits, and with the number of councillors and committeemen visiting the exhibition, manufacturers are wise to cater for a comparatively non-technical public. Such equipments as are suitable for load-improving, together with hiring or hire-purchase are of interest to both councillors and engineers, and though on the other hand the engineer may be equally interested in switchgear, many sales would be lost were the non-engineering visitors not adequately catered for. As we have already mentioned, the papers to be read at this year's Convention are of particular interest to members of Electricity Committees, and no doubt the number of visitors to the exhibition will, this year, be considerably increased by those, who, though of the electricity supply industry are not actually in it.

Mr. Purse's New Post.

MANY of our readers, and in particular those connected with the municipal electricity undertakings, will echo our congratulations to Mr. F. W. PURSE on his appointment as chief engineer of the London and Home Counties Joint Electricity Authority, and our cordial wishes for success in a task for which he is exceptionally well qualified. Up to now the history of the Joint Authority can hardly be described as epoch-making, but the mere announcement of Mr. PURSE'S appointment is sufficient guarantee that there will be no reason for such impressions in the future. The large and densely populated area with which the Authority is concerned is admittedly one which presents peculiar and difficult problems from the supply point of view, but at the same time it cannot be denied that in London itself electrical development is at present notoriously impeded by the high charges which consumers in certain districts must pay if they want a supply of electricity. By wise exercise of its functions the Authority

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can materially improve matters, and though there are some parts of London enjoying a supply so cheap that no outside intervention can lead to still lower prices we feel confident that the higher-priced areas will now gradually be brought into line with their more fortunate neighbours. The problems to be tackled in bringing about this eminently desirable state of affairs are essentially concerned with salesmanship and distribution, as apart from generation, and the Joint Authority is fortunate in its choice of an engineer who was probably the first to emphasise the difference.

Fans and Refrigerators.

THE good weather which has prevailed throughout the current month will lend point to the E.D.A. selling campaign for June, in that the appliances which form subjects of the campaign are fans and refrigerators. The window displays for the month are again simple and attractive, and specimens of two layouts are illustrated elsewhere in this issue. With these windows in view, we published two weeks ago particulars of a number of new and improved fans for the coming season, and, after considering the information contained in our article, electrical contractors and supply authorities with showrooms should be in a position to design a fan window which will display not merely fans, but the latest models which the manufacturers have to offer. Intelligent use of the E.D.A. window and the manufacturers' propaganda may reasonably be expected to make the fan sales for June exceed those of a previous year. Although it is no new thing for the electrical manufacturer to issue special literature and advertising matter to the trade, the fact that this year such propaganda may be linked up with special window displays gives to the contractors an opportunity they have not previously enjoyed, and one which, if rightly used, should establish a fair trade throughout the whole of the summer.

More Poaching.

FROM time to time we have deplored the inroads which various classes of non-electrical retail traders have made into the shop side of the electrical contractor's business, and there are signs that our repeated warnings have not been lost upon those contractors who, through too much concentration on the wiring side, have tended to overlook the big potentialities of appliance sales. Not long ago we had occasion to refer to the activities of the ironmongers in this field. Now it appears that cycle dealers are casting envious eyes upon the electrical trade, and a writer in a cycle trade paper seriously suggests that cycle traders should now establish themselves as the source of supply of electrical fittings, and "get in ahead of the boom that is surely coming." Obviously the cycle dealers have not the technical qualifications which permit the electrical contractor to give sound advice and real service to his customers, but the public does not always realise this. The growing interest of the "dabblers" in the electrical appliance trade suggests that these outsiders are more fully appreciative of the possibilities than are some of the engineers who have grown up in the business.

The Ironmongers' Policy.

IF further evidence were needed of the consistent and growing interest which ironmongers are showing in regard to the retail selling of domestic electrical apparatus, it will be found in a short paper and discussion at the conference at Cromer last week, of the Ironmongers' Federated Association. Here the question: "Should Ironmongers Develop the Electrical Department?" was given a definitely affirmative answer, but we were interested to see that there is growing appreciation of the futility of going into the electrical business as a side-line. In fact, the author of the paper, who is a registered contractor, and has had twenty-five years' experience on the electrical side, made it perfectly clear that the ironmonger seeking to start in the electrical business to-day "will not find it worth while unless he can acquire the necessary adjuncts to commence right away as a first-class electrical contractor." The importance of placing the electrical business in the charge of a properly qualified manager was also stressed. If ironmongers proceed to develop the retail electrical trade on these lines, their activities will be placed on a proper competitive basis, which makes it all the more important for electrical traders to be up and doing, for they will no longer be faced with the unfair competition of the "dabbler" but with what will probably prove to be the still stronger effective competition of a class of trader which is and has for many years been in the most intimate contact with the members of the general public.

Needless Agitation.

WHILE we cannot bring ourselves to view with contempt and loathing those who have been so foolhardy as to raise objections to the erection of the new power station at Battersea, the protests which are now being made against the erection of overhead lines forming part of the "grid" in certain parts of the country leave us cold, because we know from actual observation that the fears of the objectors are quite without foundation. We have passed through some of the loveliest scenery in the British Isles and we have examined the steel tower lines which traverse that district—and are almost identical with those which are being erected by the Central Board—in a particularly critical spirit. We noted their effect against all kinds of background, backed by woods, and standing stark on barren rocks. In many cases the towers were hardly perceptible, but even where they were clearly visible they caused no serious disfigurement. In certain situations, in fact, they added interest to a featureless tract. During that same tour we could not fail to be impressed with the appalling sight of some of the ubiquitous Post Office pole lines. It is impossible to escape them for more than a few minutes at a time. They make possible a useful public service and are not objected to by rural preservation societies. The grid lines are infinitely better to look at, they do not cumber every lane, and they are the channels of a public service even more important than communication. Agitation against their erection is, therefore, pointless and unreasonable.

"Light's Golden Jubilee."

WE have been privately and gently reproved by one of our friends of the National Electric Light Association of America for our action in drawing attention to the fact that the late Sir JOSEPH SWAN was the inventor of the first commercial incandescent electric lamp. While we are sorry that our American friends seem to regard it in that way, we have already made it quite clear that in upholding the rightful claim of a British inventor we have no wish to depreciate the many other achievements of Mr. EDISON, whose first incandescent lamp was produced nearly a year later than SWAN'S. Our N.E.L.A. friend emphasises that they do not claim that EDISON invented the principle of the incandescent lamp, or even that he was the first to consider the use of carbon for this purpose, "the claim is made, however, with considerable assurance, that in 1879 he did devise a lamp which, together with his complete incandescent lighting system and his invention of a dynamo that would give a constant voltage, was the foundation of the electrical industry of to-day." In conclusion our correspondent says that as a practical system of lighting by use of the incandescent lamp was born in 1879, "the people of the United States are quite justified in celebrating its golden jubilee." If the celebration is to be confined to "the people of the United States," and it is clearly understood that the occasion is the fiftieth birthday of the first *American* lamp, we have nothing further to say. But we cannot help remembering that the celebration has throughout been planned as an international tribute with which the whole world would be associated. The change of front noticeable in the extracts quoted above shows that our protests have not been wasted, but a frank acknowledgment of SWAN'S priority, made publicly during the proceedings at Atlantic City, would be more to the point.

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The I.M.E.A. President's Career.

MR. A. NICHOLS MOORE, M.I.Mech.E., M.I.E.E., President of the Incorporated Municipal Electrical Association, is Borough Electrical and Tramways Engineer of Newport. A brief sketch of his career is given on this page, and a descriptive account of the Newport undertaking begins overleaf.

MR. A. NICHOLS MOORE, this year's President of the Incorporated Municipal Electrical Association, was born at Cheltenham, educated at Whitgift School, and acquired his technical training at the Sheffield School of Technology, where he took the civil and electrical engineering course. He served as a premium pupil with the Brush Electrical Engineering Co., Ltd., and was also for a time in the office of Mr. W. J. Walker, consulting engineer, Westminster.

In 1902 he obtained his first appointment in the Manchester Corporation Electricity Undertaking, serving in various capacities under Dr. S. L. Pearce, and being more particularly associated with the development of the Stuart Street station. In 1906 he was appointed resident engineer to the Belfast electricity undertaking, in which position he was responsible for the supervision of the construction of their tramways power house. In the following year he became deputy city electrical engineer, a position which he occupied until 1912. It was whilst in Ireland that he first met, and subsequently married, the eldest daughter of the late Mr. Henry Ashbee, of Greystones, Co. Wicklow.

In the early part of 1912 he was appointed borough electrical and tramways engineer at Newport, where one of his first duties was the reorganisation of the Electricity Department and the preparation of a scheme of extensions. Since that time he has prepared and been responsible for several further large extension schemes.

Probably one of the most outstanding schemes which Mr. Nichols Moore has carried out at Newport is that for the utilisation of the River Usk for circulating water purposes.

Mr. Nichols Moore is a member of the Institution of Electrical Engineers and a member of the Institution of Mechanical Engineers, and was first elected to the Council of the Incorporated Municipal Electrical Association in 1921. As is well known, he, in conjunction with the immediate Past-President, Mr. F. W. Purse, has always been a strong advocate of greater representation on the I.M.E.A. Council of the smaller undertakings, and it was due to their joint efforts that the necessary alterations in the articles of association were secured which enabled such greater representation to be obtained. Mr. Nichols Moore has always taken a keen interest in the Association's work, and has for some years been chairman of the municipal section of the I.M.E.A.-B.E.A.M.A. Joint Committee, in whose work, as is well known, he has been particularly interested. He is the Association's representative on various outside organisations, and has more recently been appointed a representative of the Association on the Conjoint Conference of Public Utility Associations. He is also a member of the Electric Fittings Statutory Committee.

In addition to his official duties under the Newport Corporation and his work on the Council of the Incorporated Municipal Electrical Association, he has been actively engaged in many other directions. He was for nine years honorary secretary (provincial) of the Associated Municipal Electrical Engineers (Great Britain and Ireland) and is a Past-President of that Association. Its establishment in its present position as a representative body was due in considerable measure to his untiring efforts on its behalf. On account of increasing pressure of work he resigned the honorary secretaryship of the Associated Municipal Electrical Engineers last year.

During the war, although exempted for munition purposes from military service, he on two occasions offered himself under the Derby Scheme, but was rejected in view of the importance of the work upon which he was engaged under the Ministry of Munitions in connection with the carrying out of large extension schemes for the supply of electricity for war purposes. He acted as consulting engineer to the Newport Shell Factory and the Uskside National Works, was a Technical Adviser on the Board of Trade Tramway Committee (South Wales and Monmouthshire Area), and was appointed by the Coal Controller as District Engineer to advise on industrial coal economy. He was for some years one of the technical advisers in the South Wales and Monmouthshire Area in connection with the Ministry of Labour Training Scheme, and one of the original members of the committee appointed by the Electricity Commissioners to consider and report upon a scheme for the development of electricity supply in the South Wales and Monmouthshire Area under the Electricity (Supply) Act, 1919; at a later date, when the Advisory Committee was established, being co-opted a member of that Committee. He has also acted as consulting engineer to the Monmouthshire County Council and more recently to the Llantarnam U.D.C. in connection with their successful application for a Special Order.

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THE I.M.E.A. PRESIDENT'S STATION.

Development of the Newport Electricity Undertaking—A Big Industrial Load—Brief Outline of Circulating Water Scheme—The Use of Submarine Cable—Remarkable Growth of the Cooker Load.

FOLLOWING our usual practice when the I.M.E.A. Convention is held away from the President's home town, we give below some details of the Newport undertaking, of which Mr. Nichols Moore has had charge since 1912. Newport is the chief town and port of Monmouthshire, and is situated on the River Usk adjacent to the Bristol Channel. Although in beautiful surroundings, it is essentially an industrial borough.

General view, from the river, of the East power station, Newport.

It has an interesting history, dating from the time of the Romans, but of its earliest days very little has been written. It is known that in the earlier centuries it was the centre of much fighting, in which its historical castle played an important part. The historical interest of Newport may possibly be said to have concluded with the Chartist Riots in 1839, concrete evidence of which may still be seen in a number of bullet holes in the entrance to the famous Westgate Hotel.

Newport has a population of 100 000, and was created a county borough in 1891, its present area being eight square miles. The district surrounding Newport is teeming with collieries, iron and steel works, blast furnaces, rolling mills, tinplate works, and other manufactories, whilst in the town itself are large sheet-iron rolling mills, bar mills, pipe mills, nail factories, chemical works, etc., and a large number of important and extensive ship repair yards. One of the principal features of the town is the docks, which are owned by the Great Western Railway Co., and which include one of the largest wet docks in the country with a sea lock 1 000 ft. long, 100 ft. wide, and 44 ft. 6 in. deep. The total water area of the docks is 135 acres. Owing to its geographical situation Newport is rapidly becoming the gateway to the Midlands for extensive exports, the admirable railway connections between Newport and the Midlands greatly facilitating this. Newport's chief exports are coal, iron, steel, patent fuel, and coke, and its chief imports iron ore, unwrought steel, manganese, timber, etc.

The Original Station.

The Newport Corporation electricity undertaking was first established in 1895, when the Llanarth Street works were erected on the western side of the Usk and a single-phase alternating current supply for private and public lighting was provided. These works are still in existence, but have been closed down as a generating station, and are now the principal sub-station and distributing centre in the heart of the town. The closing of the works as a generating station was made possible by the recent completion of a frequency-lowering scheme, by which scheme the old frequency of 87·5 has been dispensed with and the standard frequency of 50 substituted.

With the introduction of electric traction it became necessary to provide a new generating station, and the East power station, situated on the eastern side of the river, was erected in 1902. With the development of electricity supplies, however, it speedily became necessary to enlarge the station and make it the main generating station for all purposes, and in 1911 the extra high tension three-phase alternating system was introduced and the first turbo-alternator unit installed, this being a 1 500 kW Willans-G.E.C. set.

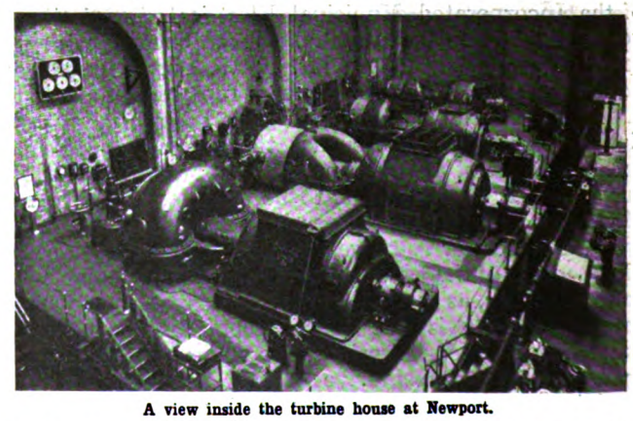
The subsequent development of the undertaking has been exceptionally rapid. At March 31st last the total output from the station in units generated was 41 301 191, the maximum demand 12 975 kW, the total kilowatts connected to the system 52 028, and the total number of consumers 13 293. The aggregate capital expenditure upon the undertaking was £1 150 000 and the net loan debt outstanding £867 897, the estimated income being £190 000.

Big Industrial Users.

The major portion of the supply is for industrial purposes, and with one exception all the large industrial works in Newport, including the G.W.R. Alexandra Docks, take their electricity supplies from the Corporation. In 1922 the Corporation obtained their Electricity (Extension) Special Order, which very considerably enlarged their electricity area, and it now embraces approximately 27 square miles. Much of the added area is rural, and is being actively developed.

The total installed generating plant capacity at the station is 34 500 kW, consisting entirely of turbo-alternator units, two of which have each a rated output of 10 000 kW, suitable for operation on a 6 000 V three-phase 50-cycle system. Both units consist of Escher-Wyss turbines, coupled in the one case to a G.E.C. alternator and in the other to a Brown Boveri alternator, with surface condensing plant in both cases supplied by Messrs. Worthington-Simpson, Ltd. For adequately handling the plant in the turbine house a 50-ton electrically-operated crane, manufactured by Messrs. Royce, Ltd., has been installed, in addition to which an old 25-ton crane is still available. For operating and controlling the generating plant and delivering the supply to the system very complete switchgear has been installed, consisting of direct current switchgear for dealing with the traction supplies and the direct current lighting and power supplies, and extra high tension ironclad cubicle switchgear, electrically-operated, for controlling the main alternators and the outgoing extra high tension trunk feeders. The whole of the switchgear is installed in an annexe adjacent to the turbine house, and most of it was supplied by the Metropolitan-Vickers Electrical Co., Ltd. The control board for operating the extra high tension switchgear is situated in a gallery in the turbine house. The works power transformers and reactors for the main generators are also installed in the annexe.

The steam-raising plant in the boiler house has a total normal evaporative capacity of 340 000 lb. per hour, and consists of a battery of two marine-type water-tube boilers,



A view inside the turbine house at Newport.

each having a normal evaporative capacity of 60 000 lb. per hour, and four similar boilers each having a normal evaporative capacity of 35 000 lb. per hour. The operating pressure of the four smaller boilers is 260 lb. per sq. in. but the two larger boilers have been designed for an ultimate working pressure of 300 lb. per sq. in. The remaining boilers are of the land type suitable for a working pressure of 160 lb. per sq. in., but these boilers will shortly be put permanently out of commission. The two larger units referred to were manufactured by Babcock and Wilcox, Ltd., and are of the very latest design. They are fitted with economisers, preheaters, mechanical stokers, forced and induced draught

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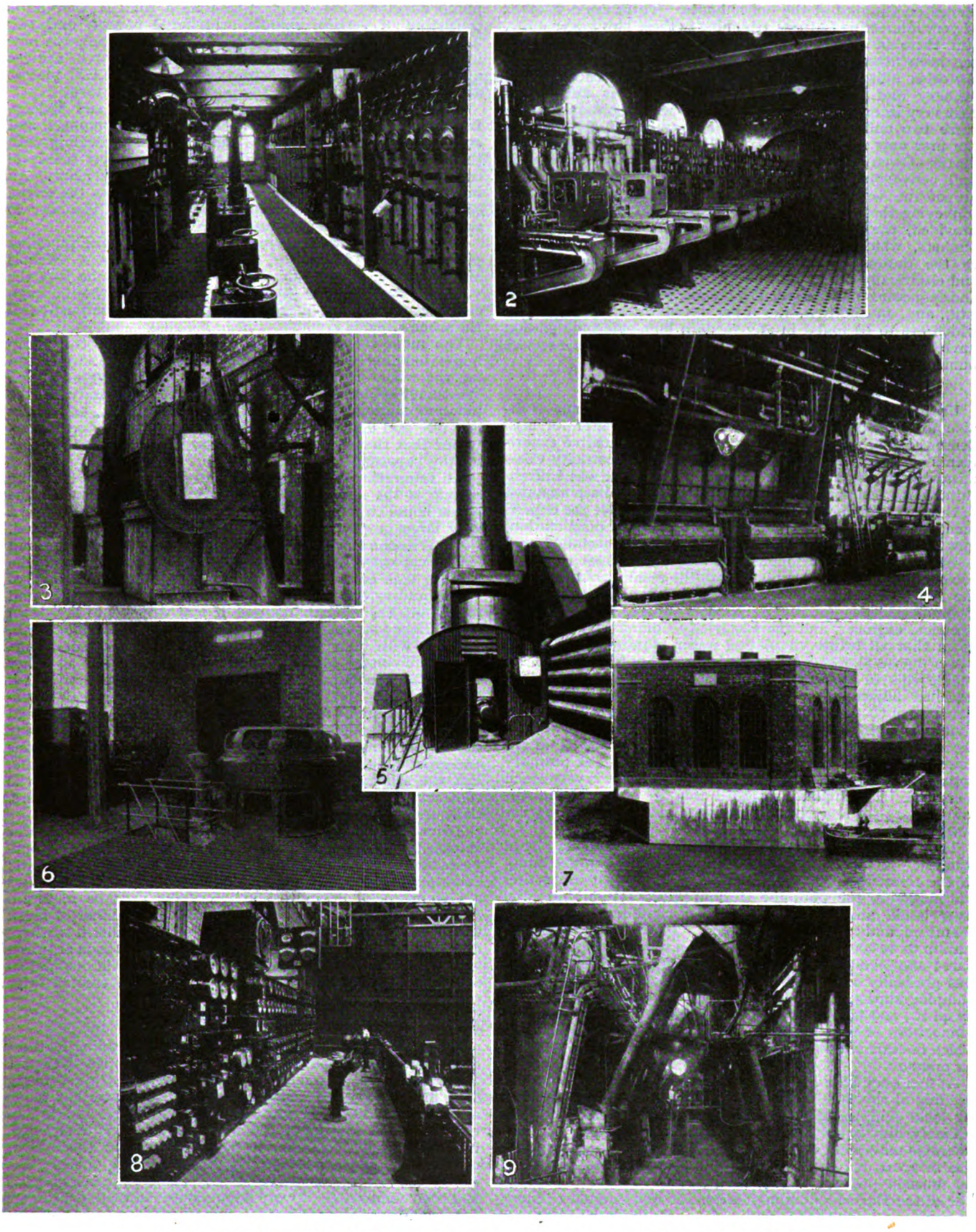

PICTURES OF THE I.M.E.A. PRESIDENT'S STATION.

IN these further views of the Newport electricity undertaking, a brief description of which is given in the accompanying article, are seen :—(1) *The l.t. switchgear annexe ;* (2) *The e.h.t. switchgear annexe ;* (3) *Screening plant at No.* 2 *Pumping Station ;* (4) *No.* 2 *Boiler House, showing new* 60 000 *lb. units ;* (5) *Forced draught plant on roof of boiler house extension ;* (6) *and* (7) *No.* 2 *Pumping Station interior and exterior ;* (8) *The control board ;* (9) *No.* 1 *Boiler House. A plan showing the lay-out of the station is reproduced on page* 641 *of this issue.*

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plant, and Davidson grit arrestors, the draught plant being placed on the roof of the boiler house. There are a number of very interesting features attaching to these two larger units, and there is a slight difference between them. One unit has been fitted with a standard Babcock pre-heater, whilst the other unit has been fitted with a Carrier-Owen combined primary and secondary pre-heater, and it is anticipated that very interesting comparative data will be obtained when these two units are tested. The guaranteed efficiency on the first unit is 86 % and on the second unit (with the Carrier-Owen pre-heater) 88 %. The usual automatic coal conveyors and ash-handling plant are installed, and are of the very latest type. For handling the ashes and conveying them from the works an overhead telpher plant is provided, the ashes being removed from the concrete ash bunkers, which are placed below ground, and transferred to the dumps for ultimate disposal. Both steam-driven and electrically-driven feed pumps are in use, also evaporator and de-gassing plant supplied by Messrs. P. and B. Evaporators, Ltd., and, in addition, the other necessary auxiliary plants which are to be found in any modern high-efficiency station have been provided. The total storage capacity of the service bunkers in the boiler house is 2 500 tons.

Circulating Water Requirements.

Until recently cooling towers were the only means available for providing the necessary circulating water for condenser cooling purposes, but as a result of exhaustive experiments carried out with the approval of the Electricity Commissioners it was ascertained that the River Usk was entirely suitable for this purpose, although it had always been assumed in the past that such was not the case. To enable the experiments to be carried out, an experimental pumping station, now known as "No. 1 Pumping Station," was installed, and is at present in continuous operation, its capacity being 300 000 g.p.h. So satisfactory were the results obtained that the Newport Council unhesitatingly adopted the report and recommendations of Mr. A. Nichols Moore, their borough electrical engineer, and the Electricity Commissioners laid it down that all future circulating water requirements for the power house should be provided from the River Usk. To enable this to be done a large pumping station has been installed adjacent to No. 1 Pumping Station. The construction of this second pumping station involved a number of civil and mechanical engineering difficulties, which have been successfully overcome. The River Usk in the vicinity of the power house has a maximum tidal range of 33 ft. at ordinary spring tide, but at certain seasons of the year this is very much increased. The highest recorded tide is + 28·00 and the lowest —13·50, and these levels were used in designing the new pumping station.

The following brief general outline of the scheme may be of interest. It consists of the construction of an intake sump in the river, with twin culverts 42 ft. in length connecting the intake to the pumping station, which is built into the river bank, and contains an intake chamber, four screen chambers, and two pump chambers. To enable the pumping station to be constructed a steel caisson was built up on a prepared and levelled site on the river bank, and as the caisson was gradually sunk into the bank the concrete walls of the pumping station were formed. The caisson measured 47 ft. by 48 ft., and had a working chamber of 8 ft. high, with two connections in the roof for attaching the shafts by means of which the excavation was removed when the caisson was under air pressure.

At first very little headway was made owing to the constant flooding of the working chamber, and it was decided to erect air locks and work under continuous air pressure. Unfortunately during the period of sinking the caisson very considerable movement of it took place riverwards, and this gave rise to great anxiety, as it was essential that the caisson in its finished position should not project beyond the wharf line of the Harbour Commissioners. It was decided to carry on work continuously day and night, including week-ends and holiday periods, and ultimately the creepage riverwards was stopped, the caisson being founded on the marl at a level of — 36·50 and the working chamber sealed with concrete and grouted up with cement. On the top of this concrete chamber the pump house building was subsequently erected.

In order to provide the necessary pool at dead-low water and to ensure that there should be no appreciable rise in temperature in the river in the vicinity of the power house, it was essential to construct a discharge well and spillway further down the river, and this work is now proceeding, a temporary discharge in the meanwhile being used. The two pump chambers are designed to take a total of four units consisting of vertical spindle centrifugal pumps, and two units manufactured by Worthington-Simpson, Ltd., are now installed, each having a capacity of 1 000 000 g.p.h. against a head of 76 ft. They are driven by 550 B.H.P. G.E.C. motors at 320/520 r.p.m., fixed at the pump room floor level.

Screening plants manufactured by Babcock and Wilcox, Ltd., have been installed in two of the screen chambers, and consist of 48 in. band screens each capable of dealing with the necessary quantity of water under the lowest tide-level conditions, together with all necessary auxiliary plant. An interesting feature is the provision of penstocks in the screen chambers so as to enable any particular screen chamber to supply water to any individual pump.

The general scheme, including the whole of the pumping plant and other machinery, was prepared by Mr. A. Nichols Moore, and in connection with the civil works he had the valuable assistance of Major W. E. Lloyd, the borough engineer, who accepted full responsibility for this portion of the scheme.

The main contractors for the construction of the pump house building were Sir William Arrol and Co., Ltd., and for the whole of the pumping plant, screening plant, etc., Worthington-Simpson, Ltd. The ultimate capacity of the pumping station is not less than 5 000 000 g.p.h., and under low tide and dry weather flow conditions it has been ascertained that there will be ample water in the river to provide for this capacity.

An interesting feature in connection with the distributing system is the submarine cable scheme, which connects the power house on the eastern side with the western side, where a very large proportion of the industrial demand is situated. For this reason it was necessary to provide ample underground feeder capacity between the East power station and the western side of the river, and to avoid the heavy cost of laying underground trunk feeders over Newport Bridge and round into the western district, it was decided to lay down in the river four extra high tension 6 000 V submarine cables, together with pilot and telephone cables. These submarine cables are connected with the underground feeders at either end in disconnecting chambers provided with selective link gear, and, to provide for the possibility of increased transmission pressure at some future date, the cables were designed for an ultimate working pressure of 11 000 V. The submarine cable scheme involved very serious engineering considerations and great difficulties, but these were all successfully overcome, and the scheme carried out and completed well inside the contract period, the responsible contractors being Messrs. Callender's Cable and Construction Co., Ltd.

To enable the high tension supplies from the East power station to be stepped down and delivered for general purposes throughout the electricity area, a large number of static sub-stations have been erected in which the 6 000 V supplies are transformed down to 200/230 V, as may be required. In addition there are now being installed a number of kiosk transformer sub-stations in the more outlying districts where development is taking place, and ample area has been acquired to provide sites for the kiosk transformer sub-stations and to enable permanent sub-station buildings to be erected later where necessary.

Domestic Developments.

Mention may perhaps be made of two outstanding features of domestic development in connection with the Newport undertaking, viz., the remarkable development of the cooking load, and the assisted wiring scheme. The former has made astounding strides. It was introduced in 1923, and to-day the number of cookers on consumers' premises is over 3 000, whilst additional cookers are being installed at the rate of upwards of 30 per week. The assisted wiring scheme was introduced in 1926, and at March 31st, 1929, 3 742 installations had been connected. A very large number of these consumers are also users of electric cookers and other domestic apparatus, the total number of units supplied for domestic cooking and heating purposes for the year ending March 31st, 1929, being 5 300 000.

From the foregoing it will be seen that the undertaking is being rapidly and completely modernised so far as the power house is concerned, and that on the distribution side every opportunity is being taken to ensure a rapid development of electricity supplies and the provision of all possible facilities for those living within the Corporation's electricity area to make the fullest use of the energy provided.

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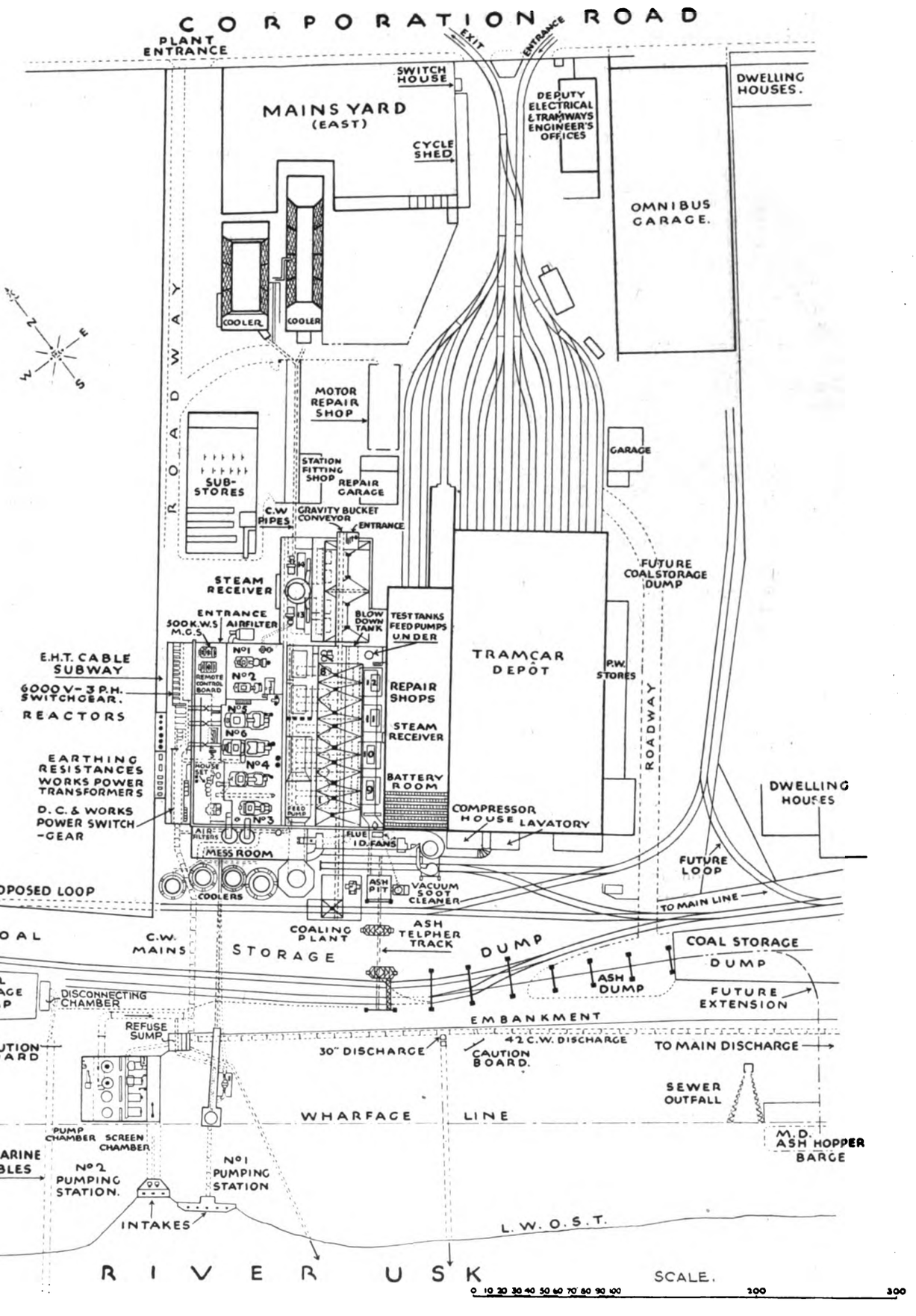

PLAN OF THE NEWPORT ELECTRICITY UNDERTAKING.

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THE TORQUAY UNDERTAKING.

Remarkable Growth from Small Beginnings—Bulk Supplies to Neighbouring Towns—The Distribution System—Progress in Development of Supply in Rural Areas.

OWING to the fact that the recent extensions to the Torquay Corporation's Newton Abbot station were extensively described in THE ELECTRICIAN of May 3rd, we are unable to follow the usual custom of giving in our pre-Convention issue a full account of the electricity undertaking at the Convention centre. On this and succeeding pages, however, we present some supplementary particulars and pictures which should prove of interest to I.M.E.A. delegates who will have an opportunity of making a personal inspection of the station next week.

Mr. H. F. G. Woods, Torquay's borough electrical engineer and manager, whose retirement (previously announced) is delayed until the close of the I.M.E.A. Convention.

The historical side of the Torquay enterprise is amusingly developed on a later page, but it may here be mentioned that the Corporation secured its Electric Lighting Order in 1891. At the outset the choice of a site suitable for a generating station presented formidable difficulties on account of the peculiar configuration of the town, and it was eventually decided to establish the works in certain stores and cellars on the harbour side at Beacon Quay.

The system of supply adopted was alternating, single-phase at 50 cycles, with a primary distribution pressure of 2 000 V for supplying at 200 V from street transforming stations.

The supply was commenced in March, 1898. From time to time various plant extensions were made to meet the growth of the business, and by 1910, the available space being fully occupied, the necessity for finding a new site became apparent.

The emission of smoke also from the works chimney, aggravated by the unavoidably cramped dimensions of the boiler combustion chambers, had become a pronounced nuisance, which rendered the removal of the station from its position on the sea front desirable.

Although careful consideration was given to various alternative sites, the increased size of the station had rendered the old problem even more difficult, and, as no immediate and satisfactory solution could be found, it was decided to crowd in more generating plant upon the old site to enable the pressing demands for electricity to be met.

At that date the supply to the Torquay Tramways Co. accounted for the major portion of the total output, while the bulk of the remainder was used only for lighting purposes.

By the year 1920 effective generating plant of 3 000 kW capacity had been installed. Owing, however, to the cramped boiler house space, the maximum steaming capacity was only equivalent to 1 500 kW without reserve; and the maximum demand had already reached that limit.

Factors Determining Policy.

The determination of the future policy of the undertaking had consequently become a matter of pressing urgency, and the Electricity Committee gave earnest consideration to the question of establishing a new station upon another site.

It being evident that no suitable site existed within the borough, attention was directed beyond its boundaries, and a site upon the River Teign, adjacent to the Great Western Railway Co.'s main line at Newton Abbot, was eventually selected as offering the requisite facilities for a larger station, and at the same time being situated at a centre suitable for distribution to other townships as well as to Torquay.

The town of Newton Abbot was supplied with electricity from a direct-current station of 520 kW capacity, owned by the Urban Electric Supply Co., Ltd., and situated close to the site selected by the Torquay Committee.

The nature of the Newton Abbot load was largely industrial, while the Torquay load was of a domestic character. The advantages to be gained by the combination of these loads from the outset were, therefore, apparent.

As the most expeditious means of effecting this, it was decided to acquire the Newton Abbot undertaking and to utilise their site, with additional lands, for the new station.

An agreement was thereupon completed between the Torquay Corporation and the Newton Abbot U.D.C., by which the latter were to exercise their option to purchase the company's undertaking, and, after so purchasing, to transfer the undertaking to the Torquay Corporation. Power to effect this transfer and to raise the necessary capital was obtained by the Torquay Corporation (Electricity) Act, 1922.

The Extended Area.

By the same Act the Torquay area of supply was extended to include, as well as the Urban District of Newton Abbot, the intervening parishes of Abbotskerswell, Coffinswell and Kingskerswell. The parish of Cockington was added by the Torquay Corporation Electricity (Extension) Order, 1923.

The Act of 1922 provided that the amount of the purchase price of the Newton Abbot undertaking should be determined by arbitration. The arbitration proceedings were, through various unavoidable causes, delayed until March, 1923, and the purchase was not actually effected and the undertaking transferred to the Corporation until May 1st, 1923. Plans and specifications for the new plant and buildings had already been prepared and all contracts placed before that date, and as soon as the Corporation took possession of the site, work on the construction of the new station was commenced and rushed forward with all possible speed. Progress was seriously handicapped by prolonged spells of bad weather and by floods, which, often for days together, prevented any access to the riverside works. In consequence of these delays the erection of plant was not commenced until March, 1924. Simultaneously with the construction of the new station, the receiving sub-station and new general offices were built at Torquay.

The underground trunk mains between Newton Abbot and Torquay were laid during the summer of 1923, and the numerous new 2 000 V mains in Torquay, necessitated by the change of supply from Beacon Quay to the main new sub-station, and from single-phase to two-phase, were laid in the early part of 1923. Beacon Quay was shut down on July 12th, 1924.

The area over which the Torquay Corporation have distributing powers totals 193 sq. miles, including the area covered by the Extension Order now pending. In addition, supplies in bulk are given to the Paignton Electric Light and Power Co., Ltd., and to the Teignmouth Electric Lighting Co., which together cover an area of some 150 sq. miles.

The primary e.h.t. transmission is at 11 000 V, and in consequence of the h.t. pressure having been fixed originally at 2 200 V at Torquay, that pressure has been retained for secondary transmission in the towns, and adopted for local distribution in the rural areas. The borough of Torquay is supplied from the main sub-station in the Upton Valley.

The e.h.t. 11 000 V switchgear at the Torquay sub-station is of the B.T.H. Co.'s compound-filled draw-out truck type. The equipment comprises 14 panels which control the two incoming feeders from Newton Abbot, the two incoming-outgoing ringmain feeders to Paignton, three rotary convertors for supplying the Torquay Tramways Co. and the various three-phase—two-phase transformers which supply the Torquay 2 200 V single-phase system.

Distribution in the town of Newton Abbot was originally given on the 3-wire d.c. system. With the exception of the main shopping centre, in which d.c. has been retained for special reasons, the distribution has now been converted to a.c., which is supplied from two main sub-stations situated, one at the power station and the other at the opposite end of the town, which each deliver energy into the 2 200 V, three-phase network. The remaining d.c. network is supplied through mercury arc rectifying plant, and from the rotary convertors in the power station.

Extensive developments have already been made in respect of the supply of electricity in the rural areas, and the results already achieved are very encouraging. Supplies are being pushed into more remote districts, and it is confidently anticipated that within three years from the present date supplies will be available throughout the Corporation's extensive and thinly populated rural area.

The sales of energy have grown from 2 700 000 kWh in 1923 to 16 000 000 kWh in 1929, and in that period the average price obtained per unit has fallen from 4·12d. to 1·57d.

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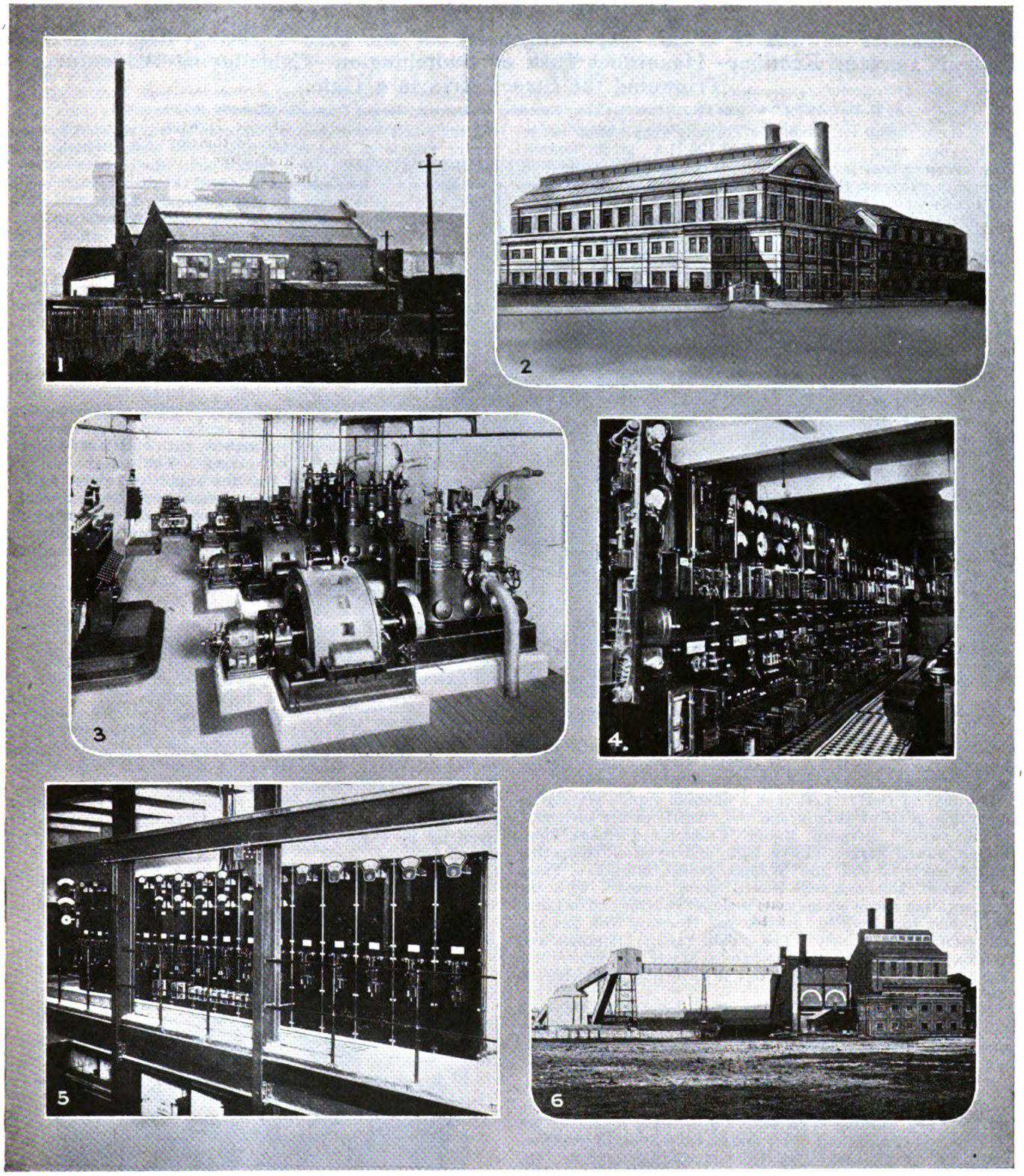

THE TORQUAY STATION IN PICTURES.

IN our issue of May 3rd we reproduced several illustrations and a lengthy description of the extensions at the Torquay Corporation's Electricity Works at Newton Abbot which were formally inaugurated on May 1st by the Mayoress of Torquay. Above is given a further selection of views which are of particular interest in view of the fact that the undertaking will be visited next week by members of the Incorporated Municipal Electrical Association attending the Torquay Convention. The exteriors reproduced show (1) *the side elevation of the Urban Electric Supply Co.'s station in* 1923; (2) *the station (front elevation) as it will look when the buildings are completed for* 37 500 *kW installed capacity; and* (6) *a view showing the latest extensions with the coal silo and coal conveying plant on the left. Fig.* 3 *is of historical interest, being the original installation at Beacon Quay in March* 1898, *the early working of which station is dealt with in reminiscent vein overleaf. Fig.* 4 *gives a glimpse of the e.h.t. control room at Newton Abbot, and Fig.* 5 *is a picture of the h.t. control gallery at the Upton Valley sub-station.*

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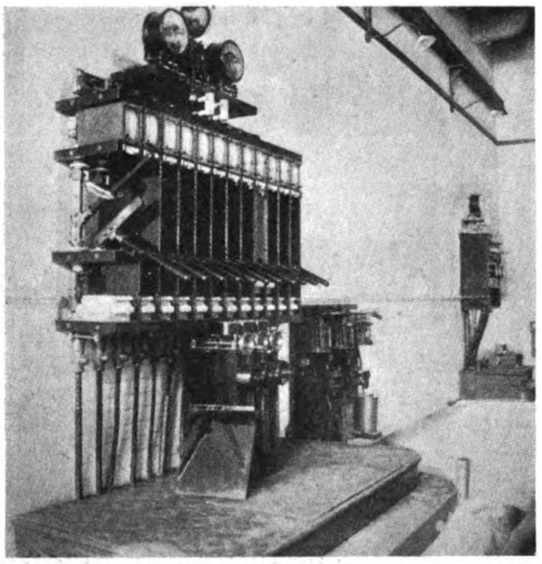
TORQUAY IN 1898.

Reminiscenses of Thirty Years Ago—Ingenuity of the Arc Lighting Engineer—The Famous Ferranti Rectifier—Hazardous Task of Switching-on—Cable-laying Adventures—Trimming the Street Arcs in a Gale.

By W. E. WARRILOW, A.M.I.E.E. (Then Arc Lamp Attendant and Improver, Torquay Corporation Electricity Department).

ON the occasion on which the Torquay Corporation is for the first time entertaining the I.M.E.A. at its annual Convention, it may be fitting to recall the opening of the first electricity works in the town in 1898, if only to remind the old hands who are still in the game of those pioneer days, and also to remind the youngsters in electricity supply of the good time they are now having as a result of those early efforts.



The switchboard at the Torquay station in 1898, with panel removed to show construction.

Reminiscences of thirty years ago are also worth while because they indicate the remarkable progress made during so short a period.

Torquay in 1898! Less than a hundred supply stations in operation in Great Britain and the "battle of the systems" in full swing! Ferranti, Mordey, Crompton, Siemens, Hopkinson, Elwell Parker, Lowrie Hall, and Fynn all competing at the electrical end, and Willans, Belliss, Musgrave, Yates and Thom, Maclaren and Fowler doing wonders with the reciprocating steam engine; not to forget Parsons and de Laval with their turbines and Crossley and Hornsby with gas and oil engines respectively. The steam raisers, Babcock and Wilcox and Galloway and mechanical stoker enthusiasts like Bennis and Vicars were each and all thrusting themselves to the front.

A wonderful galaxy of engineering talent, but what a patchwork to be presented to the bewildered minds of any municipal authority anxious to give its citizens an efficient electricity supply.

Baker as Chairman.

At Torquay in 1898 the chairman of the Electricity Committee was a working baker with a great local reputation for an excellent cottage loaf! He and his colleagues, all good men and true, on the advice of their consulting engineer, Mr. Trentham, decided that Torquay should have an alternating current, high tension, single-phase supply, and that the arc lighting of Tor Bay should be the wonder of the west; and it was so!

I came to the station from Cheltenham, which at that time had a particularly fine example of arc lighting along its famous promenade. My two years' experience in looking after those arc lamps was deemed sufficient to merit my appointment to Torquay at the magnificent salary (all electricity undertakings paid salaries, *not* wages, in those days) of 27s. per week!

The Torquay Electricity Committee encountered great local opposition to a station on the sea front, which was the only suitable spot for a site on account of circulating water. The amenities of the world-renowned bay must not be disturbed by a smoke stack, but the borough must be modernised by the introduction of electric light.

After much controversy a compromise was reached by converting two large coal cellars under the medical baths into the electricity works, these cellars being the property of the Corporation! The flues which carried off the gases from the boilers of the baths were connected through to the two Babcock boilers which supplied steam to the generating sets. There was no smoke stack, but plenty of smoke which, with the wind in a certain quarter, blew slap into the front windows of the Imperial Hotel on the cliff above the baths!

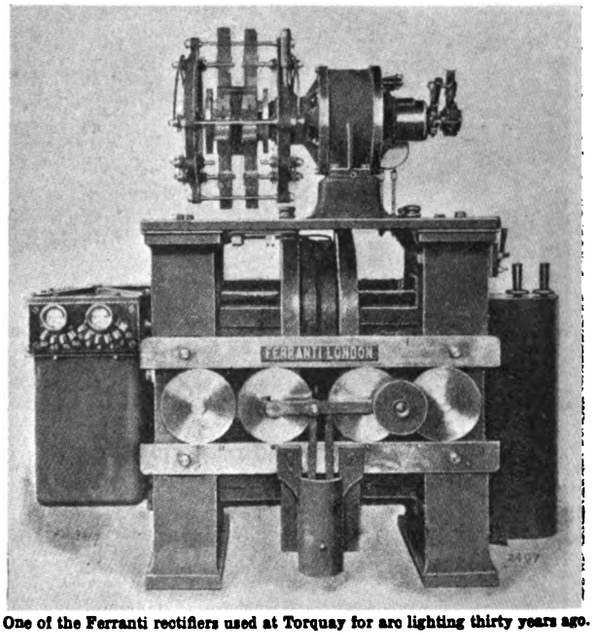
The amenities of the sea front were certainly preserved, but sadly at the expense of the station staff, who were cooped up in a narrow compass with a solid roof overhead and daylight from one end of the engine room only; the boiler room had no natural lighting, and was a positive inferno in the summer for the wretched stoker whose duty it was to fire up by hand!

The three 150 kW units which comprised the whole station were identical. Willans vertical central valve engines, direct coupled to Fynn inductor alternators, with outboard exciters, generating at 2 200 V, 50 periods. The latest Ferranti cellular switch gear controlled the supply to about half a dozen feeders connected to transformers in pavement tanks in various parts of the town. The station was a good example of compact equipment, and was a vast improvement on some of the rope and belt driven plants which were quite common at that date.

The Rectifiers.

But the rectifiers which supplied the arc lighting were the *real* part of the station. There must still be plenty of engineers to-day who remember the famous Ferranti rectifier. It was the answer of that wonderful pioneer to the protagonists of the direct current arc lamps which required to be supplied by dynamos driven by engines quite separate from the main generators. S. Z. de Ferranti would have no such complication, so he devised a rectifying unit which received its current from the h.t. a.c. supply and delivered a constant current to the arc lamps, which burned in series on a 2 200 V line. We had three such sets at Torquay.

The rectifier comprised a synchronous motor driving a high tension commutator of special construction about 10 in. diameter by some 8 in. wide, and fitted with an array of



One of the Ferranti rectifiers used at Torquay for arc lighting thirty years ago.

brushes which produced a glorious firework display when the machine was running at about 1 000 r.p.m.! Present-day stations which supply their street lighting by means of high c.p. gasfilled lamps, turned on from the main works or some sub-stations by remote controlled switches, have no idea of the excitement of series arc lighting from Ferranti rectifiers. The act of switching on was a dangerous business. A pair

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of rubber gloves was necessary, and with the right hand a rapier like switch-rod was used for the water resistance to bring up the h.t. volts as gradually as possible; with the left hand the rocker of the h.t. rectifying brush gear had to be manipulated to bring the rectified current up on the positive side of the alternating current wave. To make sure of this current being correct, a pole indicator at least 10 ft. away had to be watched at the moment of making contact with the water resistance switch; if the needle swung over to negative the whole performance had to be repeated! The first engineer essayed this dangerous operation one evening without rubber gloves, and was badly burned and nearly killed by getting his fingers round the ebonite washer guarding the rod of the water switch. He remained in contact with this at 2 200 V, and the charge engineer shut down the one set then running, before releasing his unconscious chief from the rectifier. The engineer (the late Mr. P. Storey) afterwards stated that he attributed his life to this gradual reduction of the voltage, his belief being that the breaking of the h.t. switch supplying the rectifier would have produced a reaction which would have caused immediate heart failure. After this accident the makers altered the design of the water switch so that accidental contact was impossible.

Such were the risks that we ran with our arc lighting, but it was really wonderful illumination, especially all round Tor Bay. I doubt very much if the present gasfilled lamps can come up to it, though I have not seen Torquay at night time since I left it in 1899.

The ingenuity of the arc lighting engineer of those days was well demonstrated in a clever magnetic switch fixed at the base of each arc lamp-post. With this switch two carbon filament lamps on brackets about 10 ft. from the ground (on the same post as the arc lamp, of course) were turned on when the arc lamp itself was switched off at midnight. The object of this automatic switch was to supply these carbon-filament lamps from the low tension network, thereby obviating a separate special main for this purpose. The clever part of the switch was a pivoted permanent magnet, arranged in a horizontal position, and having a catch which held the l.t. switch open when at daybreak a negative or reverse current was supplied to the high tension arc lamp circuit for about 15 secs.

The supply of this reverse current to the arc lamps meant the running up of the rectifiers at the station specially for the purpose, but the net result was that the entire street lighting both by arc lamps and carbon-filament lamps could be controlled from the works without the necessity for walking lamp men.

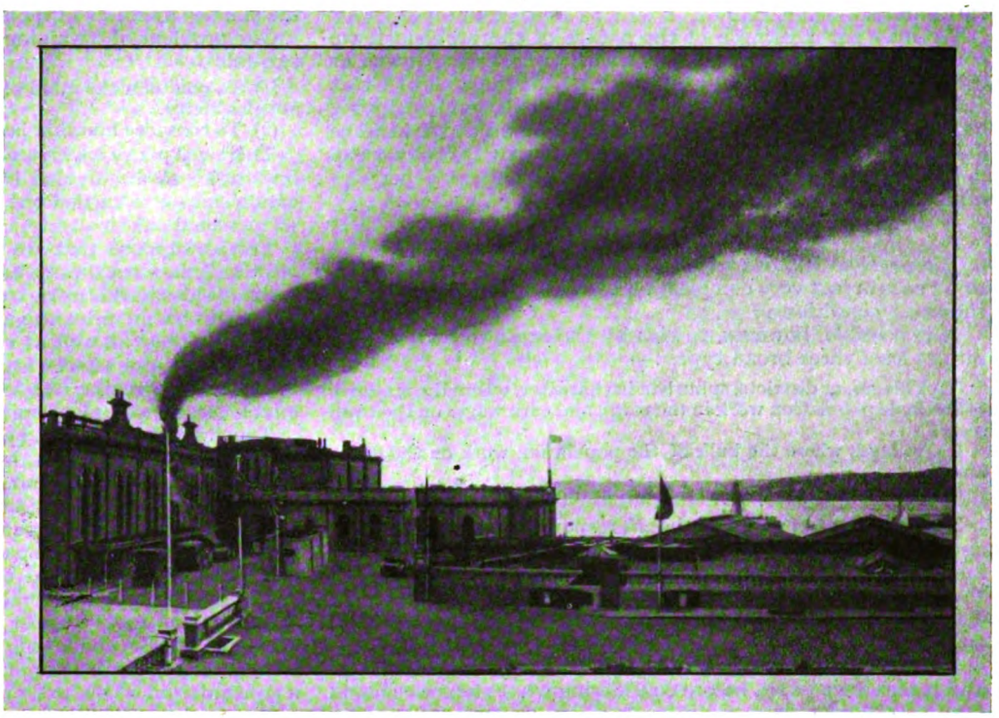
Puzzling the Police.

Incidentally, the local policemen could never understand why the arc lamps which had been turned off at midnight were again turned on in the early hours of the morning in order that the carbon-filament lamps which supplied the street lighting when burglars and "drunks" were abroad should be extinguished altogether. To-day such complication would be not only technically unthinkable but without doubt commercially impossible.

We had other excitements in the operation of the station in those days. We started very well on the night of the opening of the works. The Mayor had just proposed success to the enterprise at a dinner in the Queens Hotel when bang went a feeder fuse on the h.t. board, bang also went a transformer just outside the hotel, and nothing we could do would clear the fault; the dinner was, I believe, finished by candle light!

Service and cable laying was relieved of its usual monotony by the need for blasting the rock which was sometimes encountered in certain parts of the borough; now and again a little extra "pep" in the charge would result in a broken shop window!

The use of picks and wedges (there were no pneumatic horrors in the streets at that time) always meant two men walking back and forth to some near-by blacksmith for resharpening the blunted points; the jarring of the wrists of the most sturdy of the navvies also made progress in trenching very slow.



The old generating station at Beacon Quay, now superseded by the Newton Abbot station. This view shows the roof of the engine room buildings on the right. The boiler house was situated in cellars below the Medical Baths on the left.

Torquay was among the earliest of the hilly towns to use lead covered oil impregnated paper cables, and such was the art of manufacture at that time, the oil would descend by gravity along the h.t. feeders in the steep streets emptying the upper joint boxes and causing leakages in the lower ones; nett result a nice little flash over in the dry box, which in time would "breathe" in a supply of moisture sufficient to cause a short circuit.

The tower ladder with which I trimmed the street arcs was one of the local sights for a time, especially when a gale was blowing on the harbour front, but only once was this ladder toppled over when being wheeled across one of the wharves. I narrowly escaped being brained by a pair of heavy pliers which I had carelessly left on the top tray and which came crashing down as soon as I tilted the tower from off its stand and commenced to wheel it!

The Multi-job Staff.

The running of a small station then meant that every man had several jobs. The one jointer, after doing his service, would fix the meter and fuse boards on the consumers' premises, and in his spare time would also read the meters; on meter fixing jobs he was not allowed a mate because the chief thought one such a luxury!

And now it is all changed to the dull monotony of the efficient modern station. The delegates to the I.M.E.A. Convention can, however, give a thought or two to the Torquay pioneers who nearly thirty years ago kept the electricity supply going at great personal risk, from a couple of coal cellars at the land end of the northern pier of the outer harbour.

I wonder if the borough electrical engineer could put into the new station at Newton Abbot as a permanent exhibit one of the original rectifiers, and by some means have it running (behind protective triplex glass!), just as we used to run it on load in those dear old days. But probably the machines fetched much more than they cost when new, as scrap metal!

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OBTAINING CONSUMERS IN RURAL AREAS.*

Districts Which Respond to Propaganda—The Price Question—Development Plan for a Hypothetical Area—Some Financial Aspects.

By Lt.-Col. W. A. VIGNOLES, D.S.O., M.I.E.E.

CONSIDERABLE interest is being evinced at present in the problem of rural electrification, and no excuse is necessary for discussing how we can obtain consumers in rural areas.

We may get a glimpse of the nature of the problem if we consider that 78% of the population live in cities, towns or urban districts, which only occupy 7.7% of the area of Great Britain, the remaining 22% of the population occupying 92.3%† of the area of the country. In other words the average density of population in the towns is nearly 5 000 per sq. mile, while in rural districts it averages only 115 per sq. mile.

A Complex Problem.

The problem is, however, not only one of density of population ; it is in fact very complex, no two areas presenting exactly the same conditions.

It is possible, however, to classify the areas to be met with into at least three broad types :—

(1) Villages, or districts, suburban in character, where the majority of the male population work in the town, and earn wages on the town scale.

(2) Villages where the bulk of the population work on the land ; and

(3) Rural areas with isolated farms and cottages.

The first class of districts should respond well to propaganda and sales efforts, as the inhabitants will appreciate the amenities of the town, and will be anxious to secure them in their home. The demand for electricity should be good, and the revenue sufficient to make the supply a paying proposition.

The second and third classes are definitely " rural areas," and it may be as well, before considering what steps we should take to obtain consumers in such areas, to review generally the conditions to be met with in the country.

The supply of electricity in rural areas has the advantage, as compared with supply in towns, that usually there is no competition from gas, while, owing to the cost of transport, coal is usually more expensive than in the town. Apart from coal our sole competitor is usually oil, used for lighting, and to a considerable extent nowadays for cooking.

But electricity for lighting at 9d. per unit is as cheap as oil, while electricity at 1½d. is as cheap for cooking as coal at 50s. per ton, and in most cases cheaper than oil, while the use of electricity reduces labour, promotes cleanliness, and is altogether more convenient.

In the town, it is possible to sell electricity at prices above the cost of competitive methods, as the greater convenience and the reduction in labour frequently represents a definite money value to the town dweller.

In rural areas, among those with the smaller incomes, this is by no means the case ; the rural dweller frequently does not spend money to meet his needs, but makes his needs match his pocket, while labour saving devices make no appeal whatever.

Even so, however, a cottager may easily spend 1s. per week on oil for lighting, and 2s. 6d. per week for coal, and this figure for lighting, while small, approaches the amount used in some small houses in town.

But such cottagers are on the bottom of the scale, and we find in the villages, in certain areas anyway, farms, shops, small villas, blacksmiths' and carpenters' shops and cottages of various grades before we come to the agricultural labourer whose characteristics are as I have described.

This is especially the case in country where there are small holdings ; where the country is in the hands of large owners we probably find fewer of the small villas and a big gap between the large house and the cottagers, but it is impossible to generalise.

In districts within fifty or more miles of London, the suburban character of the district will probably be very marked, while some of these districts contain numbers of large houses which should be good consumers.

In any kind of country the principal factor in obtaining success will be to secure the large houses or farms, as consumers ; if these can be obtained it will be possible as a rule to supply the smaller premises in the vicinity.

Our problem of obtaining consumers in rural areas is really two-fold :—

(1) To create in the mind of the probable consumer the desire to use electricity.

(2) To convince him that he can afford to buy it.

There are many ways in which we can tackle these problems, but these can be divided broadly into :—(*a*) National propaganda such as is carried out by E.D.A. ; (*b*) local propaganda ; (*c*) personal salesmanship.

Let us suppose that we are responsible for the supply of electricity in a rural area, and consider a plan for the development of sales in this area.

It will be an advantage if our hypothetical undertaking includes urban as well as rural districts, as, while the propaganda and sales efforts may have to be varied in the rural districts, the greater return obtained in the urban areas will enable a more complete organisation to be developed.

The first stage should be the circulation of propaganda in the area to be developed, before any decision to bring supply into the district is announced. This propaganda can be linked up with the work that E.D.A. is doing. This should be followed by a series of lectures to women's institutes, and other organisations. Such propaganda and lectures, it has been suggested, is best carried out by an organisation other than the undertaking which is actually going to sell the electricity (the cautious rural dweller looking with suspicion at anyone trying to sell him something) and the E.D.A. will very willingly carry out this work where this course is desired. It is merely a continuation of the work that E.D.A. is continually doing.

Where a reasonable sized audience can be obtained, E.D.A. would supply the lecturer, but in a small village it would probably be necessary to rely on one of the employees of the local undertaking concerned to give the lecture, although this could be arranged under the auspices of E.D.A.

Value of Public Meetings.

Finally there should be one or more public meetings in the area, where the question of the supply to the area should be considered, it being explained that unless sufficient support is forthcoming it would not be possible to give a supply to the area. At this meeting all questions of cost should be discussed, answers given to would-be consumers, and efforts made to obtain actual signatures to supply agreements.

At such meetings it is desirable to secure the attendance of some prominent local man, e.g., chairman or member of the Rural District Council, as chairman, while the attendance of the Chairman of the Electricity Committee concerned, or a director of the company, as the case may be, will be appreciated.

At such meetings it will be found helpful to state clearly in the first instance the number of consumers required to enable the scheme to proceed ; from time to time the number of signatures can be stated, and if properly worked it will be found that the inhabitants of the area who want a supply will themselves assist to obtain the necessary signatures.

As part of the propaganda in these early stages, small exhibitions of apparatus and cinema displays should be arranged in various suitable centres. Travelling exhibits arranged on lorries are useful, with a small petrol driven set to supply the electricity required for the cinema projector or small apparatus when exhibiting in districts where the public supply is not available.

When the necessary number of consumers have been obtained (possibly not as many as were first asked for) and the scheme is proceeded with, there still remains a great deal of " selling " to do.

It will be found, probably, that the majority of the consumers secured use electricity for lighting only, and that the revenue received is not what it should be, while a considerable number of potential consumers have not " signed on."

In fact there is still room for selling propaganda and a selling organisation, as there always will be in every undertaking ; no matter how well we have done in the way of sales we shall always be able to do better.

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* Extracts from a paper read at the May meeting of the Overhead Lines Association.

† This figure is reduced to 57% if we exclude woods and forests, deer forests, mountains and heathlands.

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What should the sales organisation be and how much should we spend on it? I consider that an undertaking that is well established should spend not iess than 1% of its revenue on publicity and propaganda. An undertaking developing a new area would have to spend more than this as the revenue might be very small. I would suggest that in such a case the amount to be expended should be based on the revenue anticipated at the end of say six years.

Perhaps I may say, in passing, that out of this amount of 1% my Association ask that one-tenth should be handed to them as the subscription of the undertaking to the Association, to be expended on behalf of the undertakings on national propaganda. In other words, undertakings are asked to contribute £1 per £1 000 of their revenue towards a national propaganda scheme on which about £35 000 per annum is being expended.

Whatever scheme may be adopted, each undertaking should have an adequately paid man in charge of the sales, with sufficient assistance, and the necessary transport facilities to cover the area.

I give the following detailed scheme of expenditure on propaganda for an electricity undertaking covering a rural and urban area, where the total expenditure proposed is £1 000 per annum.

This will perhaps form a useful basis for discussion, and I would only add that it would be necessary to consider the character of an area before settling the exact allocation of expenditure between the various items.

Scheme for propaganda and publicity for an undertaking comprising urban and rural areas, with a total revenue of, say, £100 000 per annum from electricity supply :—

	Expenditure per annum. £
Local newspaper and parish magazine advertising ..	200
Poster publicity on permanent poster boards (see E.D.A. Booklet " Say it with Posters ")	100
Booklets and literature for distribution	75
Direct mail	75
Travelling van with cinema and display of apparatus, hired, for a portion of the year	150
Exhibitions. Allowance per annum. A portion of this might be accumulated and spent every few years on a large exhibition	200
Lectures, entertainments and film displays.....	100
Subscriptions to E.D.A., say one-tenth of 1% of revenue	100
Total	1 000

Advertising in parish magazines is very effective, poster publicity, if space can be obtained free—e.g., on sub-stations, etc.—is very cheap and very effective, while booklets or leaflets have their appeal.

An item has been included for travelling vans ; such a van would cost a substantial amount fitted ready for use, and must be adequately staffed, but it is thought that undertakings might be glad to have one for a part of the year, and if there was sufficient demand for such a van the E.D.A. Council would be willing to provide one. It would provide very effective propaganda.

Local Salesmanship Essential.

With all the propaganda work that can be done by E.D.A. or by the undertaking, however, the time comes when salesmanship is necessary if the prospective client is to be converted into a consumer.

It is probable, as I have indicated, that such selling efforts will be even more necessary in rural areas than in urban, owing to the lack of knowledge of the rural dweller. A good salesman suited to this particular work will be invaluable, but how is he to be found ?

There are born salesmen who can sell anybody anything, but these are few and far between, and we shall probably have to train a man. Let us, however, select a man for training who has some knowledge of country life, or if he has no such knowledge let us set about remedying the omission. A man who can discuss the crops and the seasons with the farmer, who can stay to tea and can keep his end up in the general conversation, who can handle a gun and join the farmer in a little shoot, will, provided that he knows the remainder of his job, certainly go a long way.

On the domestic side women demonstrators will be helpful, especially if they also understand country folk and can give an acceptable talk at a Women's Institute. These institutes are likely to be extremely valuable in the future ; the members are all keen on getting to know what electricity can do for them, and they will spread the good news as soon as satisfied consumers are obtained in any district. It is undesirable, however, that lectures should be given to these institutes until there is some prospect of a supply being taken to the district, even if, as suggested above, this is not announced at the time of the first lecture.

The tariff and the provision of hire and hire-purchase facilities will have a great effect on the business done. I hope all undertakings will introduce a two-part tariff with a charge per unit not exceeding one penny, and that all undertakings will provide hire facilities.

Prospective Rural Business.

Now, what business is an electricity supplier likely to obtain in rural areas ?

Here let me quote from the Electricity Commissioners' Conference on Electricity Supply in Rural Areas :—

" The particulars point to the conclusion that when electrical equipment of an ordinary character is installed for farm purposes and a reasonably full use is made of electricity both for farming and farmhouse purposes, individual farms of the four most common types are likely to represent, on a conservative basis, potential loads of the order indicated in the following Table " :—

Type of farm.	Yearly Consumption : Units. Farm house.	Farm power.	Total.
A. Arable and stock farm of about 300 acres (with threshing)	7 000	1 800	8 800
B. Arable and stock farm of about 100-150 acres (without threshing)	3 000	1 000	4 000
C. Large dairy farm of about 300 acres (with milking plant)	7 000	7 000	14 000
D. Medium-sized dairy farm of about 100 acres (with milking plant)	3 000	2 600	5 600

The figures accord with the experience hitherto gained in this country, which has shown that the electrical power requirements, although constituting a load of potential value, are likely under present conditions of development to prove of secondary importance on the generality of farms as compared with the lighting, cooking, occasional heating and general domestic requirements of the farmhouses.

Appendix 6 to report of Sub-Committee No. 1 shows that 1 007 farms in rural districts in Great Britain in 1927 used on the average 1 400 units each.

Appendix 9 shows the consumption on a 300-acre dairy farm with 300 cows, as follows :—

	Units per annum.
Dairy use	7 700
Lighting.....	500
Farmhouse, cooking, heating, washing, machine, etc.	7 000
Lighting cottages.....	200
	15 400

I am inclined to think that we might estimate that where gas is not available we should at 1d. per unit, plus a fixed charge or on a prepayment meter, be able to secure a revenue of, say, £2 per annum from the smallest cottages, £5 to £10 per annum for a normal farm, while supply to large farms and houses may run into very large figures.

I have recently received information from the U.S.A. as to progress with rural electrification in that country. At a conference held there recently it was stated that in many cases it has been shown that electricity supply " costs nothing at all " ; in other words, that the farmer by using electricity had increased his net earnings by more than the cost of the electricity.

In what is called the Redwing line, the farms in the fourth year are averaging 2 900 units per annum at an average price of 2·9d. per unit.

At the same Conference a farmer showed how electricity had enabled him to make a success of his poultry farm. He calculated that hens left to themselves would on the average lay less than 100 eggs per annum, and that unless this level was reached the poultry farmer would lose money. He had by the use of electricity brought his hens up to an average of 130 eggs per annum.

Finally, let me say that here, as in the United States, there appears to be ample evidence that at anything like a reasonable price electricity can be shown to be a paying proposition for the farmer, at least to those engaged in dairy and poultry work.

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MR. PURSE'S POST.

Appointment as Chief Engineer of London and Home Counties Joint Authority.

MR. Frederick W. Purse has been offered and has accepted the position of chief engineer of the London and Home Counties Joint Electricity Authority.

Mr. F. W. Purse, the new chief engineer of the London and Home Counties Joint Electricity Authority.

For the past ten years Mr. Purse has been chief engineer and manager of the West Ham Electricity Department, the largest municipal electricity undertaking within 100 miles of London. During his 30 years of continuous municipal service he has acquired an extensive experience of electricity supply in all its phases. His first electrical appointment was with the Bristol Electricity Department in 1897. In successive positions he was assistant at Bath for two years, deputy at Warrington for seven years, and chief at Watford, Carlisle and West Ham for five, six and ten years respectively. He has also advised and assisted many other municipalities on electrical matters.

Last year he was President of the I.M.E.A. and he is a member of Council of the I.E.E. and of the E.D.A., a member of the Registration Board and Executive Committee of the National Register of Electrical Installation Contractors, a member of many I.E.E., B.E.S.A. and other committees and sub-committees, and the author of numerous papers and articles on public electricity supply.

As Mr. Purse is a vigorous advocate of a cheap as well as an abundant electricity supply his appointment to the Joint Authority is full of promise for the densely concentrated population in the 1 796 sq. mile area stretching from Hertford and St. Albans in the north to Dorking and Reigate in the south, and from Windsor in the west to Gravesend in the east, with which he will be concerned.

It is understood that Mr. Purse will remain at West Ham until his successor is appointed.

CORRESPONDENCE.

The Editor welcomes the free expression in these columns of genuine opinion on matters of public interest, although he disclaims responsibility alike for the opinions themselves and the manner of their expression.

Wiring Regulations.

[To the Editor.]

SIR,—My company has incorporated the I.E.E. Wiring Regulations in its conditions of supply since 1911.

But, am I not right in saying that we cannot legally enforce them? I have always been given to understand that this is so.—I am etc.,

C. CULMER HODGES, A.M.I.E.E., A.M.I.Mech.E.
Engineer and Secretary
Dawlish Electric Light and Power Co.

Dawlish.
May 24th.

[We are unable to give a definite ruling on this question, though we share the view of our legal correspondent that in the case of a company legal enforcement of the Regulations would only follow an agreement to comply, signed by the consumer. We have no record of any such case having come up for decision. In the case of local authority undertakings which have, through private Bills, secured the inclusion of the Wiring Regulations in their bye-laws, the position is, of course, quite clear.—ED.]

Installation of Electric Ovens, etc.

[To the Editor.]

SIR,—At the last meeting of the E.D.A. Industrial Heating Sub-Committee I was instructed to notify you of the following modification of the London Building Act, 1894, the effect of which is to put the regulations as to the installation of electric ovens, coppers, boilers, etc., on the same basis as similar appliances heated by gas.

I may explain that the Act was passed before the use of electricity for heating was contemplated, and the only exception to the Section of the Act requiring special fire-resisting floors under ovens, etc., was made in favour of gas. As a result of representations that I have made this exception will now be given to electricity as well as to gas.

The relative Section of the Act reads as follows:—

The London Building Act, 1894, Section 66 (1):

"The floor under every oven, copper, steam boiler or stove which is not heated by gas and the floor around the same shall, for the space of 18 in., be formed of material of a non-combustible and non-conducting nature not less than 6 in. thick."

The amending resolution passed at the meeting of the London County Council held on March 26th, 1929, reads:—

"That the Council do not object to the fixing of ovens, coppers, steam boilers and stoves heated by electricity without complying with the provisions of Section 66 (1) of the London Building Act, 1894, and that the District Surveyors appointed under that Act be informed accordingly.—"I am, etc.,

W. A. VIGNOLES,
Director and Secretary
British Electrical Development Association.

15, Savoy Street,
Strand, W.C.2.
May 27th.

"The Wireman's Viewpoint."

[To the Editor.]

SIR,—The "Wireman's" human letter on the unfair competition of the "kerbstone contractor" and the exploiter of boy labour, for some reason does not touch on the commercial "vulture" who makes a hobby of paralysing any one's business but his own. In committee he worships gold and the lowest tender, and automatically sweeps aside reputations, lavishly scorns loyalty, and spurns experience and ability in favour of low prices and inefficiency. What is the advantage of a college education, we may ask, when it is numbered like a felon? Or why should skill and honesty be valued, when the lowest price is the only deciding factor?

Generally there is a clause relating to the standard of wages to be paid in these contracts, which if observed in these circumstances favours the workman at the expense of the employer, or alternatively encourages sweating and promotes doubtful methods.

Competition at the expense of the contractor does not seem fair, and yet the excuse advanced for low prices is generally attributed to gas competition.

Stripped of all colour, the contractor's work is regarded in some quarters as loot wrongly placed, suitable and capable of being diverted elsewhere in order to create more jobs for people possessing bureaucratic minds and inclinations.

Until recently the only choice before the contractor was to hit back, or, alternatively, the spectre of the pick, usually employed in roadmaking circles. Fortunately, however, two epoch-making engineers of some eminence have had courage to set an example of vital importance, which commends itself to all genuine supporters of the electrical industry.—I am, etc.,

"ANOTHER CONTRACTOR."

Manchester.
May 22nd.

POINTS OF VIEW.

The idea that electricity is only for the rich must go.—*Ald. H. B. Vorley.*

* * *

The truth may not be so complicated as some would have us think.—*Sir Oliver Lodge.*

* * *

As a conservative I dislike the slogan of "Safety First"; the Empire was not built up on that.—*Sir Hugo Hirst.*

* * *

We want to start now purifying London's atmosphere by stopping the construction of this plant at Battersea.—*Mr. Theodore Stevens.*

* * *

There is plenty of room for the application of rationalisation to our methods of production and distribution in order to eliminate competition and waste.—*Mr. H. J. May.*

* * *

One hesitates to enter into any question of rivalry as to priority in this age of scientific development, but upon the fact that television and its development is wholly British there can be no controversy.—*Mr. Clarence Tierney.*

* * *

If cheap electricity is going to benefit industry—and all parties are agreed that it will—then cheaper haulage services by electrically-operated railways will be an added stimulus to the recovery of trade by lowering the costs of production and delivery.—*Sir Arnold Gridley.*

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NEWS IN BRIEF.

Coventry Assisted Wiring Scheme—Portsmouth Showrooms—Wireless Communication with Trains—Battersea's Successful Rental Wiring Department.

COVENTRY Electricity Committee recommends an assisted wiring scheme.

The Wessex Electricity Co. recently held demonstrations on the uses of electricity at Cold Ash and Lambourn.

Seaham Harbour Electricity Committee has obtained sanction to borrow £500 for domestic apparatus to be let on hire.

The Post Office authorities hope to have the telephone cable between the mainland and the Isle of Man installed and in working order by July.

Baird television tests have been resumed in Berlin.

A telephone service between London and all parts of Czechoslovakia is now available.

Westminster (London) City Council is to instal electricity at Canal Buildings, at an estimated cost of £200.

A report is to be prepared by the Architect and the Borough Electrical Engineer of Gravesend as to heating the town hall electrically.

Brighton Watch Committee is to erect six additional police telephone boxes, and the electricity department will supply the necessary electrical energy.

Portsmouth Electricity Committee has accepted tenders, amounting to £1 273 10s., for the erection of sub-stations at South Hayling and Lee-on-Solent.

A system of wireless telephony for communication with trains running between Montreal and Toronto has been adopted by the Canadian National Railways.

The Illinois Commerce Commission is to hold a hearing shortly upon whether or not a utility corporation is required to instal one large meter in office buildings to make it possible for the owners to retail electricity to their tenants.

Tynemouth Electricity Committee has decided that the number of assisted wiring installations is to be restricted to 600 per year.

An electrical engineer is required by His Highness the Nizam's Guaranteed State Railway Co. The company's offices are at 100, Old Broad Street, London, E.C.2.

Portsmouth Electricity Committee is recommending the acquisition of property at London Road, North End, at a cost of £5 300, for the provision of showrooms for the department.

A party consisting of 100 members of the Electrical Association for Women inspected the electrically operated machinery at the Great Western Railway Co.'s Cardiff docks on May 22nd. The visit was organised by Mrs. L. A. Snow, acting hon. secretary to the South Wales Branch of the Association.

The Baird Television Development Co., Ltd., seeks leave to amend patent specification (No. 295 210) for "improvements in or relating to television and like systems." Particulars of the proposed amendment appeared in the "Illustrated Official Journal (Patents)" of May 23rd, and any notices of opposition must be lodged at the Patent Office within one month from that date.

The Electricity Commissioners, on May 16th, approved of the construction and pattern of the "Ferranti" type F.C.c., single-phase, watt-hour meter, rated sizes 10, 12½, 20, 25, 40, 50 and 100 A, 100 to 125 V, 125 to 160 V, 200 to 250 V, 350 to 450 V and 450 to 550 V, 50 cycles. The approval by the Commissioners, on March 21st, 1929, of the "Ferranti" type F.C.c., single-phase, watt-hour meter, rated sizes 10, 12½, 20, 25, 40 and 50 A, 200 to 250 V, 50 cycles, is superseded.

The Electricity Commissioners require a principal engineering inspector.

Bracknell, Berks, Social Club has appointed a committee to go into the question of the adoption of electric lighting.

A distribution engineer is wanted by the Burma Electric Supply Co., Ltd. Applications to the company's offices, 1, Queen Victoria Street, London, E.C.

The London, Midland and Scottish Railway has recently put into service a special vehicle for carrying heavy electrical transformers and other loads up to 80 tons weight.

Bangor (co. Down) B.C. has referred to the Electricity Committee the forty-four applications received for the position of manager and engineer of the electricity undertaking, at a salary of £350 per annum.

"The Use of Electricity in School Domestic Centres" is the title given to a new E.D.A. publication. The subject-matter is taken from a report by Major E. A. Baker, borough electrical engineer, Barnsley.

Battersea (London) Electricity Committee reports that 2 200 consumers have been connected to the mains under the rental wiring scheme, and that the electrical apparatus now out on hire includes 1 809 irons; 374 kettles; 1 168 fires; 344 cookers; 15 washboilers; and 70 water heaters.

Arrangements have been made by the North Midland area of the E.D.A. for the third Area Sales Conference, to be held at Bradford Electricity Offices on June 4th, when Mr. C. E. Allsopp will deliver an address entitled "The Development of the Electric Cooker."

Manchester Health Committee, with a view to minimising the smoke nuisance from works in the city, has asked the Electricity Committee to consider favourably the policy of increasing the facilities for the supply of live steam to works.

The annual meeting of the Northern Section of the E.C.A. took place on Wednesday in the Small Conference Hall of the N.E. Coast Exhibition. Among those attending were Mr. W. H. Walton (president), Mr. H. Willoughby Ellis (president elect), the chairman of the section, Mr. H. C. Hazel, Mr. L. C. Penwill and Mr. R. W. Kennedy. After the meeting, lunch was given at Messrs. Deuchar's Restaurant in the exhibition.

The prospectus of short courses of lectures and laboratory work to be given at the Manchester Municipal College of Technology during the summer of 1929, contains a list of the professors and lecturers, the subjects, dates and times of lectures, and syllabuses of classes. In the electrical engineering department, lectures will be delivered by Dr. Miles Walker Mr. A. E. Moore, Dr. A. E. Clayton, Mr. E. A. Hanney, Messrs. G. F. Freeman and R. D. Jenner and Mr. A. K. Bentley.

About 80 members of the Yorkshire Branch of the Institution of Mechanical Engineers visited the works of Messrs. Hopkinsons, Ltd., Huddersfield, on May 16th. The inspection lasted two hours, and the departments visited included pattern shops and stores, foundries, laboratory, material stores, brass, iron and steel machine shops, tool room, finished part stores, fitting and testing departments, and mine signal and electric control departments, and the centrifuge department, where demonstrations were given of the new Hopkinson centrifugal separators.

LOOKING BACKWARD.

FIFTY years ago it was reported in THE ELECTRICIAN *dated May 31st, 1879, that :–*

It took 59 seconds to telegraph the result of the Derby to New York.

Mr. Edison's "Motograph" telephone was demonstrated in London.

The International Telegraph Conference was to be held in this country, for the first time.

Dr. Muirhead and Prof. Ayrton proposed receiving at their electrical laboratory, pupils who desired to receive a complete education as telegraph engineers.

* * *

TWENTY-FIVE years ago, according to THE ELECTRICIAN *of June 3rd, 1904 :—*

Dr. Friedrich Siemens died at Dresden.

The ninth annual I.M.E.A. convention was to be held at Derby, Nottingham, and Sheffield, under the presidency of Mr. T. P. Wilmshurst.

Arbitration was proceeding to determine the price Bournemouth Corporation should pay to the Poole and District Traction Co. for the tramways undertaking.

* * *

TEN years ago, according to THE ELECTRICIAN *dated May 30th, 1919 :—*

Mr. F. W. Purse, city electrical engineer of Carlisle, was appointed borough electrical engineer of West Ham.

Mr. C. H. Wordingham in an address to I.E.E. Centres advocated that the Institution, after obtaining the Charter, should be governed by a Grand Council representative of sectional trade interests.

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LEGAL INTELLIGENCE.

Torquay Corporation and the Insulation of H.T. Cables.

THE Mayor, Corporation and Burgesses of the Borough of Torquay were the defendants in a case heard by the Torquay magistrates on Monday, being summoned for failing to cover a high tension cable with insulating material, in consequence of which N. G. Perring was killed on April 4th. A second summons charged them with failing to insulate the cable so as to prevent danger as was reasonably practicable. The Corporation entered a plea of not guilty.

Mr. B. G. Saywell, for the prosecution, said the proceedings were instituted by the Secretary of State under the Factory and Workshop Act. The offence in this case took place at an electrical sub-station in the Torbay Road which would come under the definition of a factory. On April 4th Charles Edmonds, an electrician employed by the Corporation, accompanied by Perring, entered the sub-station to wind the time switch. Edmonds had been at work a moment or two when he heard a groan, and turning round saw Perring grasping one of the h.t. cables. Edmonds pulled Perring away by the coat, applied artificial respiration and sent for medical assistance, but Perring failed to revive. The piece of cable was cut and had since been subjected to a test. It appeared that a join had been made, the ends having been fixed together with a brass ferrule, and the whole covered with Empire tape. It appeared that the join was made about eight years ago when the equipment was installed.

Evidence in support of the summonses was then called.

Mr. Kenneth Preston, divisional electrical inspector, stated that he had the piece of cable cut away and on examination found a join made by a brass ferrule, covered with layers of Empire tape. Such a cable should be out of reach or sheathed in lead. Tests were made with the cable, and the insulation broke down at the join at 900 V. In September, 1924, and again in April, 1928, he wrote to the Torquay Electricity Department calling attention to the need for sufficiently protecting high tension cables.

Opening the case for the defence Mr. P. H. W. Almy submitted that the regulations imposed by the Act were in excess of what was practicable. This particular cable was covered with insulating material, but the man who put in the brass ferrule in order to prevent an unsightly bulge did not make the insulating material as thick as he should have done. The sub-station was a small one, and no one was allowed there without special authority. As far as the inspector's letter of September, 1924, was concerned, the whole of the points in it were dealt with.

Mr. H. F. G. Woods, borough electrical engineer, produced for inspection the time sheets of the men who were employed in carrying out alterations at the sub-station in accordance with the suggestions of the divisional electrical inspector. What was then regarded as an up-to-date gear was installed, but to-day it would not be so regarded. A fortnight before this accident occurred they were asked to instal lead sheathed cables. Mr. Woods declared that modern practice was in advance of Home Office regulations.

The magistrates found the case proved and fined the Corporation £100 and ten guineas costs.

METALLURGISTS' CONGRESS.

Brief Details of the Forthcoming Meeting in Germany.

A LARGE attendance is promised at the forthcoming German meeting of the Institute of Metals. To be held in Düsseldorf from September 9th to 12th, this will be not only the first meeting of the Institute to take place in Germany, but will also constitute the first gathering of metallurgists and engineers to be held in Germany since 1914. The Conference is being held by invitation of the Verein Deutscher Ingenieure and of the Deutsche Gesellschaft für Metallkunde. In addition to the presentation and discussion of papers by members of many nationalities—nearly every country in Europe will be represented at the meeting—there will take place visits to works as well as gatherings of a social character. Though participation in the meeting will be limited to members of the Institute of Metals, non-members desirous of taking part can be elected—provided that their qualifications are satisfactory—in time to take part in all the proceedings at Düsseldorf, if their applications are received not later than July 4th by the Secretary, Mr. G. Shaw Scott, 36, Victoria Street, London, S.W.1.

PERSONAL.

MR. W. Jackson, lecturer in electrical engineering at Bradford Technical College, has resigned.

Mr. Victor Watlington is announced to speak at the Newcastle Advertising Convention, which opens on June 17th.

Mr. J. D. Peattie, of the Manchester Electricity Department, has obtained an appointment with the Central Electricity Board.

Mr. Henry Yates, the Socialist candidate for Rugby, whose death on Monday necessitates new nominations, was chairman of the Rugby Electricity Committee.

Miss Muriel Mellerup, only daughter of Mr. A. E. Mellerup, a director of R. A. Lister and Co., Ltd., has been selected to fill the part of Lady Godiva in a hospital carnival procession at Coventry.

Hammersmith (London) Establishment Committee has recommended that, subject to the approval of the Ministry of Health, a gratuity of £600 be made to the widow of Mr. Frank Hill, late borough electrical engineer.

At the meeting of the Western Centre of the I.E.E., at Cheltenham last week, Capt. S. B. Haslam was elected chairman and Mr. E. G. Okell vice-chairman for the ensuing year. Messrs. A. M. Willis, J. M. Bowman, R. Islington, T. E. Lewis and S. Thompson were appointed members of the Committee.

Mr. W. M. Selvey, of 64, Victoria Street, Westminster, is proceeding early in June to the United States and Canada for a tour of inspection of power stations, etc. One object of his visit is to obtain first hand information as to the available American experience in the problems of the emission of dust, grit and fumes, from power station chimneys. See page 657.

Mr. C. Elliott was on Monday appointed to the position of general manager of the Birmingham Section of the British Industries Fair, in succession to the late Mr. Charles Stanley. Mr. Elliott has taken a prominent part in the organisation of the heavy industries display for three years. He was the honorary organising secretary of the National Smoke Abatement Exhibition held in 1926. See page 657.

The Committee of the Meter and Instrument Section of the I.E.E. has made the following nominations to fill the vacancies which will occur on the Committee on September 30th :—Chairman : Mr. E. W. Hill (Aron Electricity Meter, Ltd.) ; Ordinary Members of Committee : Messrs. E. Fawssett (Newcastle-upon-Tyne E. S. Co., Ltd.), A. J. Gibbons (London Power Co., Ltd.). E. H. Miller (British Sangamo Co., Ltd.), and R. S. J. Spilsbury (National Physical Laboratory).

A presentation was made last week to Mr. Robert Blackmore, who, it will be remembered, has resigned the position of engineer-in-chief to the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Committee, in the form of a canteen of cutlery from the Board and staff and an illuminated address from the members of the Board. Mr. Blackmore is, of course, leaving to take up the appointment of engineer to the Central Electricity Board for the North-West England and North Wales area.

Many of our readers will doubtless remember that in June, 1913, Mr. W. E. Warrilow, then a member of our staff, organised a demonstration run of an Edison battery-driven saloon car from Dumfries to London, a distance of 362 miles, the battery (150 Ah capacity) receiving boosting charges en route. The car was driven by Mr. Maurice E. Fox, himself an Edison man, and it is interesting to note that as a result of a meeting after the passage of 16 years, Mr. Warrilow will join Mr. Fox as his assistant manager. The company, Edison Storage Batteries, Ltd., will have offices at Victoria House, Vernon Place, Southampton Row, London, W.C.2. We wish our old colleague every success in his new enterprise.

Obituary.

MR. JOHN EUGENE BRADY, on May 4th, aged 70 years. He was formerly with the Electrical Power Storage Co. and Messrs. Pritchett and Gold.

CAPT. E. IRONSIDE BAX, on May 18th, aged 83 years. He played no inconsiderable part in the establishment of the electricity supply in London during the early years, and was one of the first directors of the Westminster Electric Supply Corporation.

MR. J. J. O'CONNOR, late contract manager for the Post Office Telephone service. He entered the National Telephone Co., at Brighton, when that company was in competition with the Brighton Municipal Telephone Service, and was transferred to the Post Office in 1912 ; he retired in 1923.

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NOTTINGHAM EXCHANGE.

Details of the Lighting Arrangements and Controlling Switchgear.

THE lighting arrangements of the new Council House and Exchange at Nottingham, which was opened by the Prince of Wales on May 22nd, afford an example of the advantage of close co-operation between the architect, the decorative artist and the lighting expert. The building was designed by Mr. T. Cecil Howitt, while Messrs. W. J. Furse and Co., Ltd., of Nottingham, were the electrical contractors. The Illuminating Engineering Dept. of the General Electric Co., Ltd. is responsible for the lighting schemes. Passing through the entrance hall on the ground floor to the grand staircase, the beauty of the Italian marble is enhanced by an arrangement of reflectors, fitted with flame-sprayed lamps. The reflectors are sunk in an invisible cornice arranged round the periphery of the base of the dome. Running round the dome itself in circles are six graduated tiers of windows, each fitted with a specially prepared glass of amber tint. This tint is deeper in the lower tiers, and gradually fades to a clear transparency in the windows at the eye of the dome. The light from the reflectors in the cornice is reinforced by an additional set of 15 reflectors placed at various corners in the girders outside the dome. The combination of the cornice lighting within and the strong floodlights penetrating the irridescent coffered windows of the dome produce a brilliant yet glareless illumination. The dining room, ante-room, the library and sitting room have their particular schemes of interior decoration and lighting. In the members' room and library the illumination is obtained from lamps fixed in a series of G.E.C. trough reflectors set in the concealed cornice, sunk in the interval between the top of the panelling and the curve of the ceiling. The dining room, which accommodates 100 guests, may, perhaps, be singled out as the most attractive in the perfection of its lighting. Panelled in "Ancona" walnut, the room has a semi-elliptical or barrel ceiling decorated in pastel tinted enrichments picked out in gilt. By the use of reflectors disposed within the sunk cornice, a brilliant indirect illumination is obtained, and the panelling contrasted with the bright cream of the ceiling, is well brought out. The ante-room is panelled in light oak, the tones of which are brought out by lamps, fixed in trough reflectors of a special contour arranged in the cornice concealed behind the panelling. The fireplace is flanked on either side by two 6 ft. silver standards each containing six lamps, and in the centre of the room an octagonal table has four "Osram" pearl lamps concealed in an ornamental panel in the centre.

The new Council Chamber on the third floor is semi-circular in shape, and has seating accommodation for 64. The ceiling shows a series of graduated panels culminating in a semi-circular lay-light which acts as a reflector over the dais and its approaches. In order to intensify the light reflected from the cornice, the ceiling has also a cove finish next to the walls. Well diffused uniform illumination is obtained by means of reflectors disposed along the whole length of the cornice and concealed behind the top of the panelling.

The two division lobbies outside the Council Chamber with dome shaped ceilings are each lighted with striplite fittings concealed in a sunken cornice on a similar principle to that employed in the other rooms. All the corridors, the kitchens, service rooms, lavatories, and auxiliary staircases are lighted with specially designed adaptations of the standard "Unalux" three-light fittings, the metal work being of chased bronze.

The floodlighting of Exchange Row, the name given to the T-shaped shopping arcade which runs between the wings at the rear of the main front block, is carried out with "Gecoray" reflectors arranged behind the vases along the masonry. This arcade has already been let for high-class shops, the illumination of which will supplement the arrangement of floodlighting.

Some of the controlling switchgear supplied by A. Reyrolle and Co. for the new Council House.

The switchgear for controlling the electricity supply throughout the Exchange Buildings, has been supplied by A. Reyrolle and Co., Ltd., of Hebburn-on-Tyne. It is of the metal-clad, horizontal, draw out type, and is situated in the sub-station in the basement. There are two boards, one of seven panels for 6 600 V, 3-phase, working, and the other of fifteen panels for 400-V, 3-phase, 4-wire working. The h.t. board consists of two incoming feeder panels with a current carrying capacity of 300 A, four transformer panels of the same capacity, and one busbar section panel. The feeder panels and section panel are protected with inverse time limit overload and earth leakage protection, and the transformer panels with inverse time limit overload and Merz-Price protection. The l.t. board consists of ten 400-A feeder panels with inverse time limit overload protection, one 2 000-A section panel, and four 1 000-A transformer panels with time limit overload and Merz-Price protection.

An interesting method has been adopted for connecting the transformers to the l.t. switchgear. The transformer room is immediately behind the l.t. switch room, and special cable boxes have been fitted to the low-tension gear and shaped so that they project through the dividing wall into the transformer room. Cables have then been taken from the transformers straight to these boxes.

Some idea of the striking lighting effects which have been produced at the new Nottingham Council House and Exchange Building will be appreciated from these three representative photographs.

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IMPORTED GLASSWARE.

Continued Hearing as to the Marking of Imported Illuminating Glassware.

THE inquiry into the application of British glass manufacturers for a Marking Order in respect of imported illuminating glassware was resumed at the offices of the Board of Trade in London on Monday and Tuesday, after the Whitsun adjournment, the case for the opposition being further proceeded with.

Mr. R. W. Buckingham said his supplies came chiefly from Germany and Czechoslovakia. He alleged that 95% of the volume of the decorative lighting glassware used here was foreign, for the reason that the British makers could not meet the demand. Answering the Chairman, witness said the glassware imported by him did not bear any mark except in special cases where the seller in this country required his own distinguishing mark. As regards the cost of marking imported glassware, Mr. Buckingham said he anticipated that the consumer would have to pay at least 12½% extra on account of the cost of marking. In reference to lighting fittings, he expressed the opinion that to mark the glass would give the impression that the whole fitting was foreign

Question of Cost.

In all cases the cost of the glass was much less than the cost of the metal work which, incidentally, foreign firms could not make anything like as good as the British makers. Special reference was made to glass for panel lighting, it being pointed out that whereas in many cases the cost of the glass panel would be anything from 2s. 6d. to 6s., the cost of the completed fitting might be from 30s. to £2 for a single panel. It would be impossible to mark these panels because when sold by him to manufacturers he did not know how they were to be mounted, and it might possibly be that a mark might be so placed as to deface the panel.

Answering Mr. Barnes (a member of the committee), witness alleged that in some cases the cost of the glass portion of a lighting fitting would be increased by 100% if marked.

In connection with the allegation that English makers did not make the glass panels now used for the new form of electric lighting, witness was shown some made by Hailwood and Ackroyd, Ltd., which bore a mark in such a position that it was suggested it did not disfigure the glass. Witness, however, would not agree, and repeated his opinion as to the difficulty of marking in an effective manner, owing to lack of knowledge as to the way in which the fittings manufacturer might mount the panels.

The Chairman remarked that the Board of Trade figures showed imports of glassware amounting to £300 000, and exports of English glassware to the value of over £40 000.

Mr. J. H. Cresswell (Revo Electric Co., Ltd.), opposed the application, on the ground that any increase in the cost of imported glass—which was the raw material of his firm's business—would handicap him in competition with continental street lighting fittings. If he were forced to buy British glassware his firm would be put out of the export market altogether. Moreover, in the home market, if prices increased owing to the use of English glass many of his customers would probably import the complete fitting direct from abroad. The glass formed only a small portion of the fittings, and to mark the glass would brand the whole fitting as foreign.

The Chairman said the witness seemed to make the assumption that the object of the Merchandise Marks Act was to keep out imports, but that was not an assumption the Committee had ever made. The object was to enable the purchaser to know what he was purchasing. Answering further questions, witness said that in some fittings made by his firm the cost of the glass was 2d. in an article having a total cost of 1s. 10d. Of the glass which his firm imported, 0·35% was used for the export trade. Mr. Cresswell agreed that in future orders he did not think the cost of marking would be appreciable, but it would be considerable in marking existing stocks.

Continuing, Mr. Cresswell spoke with regard to export trade, and said there would have to be separate handling of the glass intended for re-export in fittings.

Mr. Hailwood also cross-examined witness, and asked whether in the goods supplied to Government departments, the firm sold foreign glass.

Mr. Cresswell said that in most cases the specification stated that the goods must be of British origin, and then English glass was used.

Mr. Hailwood said his firm did not charge extra for marking as they found the cost so small.

Mr. N. L. Macaskie, addressing the Committee on behalf of the opponents, said that, although the applicants asked for an Importation Order, no evidence justifying the application had been given, and no attempt had been made to deal with the difficulties which would be encountered by the Customs Authorities with a view to ascertaining that the glassware coming into the country had been properly marked. Referring to imported illuminating glassware, Counsel impressed upon the Committee that there was an extensive industry in this country in mounting glass, and it was clear that this industry would be seriously handicapped if the glass which it used had to be marked as being of foreign origin. This glass formed but a small proportion of the total cost of the completed article, 90% of the total cost in many cases consisting of English labour and materials. The opposition made the suggestion that as regards illuminating glassware an Order should not be recommended. If, however, the Committee saw fit to recommend an Order, then the opposition asked that the marking should be by means of labels. As regards marking stocks already in the country, Mr. Macaskie asked that, if an Order were recommended, a considerable interval of time, say, six to nine months, should be allowed to elapse before the Order came into operation, so that stocks might be cleared.

Mr. Wethered, replying for the applicants, said the reason why those in this country who used foreign glass for lighting fittings and similar purposes did not wish to have it marked was because they did not wish to disclose to their customers the fact that they were using foreign glass. Referring to the evidence given before the Committee on behalf of the Chloride Electrical Storage Co., Mr. Wethered pointed out that the ground of objection was not, as in the case of illuminating glassware, that the mark would disfigure the accumulator and battery containers, but that the company desired to have an alternative supply to that obtained in this country, but at the same time the desire was expressed that this foreign glass should not be marked owing to the fear that it would prejudice the sales of the company's products. He suggested that this was not an adequate reason for asking the Committee not to recommend a marking Order.

BUSINESS ITEMS.

THE GREENWICH CABLE WORKS, LTD., has changed its name to the CROYDON CABLE WORKS, LTD., while the works are now at Mitcham Road, Croydon.

F. W. COOK AND CO. (SOUTHAMPTON), LTD., of 20 to 24, Bargate Street, have opened new showrooms, for electrical fittings at Russell House, Hanover Buildings, Southampton.

The HOVE ELECTRICITY DEPARTMENT, in conjunction with the local registered electrical contractors, held a second display and demonstration at the electricity showrooms on May 15th.

The latest addition to yachts fitted with wireless is Sir William Berry's motor yacht "Sona," which is equipped with a comprehensive Marconi wireless installation, including a broadcast receiver.

The merits of Hart accumulators for television circuits were the subject of a lecture by Mr. W. Schofield, of the HART ACCUMULATOR CO., LTD., to members of the Westcliff-on-Sea Television Society, on May 10th.

New showrooms and offices erected in Parliament Row, Hertford, by the NORTH METROPOLITAN ELECTRIC POWER SUPPLY CO., LTD., were opened on May 10th in the presence of about 75 guests by the Mayor, Sir Lionel Faudel-Phillips.

The A.-S. REFRIGERATING MACHINES, LTD., one of the associated companies of the General Electric Co., Ltd., have received an order from Messrs. Boots, cash chemists, of Nottingham, for fourteen sectional refrigeration cabinets, each fitted with the hermetically sealed, leakage and explosion proof A.-S. automatic refrigerating machine, for installation in various cafes.

In connection with the inauguration of supplies at Cold Ash, an electrical exhibition was held by the WESTERN ELECTRICITY SUPPLY CO., LTD., recently. At the official opening, Mr. A. J. Bridge, publicity and development manager, gave a short address outlining the uses of electricity in the home and explaining the tariffs for domestic purposes. Cookery demonstrations, given by Mrs. Peterson of the CREDENDA CONDUITS CO., LTD., were well attended and productive of good results.

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ELECTRIC TOOLS.

ELECTRIC tools of various kinds have been on the market for some twenty years, but even at the present date their use might be greatly extended. Work by British firms in the making of electrically-operated tools, however, presents several difficulties. One drawback in designing portable tools —one which will practically disappear as frequencies and voltages become standardised—is that small motors, running at a very high speed, have to be designed for loads which may become unusually heavy for this class of motor. Added to this is the fact that only fine windings, which have to be carefully designed to stand up against heavy overloads, can be used. For instance, a ¼ in. drill may stick on the break-through, and, unless the design has been almost perfect, the risk of a burn-out is great, especially if the drill is operated from a 250 V circuit. We describe below some of the most modern equipment produced by leading British and foreign firms.

B.E.N. PATENTS, LTD., of 92, Tottenham Court Road, London, W.1, offer a large range of tools for light and heavy work. One of their newest productions is a portable electric saw, designed principally for the use of carpenters. There are two models, one with a maximum cut of 1½ in. in hardwood, the other with a maximum cut of 3⅜ in. The motor driving the larger saw is series wound, operating on a.c. or d.c. 100–250 V, as specified. A fan cooled ball-bearing armature with thrusts is used. A silent running worm drive transmits power to the saw blade. The cutting speed with 10 in. blade is 5 ft. per min. through 3 in. ash. All aluminium housing is used, and the saw is supplied in a fibre carrying case. The weight is 31 lb., the speed of saw blade 3 600 r.p.m., and the consumption approximately 1·3 W. A special feature of this saw is the combined depth gauge and saw guard. This telescoping guard completely encloses the blade and is automatically opened by release of the slipper plate only when the saw is pushed into the material. If desired, adjustments can be made to give any variation in depth of cut.

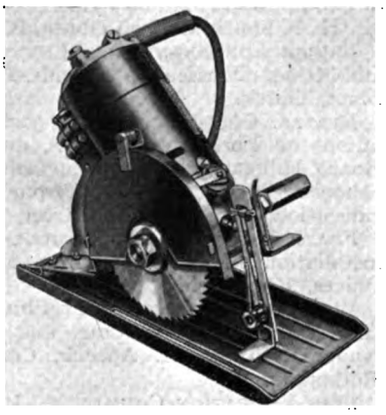
The B.E.N. sanding and polishing equipment for nitro-cellulose lacquers has recently been introduced. The following description applies to the combination machine type HC-5, which is the most popular model. The machine consists essentially of a rotatable disc—to which various devices may be fitted—driven through a 6 ft. by 7/16 in. flexible shaft from a ½ H.P. motor mounted on a movable tripod. The motor may be run at four speeds, giving 875, 1 300, 2 350 and 3 500 r.p.m. to the operating disc; the lower speeds are used for polishing and the higher for the preliminary sanding, etc. The speed changes are effected by transposition of belt and pulleys. The equipment of this model includes backing discs, facing belts, abrasive wheels, lambswool polishing buffs, rotary woollen mop, rotary wire brush, sanding drum and sanding sleeves.

Electric Drills.

This firm also acts as agent for The United States Electrical Tool Co., of Cincinnati, Ohio. "U.S." drills are offered in sizes from ¼ in. to 1½ in. Hand, suspended-type, and bench drills are provided. Buffeting, polishing and grinding attachments can be fitted. All motors fitted to drills are suitable for either a.c. or d.c. Nearly all kinds of electric tools are supplied by the American firm: among them may be mentioned valve grinders, valve refacers, hand blowers—for removing dust and free dirt—and grinders of all kinds, up to very heavy models.

The "N.U." electric drills manufactured by the SUN ELECTRICAL CO., LTD., 118–120, Charing Cross Road, London, W.C.2, are designed as light hand drilling machines, but they may also be used as bench drills by the addition of one of two bench stands which are sold separately. The machines are exceptionally light, and consequently can be operated by hand without undue strain. The switch is located conveniently in the revolver-type, or double-lateral handle, so that the operator does not have to alter his hold to switch off. Five sizes are available:—5/16 in., ⅜ in., ½ in., 5/8 in., and ¾ in., these capacities being for high speed steel drills, drilling in mild steel.

The "Sunco Universal" drilling machine has a stand designed to take a heavier type of drilling machine, with capacities ⅞ in., 1¼ in., and 1⅞ in. The stand consists of pillar with base, an adjustable end plate against which the top of the drilling machine rests, and a fitting which serves the double purpose of supporting the machine and transmitting its power to the drill. The power transmission is effected through an adjustable driving spindle provided with Morse cones and sockets. The drills are listed under three headings: d.c., up to 250 V; a.c., up to 250 V. and up to 380 V; Universal, 100 to 110 and 200–250 V. The "Sunco" electric screwdriver may be used with all types of wood screws; a reversing switch is incorporated. The winding is suitable for d.c. or a.c., 40–60 cycles, the consumption being 230 W. The company's rectifying and polishing machine for final finishing of press tools, dies, etc., is supplied complete in box and comprises drilling machine with grinding wheel, hard felt burnishing mops, and copper polishing bobs. Grinding and buffing machines are also manufactured by the Sun Electrical Co.



An electrically-operated saw, by B.E.N. Patents, Ltd.

THE GENERAL ELECTRIC CO., LTD., are the proprietors of the Witton Kramer Electric Tool and Hoist Works, of Witton, Birmingham. "Witton Kramer" portable drills are made in 6 sizes, ranging from ⅜ in. to 1¼ in., with consumptions from 200 to 1 100 W, and weights from 12½ to 65 lb. Three types are designed for d.c. only, while the remaining three also take a.c., 25/60 cycles. The motor shell is of cast steel in the d.c. machines, and of electric steel stampings housed in aluminium shell in the case of universal models. The shell is fitted with two aluminium end shields, the top shield containing the brush gear and carrying the feed screw, while the bottom shield forms the gear case and carries the bearing for the drill spindle. The switch, of the push button type, is contained in an aluminium cover fitted to the outside of the motor shell. Witton Kramer magnetic drill posts are supplied to obviate the necessity of using ordinary pillars with clamping down bolts. The post, with 8 in. or 12 in. base and either single or double post is placed on the steel or ironwork in which the hole has to be drilled, the current is switched on and the equipment is then held magnetically.

The A.E.G. ELECTRIC CO., LTD., of 131, Victoria Street, London, S.W.1, specialise on welding machines, of which they have a large range embracing butt welders, spot and seam welding machines and arc welders. Butt welders are available in sizes up to 450 kVA for welding sections up to 25 000 sq. mm. Machines are available for welding boiler tubes, bicycle and motor car frames, triangular brake shafts, drawhooks, railway buffers and many other purposes. Seam welding machines are designed for dealing with petrol cans, preserve tins, etc. Arc welding machines are divided into the two main classes of those with self-excited and separately excited generators, the type to be chosen depending on the conditions to be satisfied.

W. E. HIGHFIELD SHIELD.

Details of the Forthcoming Competition organised by the A.S.E.E.

WE are advised by the Association of Supervising Electrical Engineers that this year's competition for the W. E. Highfield Shield, will include, in addition to the shield itself, five prizes, three to members and two to associates. The value of the prizes will range from £1 1s. to £4 4s.

The rules of the competition are: (1) papers to be of about 1 000 words; (2) subjects of papers must refer to the electrical industry and/or the association; (3) all papers, addressed to the general secretary, must reach head office not later than noon on September 2nd; (4) all papers will be typed out by head office and each paper given a number. The typed copies will be judged by a Special Examining Board, to be set up by the Board of Control, which will select the winning papers. The names of the writers of the papers will be known only to the general secretary, who will not disclose the names until after the decision of the examiners has been received; (5) a signed declaration that the paper is the unaided work of the competitor must accompany each paper.

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BUSINESS OPENINGS.

Latest Particulars of Electrical Engineering and Wiring Installation Contracts for which Tenders are being Invited at Home and Abroad.

WE give below the latest particulars of contracts for which tenders are invited. The closing date is given, when available.

BICESTER URBAN DISTRICT COUNCIL.—Electric light wiring of two houses in Banbury Road, Bicester. Specification from Mr. H. T. Smith, Council House, Bicester.

THIRSK CONGREGATIONAL CHURCH.—Electric light wiring and fitting. Particulars from Mr. Frank Taylor, 2, Melbourne Place, Thirsk.

BELFAST CORPORATION, May 31st.—Electric lighting installations at York Street School, and Belvoir Hall, Donegall Road, Hillman Street, Springfield, and St. Mark's P.E.S. Schools. Specification, etc., from the Education Architect, Education Offices, Victoria Street, Belfast; deposit £2 2s.

FEATHERSTONE COUNCIL SCHOOL, May 31st.—Electric light installation. Specification from Mr. C. Harris, Education Offices, Knottingley.

WEST RIDING ELECTRICITY COMMITTEE, May 31st.—Electric lighting of Maltby Crags and Aston Schools. Forms of tender from Mr. A. Adcock, Craigmoor, Godstone Road, Rotherham.

FIFE EDUCATION COMMITTEE, June 1st.—Electric lighting work in Markinch Public School new buildings. Schedules from Mr. G. Sandilands, Education Offices, Wemyssfield, Kirkcaldy.

BURNLEY-IN-WHARFEDALE URBAN DISTRICT COUNCIL, June 3rd.—Electric lighting and heating installation in the Council Offices. Specifications from the Surveyor.

COMMISSIONERS OF H.M. WORKS, ETC., June 3rd.—Fuse boards and switches. Forms of tender, etc., from the Controller of Supplies, King Charles Street, Westminster, London, S.W.1.

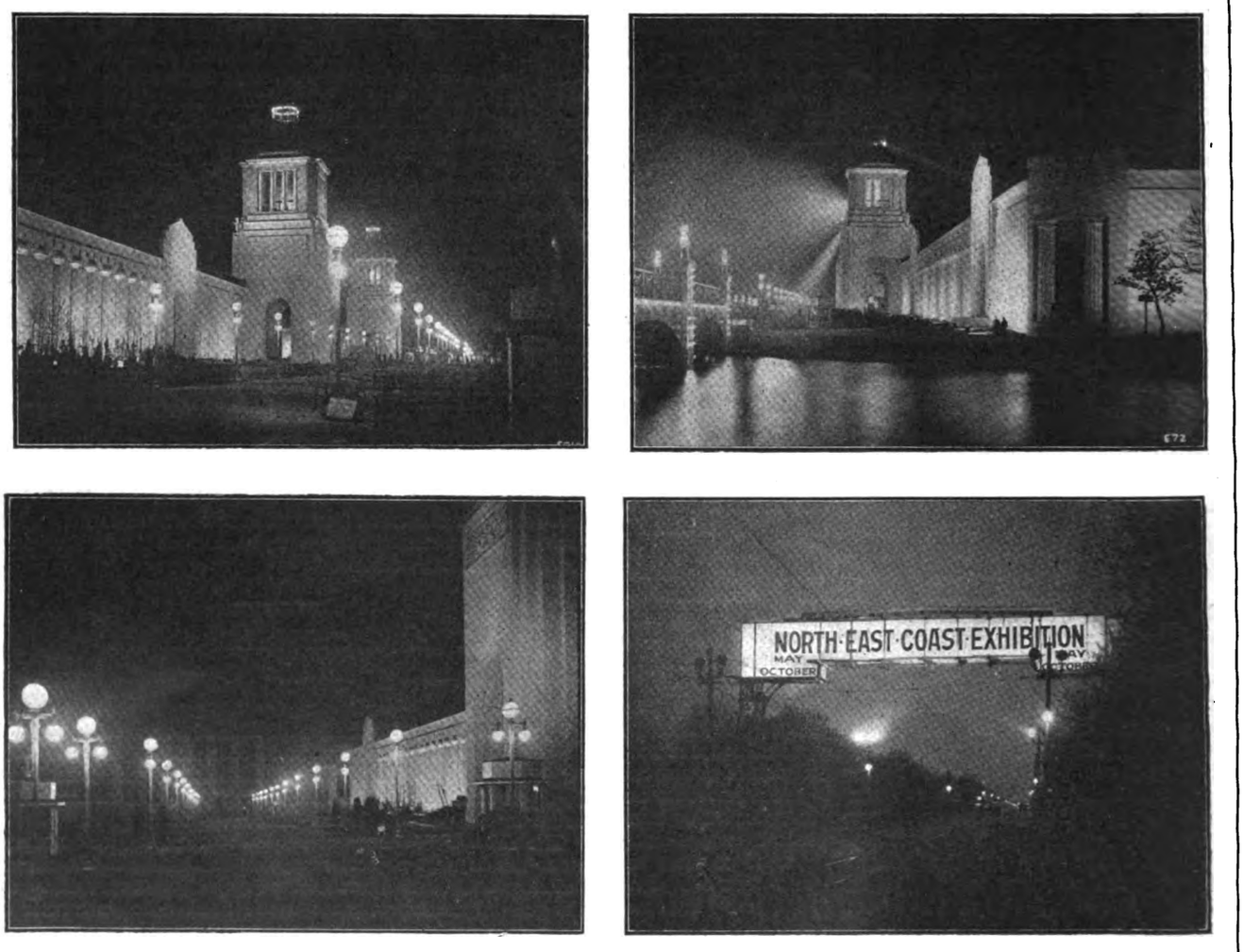
DUMBARTON COUNTY EDUCATION COMMITTEE, June 3rd.—Electrical work in new Primary and Secondary School at Kirkintilloch. Applications for schedules, etc., to the Clerk and Treasurer, 18, Park Circus, Glasgow, C.3.

THURROCK, GRAYS AND TILBURY SEWERAGE BOARD, June 4th.—Supply of a.c. motors, pumps, wiring, etc. Specifications can be obtained at the Sewerage Works, Marsh Farm, Tilbury.

MANCHESTER CORPORATION, June 6th.—Electrical installation at Mobberley Open Air School. Specification, etc., from Education Offices, Deansgate, Manchester; deposit £1 1s.

SHEFFIELD CORPORATION, June 7th.—Electric wiring and fitting at Carfield, Firshill, Hunter's Bar, Intake, Lowfield, Woodbourn, Woodseats, and Woodside Council Schools. Specifications, etc., from Mr. W. G. Davies, city architect, Town Hall, Sheffield; deposit £1.

SUTTON AND CHEAM URBAN DISTRICT COUNCIL, June 7th.—Installation of fire alarm system, connected with the fire



THESE pictures of the N.-E. Coast Exhibition show: (top left) a view of the main avenue with the Palace of Engineering and the two towers colour-floodlighted; (top right) the avenue at the opposite end showing the Palace of Industries with colour-floodlighting from projectors in spherical lanterns mounted above the lighting standards on the roadways; (bottom left) a view towards the pylons, showing the colour-floodlighted Palace of Engineering in the foreground and lighting standards with special spherical lanterns containing the floodlight projectors, mounted at the top; (bottom right) the large sign spanning the roadway. This sign is also floodlighted, as is every building and structure throughout the exhibition. The whole of the floodlighting scheme was arranged by the British Thomson-Houston Co. in conjunction with the consulting engineers, to the approval of the architect.

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station. Plans showing positions of fire alarm boxes, etc., from the Engineer and Surveyor.

CENTRAL LONDON SCHOOL DISTRICT, June 8th.—Supply of four electric motors, switchgear, shafting, belting, etc. Specification from Mr. G. P. Morrell, clerk to the Managers, Greenford Avenue, Hanwell, London, W.7.

CLYDE NAVIGATION TRUST, June 8th.—Six or 12 months' supply of electrical stores, etc. Form of tender (No. 8) from the Superintendent of Stores, 1, Graving Dock, Govan.

CHEADLE AND GATLEY URBAN DISTRICT COUNCIL, June 11th.—Overhead distribution scheme (contract 47) and two e.h.t. truck cubicles (contract 50). Specifications from Mr. R. W. Willis, 37, High Street, Cheadle; deposit £1 1s. for each.

▶ STOCKTON-ON-TEES CORPORATION, June 11th.—Supply of two 1 250 kVA, 3-phase transformers and l.t., 3-phase switchgear, Specification, etc., from Mr. S. G. Marston, Electricity Works, Thompson Street, Stockton-on-Tees.

EAST HAM EDUCATION COMMITTEE, June 12th.—Electric lighting installation at the Salisbury School. Specification, etc., from the Secretary, Education Office, Town Hall, East Ham, London, E.6; deposit 10s. 6d.

STOKE-ON-TRENT CORPORATION, June 12th.—Supply of 33 000 V overhead transmission lines. Specification, etc., from the City Electrical Engineer, St. George's Chambers, Kingsway, Stoke-on-Trent; deposit £2.

WALTHAMSTOW URBAN DISTRICT COUNCIL, June 12th.—Two natural draught cooling towers and ferro-concrete tank, at the Electricity Works. Specification, etc., from Mr. G. R. Spurr, Electricity Works, Exeter Road, Walthamstow; deposit £1.

FARNWORTH URBAN DISTRICT COUNCIL, June 15th.—Supply of l.t. cables. Specifications, etc., from Mr. A. J. Hutchinson, engineer and manager, Electricity Department, Albert Road, Farnworth, Lancs.

BELFAST CORPORATION, June 17th.—Manufacture and supply of (a) h.t. combined cubicle and truck-type switchgear (Specification W. 85); and (b) transformer kiosks (W. 88); and manufacture, supply, and erection of (c) 1 000 kW rotary convertor (W. 86); (d) 500 kW rotary convertor (W. 87); (e) c.c.switchgear for sub-stations (W. 89); (f) h.t. armour-clad switchgear for sub-stations (W. 90); and (g) h.t. truck-type switchgear for sub-stations (W. 91). Specifications from Mr. F. H. Whysall, city electrical engineer and manager, East Bridge Street, Belfast; deposit £2 2s. for each.

WEST HAM EDUCATION COMMITTEE, June 17th.—Electric light installation at Fyfield Open Air School Extension, near Ongar, Essex.

STOKE-ON-TRENT CORPORATION AND STAFFORD COUNTY COUNCIL, June 22nd.—Electric light and power installation in new buildings at North Staffordshire Technical College, Stoke-on-Trent. Further particulars from the Clerk to the Governors, Town Hall, Hanley; deposit £5 5s.

Overseas.

UNLESS otherwise stated, particulars of overseas contracts are to be had from the Department of Overseas Trade (Room 52), 35, Old Queen Street, Westminster, London, S.W.1. *Note.—An asterisk denotes that local representation is, in practice, essential.*

VICTORIAN ELECTRICITY COMMISSION, July 15th.—Two 750 kVA transformers and spares (No. 29/42). (Reference B.X. 5 325.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, July 23rd.—Telegraph instruments (schedule C. 436). (Reference B.X. 5 323.)

NEW ZEALAND POSTS AND TELEGRAPHS, August 7th.—Enamelled and silk covered resistance wire (No. P. and T. 151/1 497.) (Reference B.X. 5 322.)

EGYPTIAN MINISTRY OF THE INTERIOR, August 13th.—Supply of electric power plant, with underground and overhead network, for the town of Maghagha, Minieh Province. (Reference B.X. 5 318.)

PIETERSBURG (TRANSVAAL) MUNICIPALITY, August 13th.—Supply of h.t. and l.t. cable, lamps and sundries, in connection with extensions of the electricity undertaking. (Reference B.X. 5 312.)

PIETERSBURG (TRANSVAAL) MUNICIPALITY, August 13th.—Supply and erection of steam raising plant, engine, alternators and switchgear (contract A). (Reference A.X. 7 983.)

AUCKLAND ELECTRIC POWER BOARD, August 19th.—Single phase transformers. (Reference B.X. 5 324.)

NEW ZEALAND GOVERNMENT RAILWAYS, September 4th.—Supply of motor generator (specification 287). (Reference B.X. 5 308.)

WINDOW FLOODLIGHTING.

Beauty of Stained-Glass Windows Revealed by Floodlight.

AN interesting scheme of floodlighting has been installed by the BATE ELECTRICAL CO., LTD., of 6, Creed Lane, London, E.C.4, in the Stationers' Hall, London. This hall is lighted by six stained glass windows, in addition to windows of other type, and in order that the beauties of the stained glass may be appreciated during dinners and similar nocturnal functions in the hall, a battery of five "Kandem" floodlight projectors, each fitted with a 1 000 W lamp, has been arranged in the garden adjoining the hall, so that the windows on the west side of the building can be illuminated. A large window of stained glass at the north end of the hall can also be illuminated, but in this case nine smaller flood units are employed; the lamps installed in this latter battery are each of 150 W. In addition, the centre of the window is lighted by a trough reflector, thus giving an even distribution of light over the whole area of the glass.

The scheme was developed by the Bate Electrical Co., under the supervision of Henry Dawson and Son, the architects, and the first practical use of the installation was made on Tuesday evening.

HAMMERSMITH WIRING CONTRACTS.

New List of Installation Contractors Placed on the Rota.

HAMMERSMITH (London) Borough Council recently terminated its contracts with local electric wiring contractors for the execution of electric wiring installations under the Council's scheme for the wiring of property, and an advertisement was issued inviting quotations for carrying out such work in accordance with a revised specification. In connection with the operation of the Council's wiring scheme and the execution of electric wiring installations by contractors thereunder, the Electricity Committee has had certain negotiations with the local branch of the Electrical Contractors' Association. A deputation composed of local contractors met a special Sub-Committee of the Electricity Committee in April, and several points were put forward by the deputation, the principal ones being: (*a*) That the Council should agree with local representatives of the Electrical Contractors' Association a fair and reasonable price per point for the execution of wiring work, and (*b*) that the Council should restrict its contracts for wiring work to Hammersmith members of the Electrical Contractors' Association. The Electricity Committee reports that it is unable to recommend the Council to adopt the proposals. As a result of an advertisement, 26 quotations were received from wiring contractors, and the average prices quoted were: For lighting installations, 4 points (*a*) 110 V, £4 9s. 4d, (*b*) 220 V, £4 7s. 6d.; 5 points, (*a*) £5 10s. 1d., (*b*) £5 7s. 10d.; 6 points, (*a*) £6 10s. 3d, (*b*) £6 8s. 8d.; 7 points, (*a*) £7 11s. 7d., (*b*) £7 8s. 6d.; 8 points, (*a*) £8 12s. 1d., (*b*) £8 8s. 10d.; 9 points, (*a*) £9 12s. 3d., (*b*) £9 8s. 9d.; 10 points, (*a*) £10 12s. 3d., (*b*) £10 8s. 4d.; 11 points, (*a*) £11 12s. 6d., (*b*) £11 8s. 4d.; 12 points, (*a*) £12 13s. 3d., (*b*) £12 8s. 11d.; 13 points, (*a*) £13 12s. 11d., (*b*) £13 8s. 4d.; 14 points, (*a*) £14 11s. 11d., (*b*) £14 7s. 6d.; 15 points, (*a*) £15 12s. 5d., (*b*) £15 7s.; 16 points, (*a*) £16 11s. 5d., (*b*) £16 5s. 9d. Power installations: 1 point, (*a*) £2 13s. 4d., (*b*) £2 3s. 6d.; 2 points, (*a*) £5 1s. 1d., (*b*) £4 0s. 1d.; 3 points, (*a*) £7 6s. 11d., (*b*) £5 13s. 1d.; 4 points, (*a*) £9 17s. 2d., (*b*) £7 16s. 11d.; 5 points, £12 8s. 8d., (*b*) £9 13s. 4d.

The Committee's Recommendation.

An intimation was given to all local contractors that the Council was prepared to consider offers to enter into contracts to execute electric wiring installations, orders being placed in a consecutive manner according to a rota, in accordance with the Council's specification, at the above-mentioned rate of charge. As a result of the replies received, the Committee has recommended the Council to place contracts with the undermentioned local contractors for six months from June 1st, 1929:—Brooks and White, Alan Bantock and Co., F. E. Beltram, W. T. Canning and Co., E. W. Chamberlen, Fenn and Co., A. H. Fisher, G. Goodchild, J. R. Goode, Sydney Hellyar, Ltd., L. T. Hall, O. E. Jones, W. T. Lofting, C. J. Mount, M.E.D.A.S., Ltd., A. E. Mayhew and Co., J. B. O'Brien, Smith, Owen and Co., H. E. Steer, Thornton and Co., A. H. Verney, Wilkins Electrical Works.

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N.E. COAST EXHIBITION.

Further Exhibits of Electrical Interest at Newcastle.

WE gave in our last issue brief descriptions of a number of the electrical exhibits to be seen at the North-East Coast Exhibition, at Newcastle-on-Tyne, and this week we give further particulars of some of the plant exhibited.

The stand of CLARKE, CHAPMAN AND CO., LTD., of Gateshead, for instance, is devoted to power station and marine equipment. The pulveriser shown is capable of dealing with 10 tons of coal per hour at a shaft speed of 960 r.p.m., and is driven by a 180 H.P. motor, suitable for land or marine purposes. Another pulveriser exhibited is capable of handling 30–160 lb. of coal per hour, driven by a 3 H.P. motor at a speed of 2 800 r.p.m. An electrically driven ship's windlass, with a motor on the windlass bedplate controlled by a Clarke, Chapman patent booster system, suitable for a 2¼ in. dia. cable, is another feature of the show, and this is fitted with a 47 B.H.P. motor, which runs at a speed of 900 r.p.m. with an input of 220 V.d.c. Demonstrations of the equipment are available.

Electric Winches.

Electrically driven ship's cargo winches, controlled by the same system form another exhibit. These are self-contained and have infinite variable speed of haul, dealing with 5 tons at 60 f.p.m.; 2 tons at 150 f.p.m., and light hook speed 480 f.pm. The machines have creeping speeds at all loads and are capable of being stalled under any conditions. Demonstrations are being given. A motor generator set, consisting of a 70 H.P. 440 V 3-phase 40 cycle squirrel cage motor driving a standard marine type 45 kW 220 V. d.c. compound-wound generator is also shown. This set is used to supply the necessary direct current for the winch and windlass, while the switchboard consists of a standard marine type complete with a d.p. no-volt overload circuit breaker for the generator, and 4 d.p. circuit switches and fuses. The board is in accordance with Lloyds rules and requirements.

Messrs. BABCOCK AND WILCOX, LTD., of Babcock House, Farringdon Street, London, E.C., are giving a general display of their principal manufactures. The Babcock boiler is represented by two scale models, one representing a cross type marine boiler complete with inter-deck superheater, superposed counter-flow economiser, and tubular air heater, the furnace being fitted with the latest type of mechanical chain grate stoker; the other model represents a marine boiler as installed in the mercantile marine, and fitted for the burning of oil fuel. The company also shows a complete model illustrating the Babcock process of low temperature coal distillation with the recovery of tar oils, showing low temperature retorts supplying pulverised semi-coke to the furnace of a pulverised fuel boiler, or, alternatively, supplying semi-coke in lump form to the chain grate of a stoker-fired boiler. Another model shows the firm's balance lever luffing crane as used for coal unloading, general cargo discharge and similar purposes. The main exhibit consists of a complete totally-enclosed single gear 7 in. by 12 in. steam winch. This plant is shown in operation, the winch being arranged for a lifting load of 1 ton, and being operated for the purposes of exhibition by compressed air supplied from a Bellis and Morcom motor-driven two stage compressor. A representative selection of pipe work is shown, consisting of expansion bends, straight runs, and connections.

It is interesting to note that the whole of the electrical equipment for the Amusement Park was supplied by the Newcastle Branch of the GENERAL ELECTRIC CO., LTD., and here are seen "Osram" lamps and "Fairy-land" strip. The African Village and the Water Chute are two other examples, while the old Tyne Bridge is also illuminated by means of Osram lamps and Fairy-land strip. Among the interior installations may be mentioned the Festival Hall, the Grand Foyer and the Main Hall. Throughout the Palace of Industry and the Palace of Engineering, the two main buildings allocated to exhibition purposes, 300 W Osram gasfilled lamps are used. Many stands are equipped with G.E.C. fittings of various types, including "Wembley" lanterns, and in several instances auxiliary floodlighting is provided in addition—a notable example being the exhibit of a Diesel type engine. Two other examples of lighting are the Boulton Kiosk and the "Evening World" Pavilion, while the lighting of individual stands has called for "Gecoray" reflectors to the number of 1 200.

ELECTRICITY SUPPLY.

AN electricity supply scheme for Shoeburyness has been adopted.

Dover Electricity Committee has received sanction to borrow £3 000 for unspecified electricity services.

Bury (Lancs.) T.C. has received sanction to loans of £20 000 for mains, and £10 000 for sub-station equipment.

Cranbrook R.D.C. has given permission to the Weald Electricity Co. to erect a transformer at Goudhurst.

Dumfrie-shire C.C. has applied for a loan of £10 000 for cable extensions, distribution, generating, and boiler plant.

Guildford Electricity Committee has decided to extend mains at a cost of £2 220 to afford a supply to Clandon village.

Faringdon R.D.C. and Traders' Association has decided to invite the Wessex Electricity Co. to extend its scheme to the district.

Cookham R.D. Council has agreed to a proposal by the Western Electricity Supply Co. for the erection of overhead cables at Cookham Dean.

Dronfield U.D.C. is asking Sheffield Corporation for terms for a bulk supply. The Staveley Coal and Iron Co. offered a supply, but has withdrawn the offer.

Hungerford R.D.C. has consented to the application of the Wessex Electricity Co. to erect overhead and lay underground cables from Hungerford to Shalbourne.

In order to provide an l.t. supply to tenants' installations at the Royal Edward Dock, Bristol Electricity Committee reports that a new cable is necessary.

Haltwhistle R.D.C. has lodged an objection against the Newcastle-upon-Tyne Electric Supply Co.'s application for the South-West Northumberland Electricity Order.

Bradford Corporation has obtained land in Harrogate Road, Greengates, for the erection of a transformer chamber and voted £4 240 for a district transformer chamber in Ivanhoe Road.

Dewsbury T.C. has applied for a loan of £10 000, for mains and services. It has been decided to take no action in setting up a department in connection with the assisted wiring scheme.

Marylebone (London) Electricity Committee reports that the additional soot and grit catchers have now been erected, and all boiler plant at the generating station is now provided with this auxiliary equipment.

The Berkshire branch of the National Farmers' Union is advising members not to sign electricity company's wayleave consent forms, until the question of compensation for damage done to crops has been settled.

The Aylesbury Town Clerk has been instructed by the Council to take steps to enable an application to be made to the Electricity Commissioners for an Order to extend the area of supply so as to include Bradenham.

The High Street (Ealing) Traders' Association has asked Ealing Electricity Committee for a quotation for the supply and installation of electric lanterns fitted with 1 000 W lamps outside business premises in the High Street.

Macclesfield Guardians have accepted the offer of the Macclesfield Electricity Co. to supply the Macclesfield poor law institution at the reduced charge of £5 per kW and 1½d. per kWh up to 5 000 kWh per quarter.

Voltage Variation.

The Electricity Commissioners have refused consent to the Richmond (Surrey) Electric Light and Power Co. for permission to vary the voltage by 5% instead of 4% in connection with the proposed change-over from d.c. to a.c.

Wing R.D.C. has decided to ask Aylesbury T.C. whether a supply can be given to the parishes of Ivinghoe, Pitstone, Marsworth and Cheddington, and Luton Corporation is to be asked if it can supply electricity to the parishes of Soulbury and Wing.

Reigate R.D.C. has accepted the offer of the County of London Electricity Supply Co. for electricity for power at the Merstham Outfall, at 1¼d. per kWh, provided consumption exceeds 1 250 kWh per annum per H.P. installed. The Minister of Transport has consented to the retention of certain overhead lines erected by the Sussex Electricity Supply Co. in the Council's area and adjacent districts.

The underwriting of the new loan issued by the Central Electricity Board took place on May 23rd. The issue is for £3 000 000 4% stock, 1959-89, at 83% The interest on the stock is to be a first charge on the whole undertaking and revenues of the Board. The Board's two sources of revenue are from sales of electricity in bulk to authorised undertakers, and from a levy on the electricity supply industry in connection with the standardisation of frequency.

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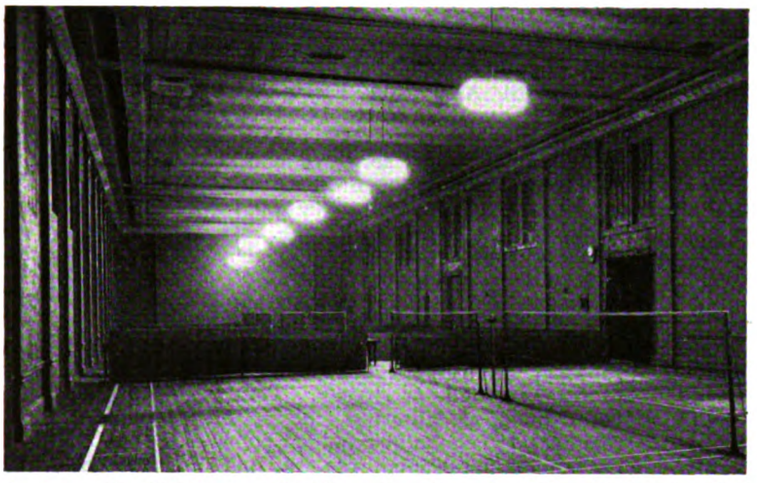
ELECTRICAL NEWS OF THE WEEK IN PICTURES.

Mr. W. M. Selvey, who, as announced on page 650, is shortly sailing to America on a tour of inspection of power stations.

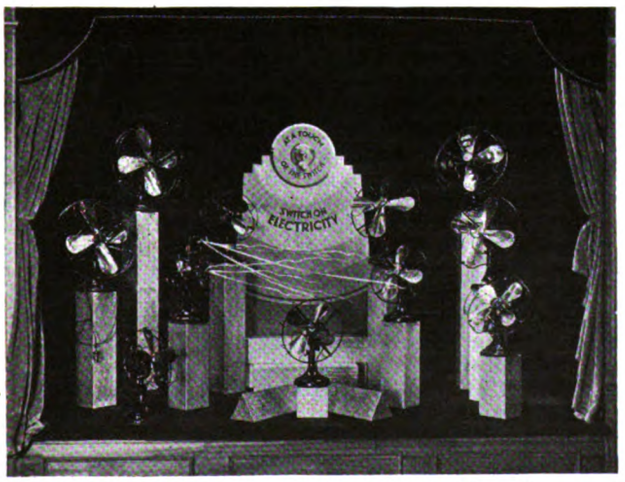
Mr. H. Willoughby Ellis, who has been nominated as president of the E.C.A. Allied Associations for the 1929–30 session.

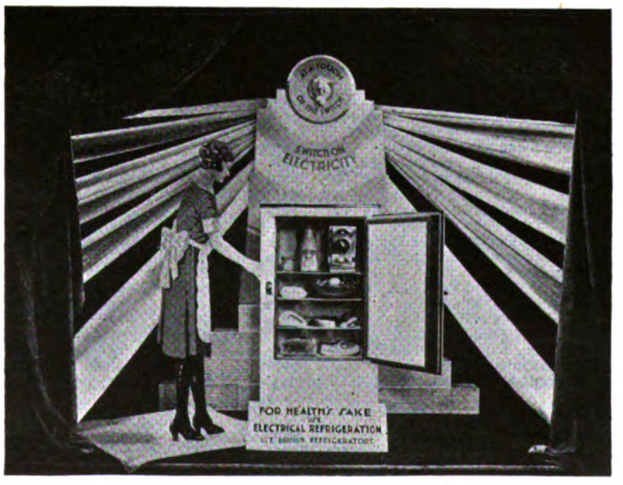
Mr. C. Elliott was appointed on Monday to succeed the late Mr. C. Stanley as general manager of the Birmingham Section of the B.I.F. See page 650.



An interesting lighting installation at the Alexandra Palace Badminton Club courts. The lighting units employed are made of a wire frame covered with Jap silk, the top being left open. Inside the unit there are 5 lamps of the frosted variety of 200 W each. As will be gathered from the picture, the units are arranged on the line of the net but in between the courts. Mounting height has been found best at 17 or 18 feet.

Firemen carrying scaling ladders to the roof of the Engineers' Club, Coventry Street, London, where a fire occurred on Monday. The premises were considerably damaged by water, but at the time of going to press no definite information was available.





In a recent issue we gave a number of suggestions from manufacturers with respect to the forthcoming fan trade. This week we reproduce the two June windows for the Monthly Selling Campaign organised by the E.D.A., one of which is devoted to fans. By making the most of the information contained in our special issue, and using the simple fittings of the E.D.A. design, a really attractive window containing all that is new in fans may be arranged. The second window is devoted to refrigeration, and again preserves the simplicity of previous windows. Both these designs may be arranged without professional assistance within a short space of time, and, with the warm weather now prevailing, good business is likely to follow such displays.

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COMPANY NEWS.

Telegraph Securities Declining—Ferranti's and Callender's Bonus Share Issues—Meetings of Eastern, Eastern Extension and Western Telegraph Companies—Directors' Reports and Dividend Announcements.

GENERAL Electric shares continue to sag, and a further fall of 1s. 3d. has brought the price down to 53s. 9d. W. T. Henley's Telegraph Works ordinary shares have recovered half-a-crown to 55s., and Ever Readies have put on threepence. In the electricity supply section, Newcastle and District and Yorks Electric Power ordinary shares are respectively 1s. 3d. and 1s. higher. Underground Electric Railways ordinary shares are 6d. down. Eastern Telegraph stock is five points lower, Marconi's Wireless have dropped 3s.9d., British Electric Traction preferred ordinary stock has risen 1½ points, and International Marine are 2s. 6d. down.

Last Annl. Divd.	Description	This Week.	Last Week.	1926 to 1928. Highest.	Lowest
%	**Electricity Supply.**				
d)	Brompton & Kensington Ord. ..	26/-	26/-	35/6	23/9
4	Central Elec. Sup. 4% Deb. ..	94	94	95½	88½
a)	Charing Cross Elec. Ord. (£1) ..	26/-	26/-	51/-	24/3
4½	,, ,, ,, 4½% C.P. (£1)	17/6	17/6	18/3	16/6
(*b*)	Chelsea Elec. Sup. Ord.	26/6	26/6	45/3	24/-
10	City of Lond. Elec. L'ting Ord. ..	33/1½	33/1½	52/10½	26/-
6	,, ,, ,, ,, 6% C.P.	23/-	23/-	24/3	21/6
10	County Lon. Elec. Sup. Ord. ..	55/-	55/-	68/6	25/9
6	,, ,, ,, ,, 6% C.P.	23/-	23/-	24/-	21/3
e)	Kensington & K'bridge Ord. (£1)	26/6	26/6	27/6	23/9
1/9⅝	Lon. Elec. Sup. Ord. (£1) ..	27/6	27/6	37/6	23/-
1/9⅝	Metro. Elec. Sup. Ord.	46/3	46/3	53/-	24/9
4½	,, ,, ,, 4½% C.P. ..	17/6	17/6	18/3	16/3
7½	N'castle & Dis. Elec. Ltg. Ord. ..	28/9	27/6	31/9	17/6
1/28	N'castle-upon-Tyne Elec. Sup.Ord.	26/3	26/3	30/3	19/3
6	N Metro. Elec. 6% C.P.	23/-	23/-	23/9	20/10
6	Notting Hill 6% C.P. (£10) ..	11	11	11½	9½
c)	St. James & P.M. Ord (£1) ..	27/6	27/6	28/6	23/6
1/6	Shrops. Worcs. & Staffs. Power B. Ord.	48/9	48/9	37/6	21/4
1/9½	W'minster Elec. Sup. Ord. (£1) ..	26/-	26/-	52/9	24/-
4½	,, ,, ,, 4½% C.P.(£1)	17/6	17/6	17/10½	16/7½
8	Yorks. Elec. Power Ord.	35/-	34/-	38/9	24/6
6	,, ,, ,, 6% C.P. ..	24/-	24/-	26/9	20/7
	Railways and Tramways.				
8	Brit. Elec. Trac. Pfd. Ord. Stk. ..	130½	129	152	117
6	,, ,, ,, 6% Pf. Stk.	127½	127½	133	103½
4	Cent. Lon. Ry. Ord. Stk. (asstd.)	72	72	72	54
4	,, ,, ,, 4% Deb.	80	80	83	77½
4	City & S. Lon. 4% Perp. Deb. ..	78½	78½	81	76½
5	Lon. Elec. Rly. Cons. Ord. Stk. ..	73½	73½	75½	42½
4	,, ,, ,, ,, 4% Pf. Stk.	73	73	77	68
4	,, ,, ,, ,, 4% Deb. ..	80	80	83	76½
5	Lon. & Sub. Trac. A. Deb. ..	95½	95½	97½	74
4	Lon. Un. Trams. 1st Deb... ..	64	64	63	39
4½	Met. Elec. Trams, 4½% Deb. ..	72	72	73½	62
5	,, ,, ,, 5% Deb. ..	67½	67½	70½	65½
3½	Met. Rly. Cons. Ord. Stk... ..	61	61	81	54½
3½	,, ,, ,, 3½% Pf. Stk. ..	63	63	67	60½
3½	,, ,, ,, 3½% Deb. ..	70	70	73½	67½
5	Met. Dis. Rly. Ord. Stk.	76½	76½	77½	52½
4½	,, ,, ,, 4½% 1st Pref. ..	81½	81½	84	74½
6	,, ,, ,, 6% Perp. Deb. ..	116½	116½	118½	110
4	S. Met. Elec. Trams, 4% Deb. ..	70	70	70	64½
7	Underground Electric Rlys. Ord.	23/6	24/-	28/2	11/-
—	Yorks. (W.R.) Trams, Ord. ..	5/-	5/-	16/-	3/-
4½	,, ,, ,, 1st Deb. ..	59	59	78	60
	Electrical Manufacturing.				
7	Brit. Elec. Transformer 7% C.P...	13/9	13/9	19/10	4/6
15	Brit. Insulated Cables Ord. ..	75/-	75/-	86/3	56/-
6	,, ,, ,, 6% C.P. ..	22/6	22/6	23/10	21/-
7	British Thomson-Houston Pref. ..	23/9	23/9	24/9	19/7
7	,, ,, ,, 7% Deb.	103½	103½	109½	102½
10	Brush Electrical Ord.	28/9	28/9	30/9	24/-
15	Callender's Cable Ord.	87/6	87/6	91/3	66/-
6½	,, ,, 6½% C.P. ..	25/-	25/-	25/9	22/-
7½	,, ,, 7½% B. Pref. ..	27/6	27/6	28/3	25/-
8	Crompton-Parkinson 8% Cum. Pf.	25/-	25/-	27/-	14/-
6	,, ,, 6% Cum. 2nd Pf.	17/6	17/6	19/6	9/7
7½	Edison Swan Elec. 1st Pref. ..	25/7½	25/7½	13/-	7/4½
5	,, ,, ,, 1st Deb. Stk.	86½	86½	92	81½
7½	Elec. Construction Ord.	18/9	18/9	32/6	23/6
7	,, ,, 7% C.P. ..	22/6	22/6	22/9	21/-
—	English Elec. Ord.	6/3	6/3	15/9	5/-
—	,, ,, 6% C.P. ..	8/1½	8/1½	18/9	7/-
7	Ericsson Telephones 7% Pref. ..	20/-	20/-	22/7½	17/6
35	Ever Ready (Gt. Britain) Ord. ..	23/9	23/6	92/3	18/1
6	Ferranti 6% Pref.	18/-	18/-	19/4½	16/9
7	,, 7% 2nd Pref.	21/3	21/3	19/3	13/9
10	General Elec. Ord.	53/9	55/-	46/6	26/6
‡25	W. T. Henley's Ord.	123/9	121/3	120/-	69/3
12½	Johnson & Phillips Ord.	36/3	36/3	67/11	34/-
7½	Lon. Elec. Wire & Smith's Pref...	23/9	23/9	25/-	22/3
7½	Siemens Bros. & Co. Ord. ..	27/6	27/6	36/6	24/9
10	Telegraph Const. Ord. (£12) ..	24½	24½	30½	20
	Telegraph.				
3½	Anglo-Am. Tele. Ord. Stk. ..	61½	61½	63½	56½
10	Eastern Ord. Stk.	272½	277½	273	135
3½	,, 3½% Pref. Stk.	67½	67½	70½	59
4	,, 4% Deb.	78½	78½	81½	74
10	Eastern Extension Ord. (£10) ..	27½	28	27½	14
22	Gt. Northern Telegraph (£10) ..	33	33	43½	26
10	Indo-European (£25)	50½	52½	48½	30
20	Marconi's Wireless T. Ord. ..	78/9	82/6	84/4	12/-
15	,, Int. Mar.	62/6	65/-	90/-	16/6
10	Western Tel. Ord. (£1)	27½	28	27½	12½

(*a*) 19.5d. per share. (*b*) 1s. 9·3d. per share. (*c*) 1s. 6·949d. per share.
(*d*) 1s. 8·706d. per share. (*e*) 1s. 7·181d. per share. ‡ Including 1s. bonus.

FERRANTI, LTD.—It is proposed to capitalise £40 000 of gen. res. and distribute it among ord. shhldrs. in proportn. of two new shs. for every three held.

ISLE OF WIGHT ELECTRIC LIGHT AND POWER CO., LTD.—Rev. for 1928, £32 193, agst. £30 087, plus £1 035 brt. in. To gen. res., £1 500; staff benevolent fund, £500. Fin. div. 4%, makg. 8%, tax free. Fwd., £1 032.

INTERNATIONAL HYDRO-ELECTRIC SYSTEM.—Application has been made to the New York Stock Exchange for listg 1 045 000 shs. of class "A" stk., of which 475 000 shs. have been issued, and 570 000 shs. are held in reserve for convrsn. of debs.

LEWES AND DISTRICT ELECTRIC SUPPLY CO., LTD.—Net receipts for 1928, £11 218, agst. £11 598. After deductg. exes. and int. and providg. £3 500 for renewals, surplus is £3 658, agst. £4 522, plus £3 403 brt. fwd. To res., £2 000; ord. div. 10%; fwd. £2 735.

POTTERIES ELECTRIC TRACTION CO., LTD.—Rev. for 1928, £266 148. After deducting all exes. chargeable to rev. and addg. £3 400 brt. fwd., blce. is £28 618. Deb. and loan int. £18 636; to res. £5 000. Fwd. £4 982. Arrears of div. on 5% cum. pref. shs. at Dec. 31, 1928, amtd. to £59 719.

ELECTRIC FURNACE CO., LTD.—Pft. for year ended March 31, 1929, £16 047. Div. at rate of 7% p.a., less tax, on pfd. ord. and ord. shs. from date of incorporation to March 31, 1909. To writg. off prelim. exes., £2 416; to gen. res., £5 000. Fwd. £2 160. Satisfactory workg. agreements have been made with Associated Electrical Industries, Ltd., and important groups in France, Germany and Sweden.

EASTERN EXTENSION, AUSTRALASIA AND CHINA TELEGRAPH CO., LTD.—Gross rev. for three months ended March 31, 1928, £517 779; deducted for ord. exes. and maintenance ships res. fund £219 045; blce., £298 734. Income tax, payable in England, £47 694; mtge. deb. stk. int., £7 524; blce., £243 516, plus £653 622 brt. in. Div. of 2½%, less tax, has been paid. To gen. res., £797 138.

GREAT NORTHERN TELEGRAPH CO., LTD.—Traffic receipts and pft. from participatn. in other telegraph undertakgs. for 1928, £983 551, int. from res. fund acct. and other sources, £202 844, sundries £64 383, and blce. fwd. from previous year £219 308; total £1 470 087. Total expenditure £808 875. Intm. div. of 5% absorbed £100 000, proposed fin. div. of 7½% requires £150 000, and proposed bonus of 7½%, £150 000; to res. and renewal fund, £33 333, and directors' fees, £3 056. Blce. fwd. £224 823. An additnl. wire between Irkutsk and Vladivostock was taken into use in Feb. 1929. New and improved instruments were installed at the relay stations, resulting in considerable increase of transmission speed. With regard to two wireless stations to be erected near Shanghai by Radio Corporation of America, working agreements have been concluded wh. provide that, as regards exchange of traffic, each party shall give preference to the other. On April 15 this year, when the bilateral service was opened between Europe and the new wireless station at Nagoya (Japan) cable rates were considerably reduced.

CALLENDER'S CABLE AND CONSTRUCTION CO., LTD.—Accts. for 1928 show blce. to credit of pft. and loss acct., £360 581. Deductg. provisn. for depreciatn. (£50 000), income tax, deb. stk. int., divs. for year on 6½% and 7½% pref. shs., stamp duty on new cap. authorised and contributn. to pensn. fund (£10 000), leaves £216 081, plus £474 165 brt. in. Div. proposed on ord. shs. (Nos. 1–800 000) of 15% p.a., being 3s. per sh., less tax, of which 1s. p. sh. was paid on Nov. 2, 1928. Fwd. £570 246. Past year was marked by absence of large cable contracts, but gen. business remained steady and in many directions improved materially. Result of year's operatns., as shown by accts., was satisfactory, blce. at credit of pft. and loss being slightly in excess of that of preceding year, and carry-forwd. substantially increased. Since beginning of 1929 outlook has distinctly improved, and the volume of business is increasg., both in regard to Erith Works and to the rubber wires and cables mfd. at the Anchor Works. In additn. to usual div. directors propose that a bonus in ord. shs. be issued without paymt. to all ord. shhldrs. on the basis of one fully paid-up ord. sh. for each five ord. shs. held. Work on the contract received from the Electricity Board for the South-Eastern Section of the Southern Grid

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has been commenced, and erectn. is being proceeded with. An imporgtant contract for underground mains in the London area has been received from the London Power Co., and the cables are being manufactured. Considerable progress has been made with Overseas work, especially in India. Anchor Cable Co. has had an excellent year. Results of year's operatns. are eminently satisfactory. Okonite-Callender Cable Co., New Jersey, in which company holds a large int., has also made steady progess. Directors accepted an offer made to them for the purchase of the old-established cable mfg. business of W. T. Glover and Co., Ltd., Manchester. Some other cable mfg. cos. have since become associated with them in this transaction. Board have set aside from pfts. of 1928 a sum of £10 000 as a contributn. towards a pensn. fund.

Company Meetings.

KALGOORLIE ELECTRIC POWER AND LIGHTING CORPORATION, LTD.—Mr. G. C. Howard, presiding at the meeting on May 23rd, said, after transferring £7 000 to a depreciation reserve account and bringing in the balance brought forward from the previous year, there was an available balance of £10 772, which it was recommended should be allocated as to £6 149 to payment of 6% on the income debenture stock and £3 000 to the payment of 6% on the ordinary shares, £1 000 being placed to general reserve and £623 carried forward. There was an unfortunate drop in revenue, attributable in part to a severe cyclone which caused damage to transmission lines and cooling towers. Notwithstanding this setback, they were able to recommend the same dividend as last year. The plant and machinery was in first-class order. If the Golden Horse Shoe Mine carried out its proposed programme, the installation of the necessary plant would be spread over five years, and a substantial amount of power would be required, which the company would be in a position to supply. The high tariffs on machinery imported into Australia had threatened to throttle industry, but they were advised that the new Minister controlling tariffs had adopted a sympathetic and more encouraging attitude.

SIEMENS BROTHERS AND CO., LTD.—Lord Queenborough, presiding at the meeting on Monday, said the profit for the past year was £335 758, a decrease of £20 977, and adding £250 041 brought forward from last year there was a balance of £585 799. After provision for debenture interest, preference dividend, etc., it was proposed to pay a final dividend on the Ordinary shares of 5%, making 7½% for the year, and to carry forward £313 360. During the year they had manufactured a submarine telegraph cable for the Philippine Islands, and further progress had been made with new designs to meet the ever-increasing demands for long distance submarine telephonic transmission. They were entrusted by the Government with the manufacture of the new submarine telephone link between this country and Northern Ireland, via the Isle of Man, and had also manufactured a telephone cable which was laid from this country to the Isle of Wight and another intended for service in the Gulf of St. Lawrence. A number of supertension cables which the Company supplied and laid across Sydney Harbour were the largest cables which had ever been made for any purpose. There had been a considerable demand for manual and automatic telephone exchanges and apparatus, both at home and abroad. The Company, in co-operation with the Post Office engineers, had developed a new type of telephone instrument known as the Neophone, which had been found to be a real advance in transmission efficiency and articulation. There had been a great increase in the demand for radio batteries, and their marine specialities were being increasingly adopted by the larger shipping companies and shipbuilders. The report and accounts were adopted and the dividend was approved.

EASTERN TELEGRAPH CO., LTD.

Accounts for First Three Months of 1929 Adopted—Particulars of the Cables and Wireless Merger—Alterations to Articles of Association Approved.

THE 98th ordinary general meeting of the Eastern Telegraph Co., Ltd., was held on Wednesday, May 29th, Mr. J. C. Denison-Pender presiding.

The Chairman said : I will proceed to deal with the accounts which cover a period of only three months, namely, for the quarter ended March 31st, 1928. The reason for this is that this is the date as from which the Report of The Imperial Wireless and Cable Conference recommends that Imperial and International Communications, Ltd., should acquire the "communications assets" of your company, and of the Eastern Extension, Australasia and China Telegraph Co., the Western Telegraph Co. and Marconi's Wireless Telegraph Co., and of their wholly owned subsidiaries, and should purchase the Pacific Cable Board's undertaking, including the West Indian undertaking now worked by them, also purchase the Imperial transatlantic cables, and the lease from the Government of the beam wireless stations, which were both operated by the State. After providing for all expenses, income tax and debenture interest, and for the dividend on the preference stock, there remains a balance of profit of nearly £150 000, so that we have been able to maintain the dividend at the rate of 10% per annum, free of tax, which we have paid for many years past, and still leave a balance of £24 672 13s. 2d. This amount, together with the balance of £525 764 12s. 10d. brought forward from the preceding year, has been transferred to the general reserve fund, thus closing the company's revenue account as at March 31st, 1928.

If the necessary percentage of stockholders and shareholders in the cable and wireless companies agree to exchange their stock or shares for shares in the newly formed company—Cables and Wireless, Ltd.—this will be the last meeting of the Eastern Company under existing conditions. Its name will be preserved and it will remain as a separate entity, although no longer operating a telegraph business, but remaining simply as a company holding reserve fund investments and investments in the new Imperial and International Communications Co.

It is now common knowledge that the Imperial Wireless and Cable Conference made a unanimous recommendation as to Empire communications, and also approved the tentative arrangement come to between the Eastern associated companies and the Marconi Co. for the merging of interests. As a result of this momentous decision two companies have been formed : Cables and Wireless, Ltd., and Imperial and International Communications, Ltd. The former was designed to hold the ordinary stock and shares of the cable companies and preference and ordinary shares of the Marconi Co. The latter, Imperial and International Communications, Ltd., to acquire the communications assets of these companies together with telegraphic services which were either owned or being operated by the Government. This latter company will therefore be world-wide in its ramifications and very comprehensive in its scope.

You have recently received from the Bank of England an offer on behalf of Cables and Wireless, Ltd., to exchange your existing holding of ordinary stock in this company for shares in the new Cables and Wireless, Ltd., an offer which your directors unanimously and unreservedly recommend you to accept.

I should remind you that the directors of the new undertakings have endeavoured to remove a disability from which rationalisation in many cases suffers, namely, the dismissal of staff, for they have made an offer to take over the staffs of all the interests coming within the merger, on terms not less advantageous than those which they are at present enjoying, a course which they believe to be both in your and the national interest.

The Chairman also said :—Upon the notice convening this meeting you will observe that, in order to conform with the recommendations of the Imperial Wireless and Cable Conference, it is essential that certain alterations should be made in the articles of association of this company, and to that end two resolutions will be submitted to you.

Resolution No. 1 simply ensures that the predominant shareholding interest in this company shall remain British.

Resolution No. 2 provides that the directors of Cables and Wireless, Ltd., and Imperial and International Communications, Ltd., and this Company shall be identical, and that no director or managing director shall as from April 1st last receive any remuneration from this company.

Resolution No. 3 empowers your board to apply by way of compensation to directors who have to relinquish their directorates in consequence of the amalgamation, a sum which in total shall not exceed £11 500.

The resolutions were carried unanimously, and the report and accounts were unanimously adopted.

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EASTERN EXTENSION, AUSTRALASIA AND CHINA TELEGRAPH CO.

Report for First Quarter of 1929 Approved—The Cables and Wireless Merger—Alterations of Articles of Association Adopted.

THE 95th ordinary general meeting of the Eastern Extension, Australasia and China Telegraph Co., Ltd., took place on Wednesday, Mr. J. C. Denison-Pender presiding.

The Chairman said: The first item of business for your consideration is to pass the report and accounts for the three months ended March 31st, 1928, in which there is no item calling for any particular notice, and I assume you will take the report and accounts as read. The reason for the limitation of period to the date specified is that an arrangement was entered into on March 14th, 1928, between the Eastern and Associated Telegraph Companies and Marconi's Wireless Telegraph Co., Ltd., for the merging of cable and wireless interests. Of this fact, the Imperial Wireless and Cable Conference, which was then sitting, was duly informed. In its report, the Conference recommended to the Government the formation of an Imperial Communications Co., which would acquire as from April 1st, 1928, the communications assets of the Cable and Marconi Companies; also those of the Government's cable and wireless systems. In order to obviate any inconvenience to shareholders which might have resulted through the non-payment of interim dividends during the transition period, and which action, if followed, might also have caused adverse market fluctuations of your shares, it was decided to pay dividends quarterly as hitherto. You have, therefore, received the usual amounts, at the rate of 10% per annum, free of tax, on July 15th and October 15th, 1928, and on January 15th and April 15th, 1929, covering the full dividends in respect of the year 1928.

If the necessary percentage of stockholders and shareholders in the Cable and Wireless Companies agree to exchange their stock or shares for shares in the newly formed company —Cables and Wireless, Ltd.—this will be the last meeting of the Eastern Extension Co. under existing conditions. I am glad to think, however, that, having been in existence for fifty-six years, its name will be preserved and that it will remain as a separate entity, although no longer operating a telegraph business, but remaining simply as a company holding reserve fund investments and investments in the new Imperial and International Communications Co.

It is now common knowledge that the Imperial Wireless and Cable Conference made a unanimous recommendation as to Empire communications. and also approved the tentative arrangement come to between the Eastern Associated Companies and the Marconi Co. for the merging of interests. As a result of this momentous decision two companies have been formed: Cables and Wireless, Ltd., and Imperial and International Communications, Ltd. The former was designed to hold the ordinary stock and shares of the cable companies and preference and ordinary shares of the Marconi Co. The latter, Imperial and International Communications, Ltd., to acquire the communications assets of these companies, together with telegraphic services which were either owned or being operated by the Government.

You have recently received from the Bank of England an offer on behalf of Cables and Wireless, Ltd., to exchange your existing holding of ordinary shares in this company for shares in the new Cables and Wireless, Ltd., an offer which your directors unanimously and unreservedly recommend you to accept.

The directors of the new undertakings have endeavoured to remove a disability from which rationalisation in many cases suffers, namely, the dismissal of staff, for they have made an offer to take over the staffs of all the interests coming within the merger, on terms not less advantageous than those which they are at present enjoying, a course which they believe to be both in your and the national interest.

In connection with the negotiations with the Government and with the other interests concerned, I should like to pay a tribute to the spirit of accommodation shown on all sides.

Extraordinary resolutions were passed to the effect that provided the plan for the cables and wireless merger shall have become operative, the articles of association be modified by the insertion of provisions to ensure that the company remain under British control; and that the directors of Cables and Wireless, Ltd., shall *ipso facto* be the directors of the company.

Two ordinary resolutions (1) to apply the sum of £3 000 for the purpose of compensating such directors as will lose office in the company as a result of the merger, and (2) to convert the paid-up shares into stock were also carried.

The report and accounts were unanimously adopted.

WESTERN TELEGRAPH CO., LTD.

Resolutions for Alteration of Articles of Association—Directors Recommend Acceptance of Offer of Cables and Wireless, Ltd.—All Staff to be Taken Over.

MR. J. C. DENISON-PENDER, presiding at an extraordinary general meeting of the Western Telegraph Co., Ltd., on Wednesday, said: Although by our notice convening the meeting you are called together merely to pass certain resolutions, the occasion is in reality one which marks a very important stage in the life of our company.

If the necessary percentage of stockholders and shareholders in the Cable and Wireless Companies agree to exchange their stock or shares for shares in the newly formed company—Cables and Wireless, Ltd.—this will be the last meeting of the Western Co. under existing conditions. I am glad to think, however, that, having been in existence for fifty-six years, its name will be preserved, and that it will remain as a separate entity, although no longer operating a telegraph business, but remaining simply as a company holding reserve fund investments and investments in the new Imperial and International Communications Co.

It is now common knowledge that the Imperial Wireless and Cable Conference made a unanimous recommendation as to Empire communications, and also approved the tentative arrangement come to between the Eastern Associated Companies and the Marconi Co. for the merging of interests. As a result of this momentous decision two companies have been formed: Cables and Wireless, Ltd., and Imperial and International Communications, Ltd. The former was designed to hold the ordinary stock and shares of the Cable Companies and preference and ordinary shares of the Marconi Co. The latter, Imperial and International Communications, Ltd., to acquire the communications assets of these companies, together with telegraphic services which were either owned or being operated by the British Government.

You have recently received from the Bank of England an offer on behalf of Cables and Wireless, Ltd., to exchange your existing holding of ordinary shares in this company for shares in the new Cables and Wireless, Ltd., an offer which your directors unanimously and unreservedly recommend you to accept.

The directors of the new undertakings have made an offer to take over the staffs of all the interests coming within the merger, on terms not less advantageous than those which they are at present enjoying.

In connection with the negotiations with the Government and with the other interests concerned, I should like to pay a tribute to the spirit of accommodation shown on all sides.

The resolutions about to be put to you are for the purpose of making certain alterations in our statutes, in order to conform with the recommendations of the Imperial Wireless and Cables Conference.

The first resolution is to establish that the company shall always be under British control, and ensures that the predominating shareholding interests in the company shall remain British.

By the second, your directors cease to hold office under our present articles of association and these are altered so as to enable the directors of Cables and Wireless, Ltd., to be also the directors of the Western.

Resolution No. 3 is in a different class, and is of a more domestic character.

It was a condition made by the Imperial Wireless and Cable Conference and approved by the respective Governments in recommending the present scheme that the number of directors be limited to twenty-two, and it is consequently essential that some of your directors, have to relinquish their directorates. This resolution empowers your board to apply a sum in compensation which will not exceed £5 500.

Finally, you will be asked to authorise your directors to convert the paid-up shares into stock.

The resolutions were carried unanimously.

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COMMERCIAL INFORMATION.

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debt. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

BOWEN, Mr. G., 70, Theobald's Road, W.C., wireless dealer. £14 16s. April 16th.

CLARKE, John, and TIMMIS, Harold Edgar (trading as FORWARD ELECTRIC CO.), 46, Holloway Head, Birmingham, power plant and electrical engineers. £31 18s. 10d. February 13th.

DOE, Ernest E., 578, Oxford Road, Reading, wireless dealer. £29 17s. 5d. March 28th.

ELECTRICAL CONTRACTING CO., 7, Christmas Street, Bristol. £13 13s. 3d. March 18th.

FIDELITY AGENCY, 3/5, Burlington Gardens, Old Bond Street' W., electrical contractors. £11 12s. 6d. April 16th.

HUGHES BROS., 1,090, Manchester Road, Bradford, electricians. £10 10s. 11d. April 17th, and £21 18s. 1d. April 18th.

PENROSE, Mr., 1, Preston Street, Fleetwood, wireless dealer. £12 13s. 8d. March 18th.

W.M. WIRELESS CO., LTD., 531, Forest Road, Walthamstow. £123 3s. 1d. March 26th.

Deed of Arrangement.

GREEN, Herbert Thacker, KNOWLAND, Harry, trading at 221D, Great Cheetham Street, Higher Broughton, and 1123, Chester Road, Stretford, as GEEKAY RADIO SUPPLIES, wireless dealers. Dated May 17th, filed May 24th. Trustee, J. A. Seddon, 18, St. Ann Street, Manchester, accountant. Secured creditors, £54, liabilities unsecured, £568; assets, less secured claims, £102.

Receivership.

BRITISH AUTOMATIC REFRIGERATOR CO., LTD. W. Mills, of 31, Budge Row, E.C. was appointed receiver on May 9th, 1929, under powers contained in debentures dated March 30th, 1928.

Private Meetings, etc.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

JONES, Clarence Lionel Frederick, electrical and wireless engineer, Colwyn Avenue, Rhos-on-Sea. The creditors were called together on May 24th at Colwyn Bay, when a statement of affairs was submitted which showed liabilities of £599, and assets comprising stock £210, estimated to realise £100; fittings and fixtures £25, expected to produce £10; book debts £87, valued at £65; and deposits, £2.

It was reported that after the debtor had completed his apprenticeship to a well-known firm he continued with the firm until he joined the army in 1915. He was discharged in 1918, but owing to his war service, his health was affected, and he had to relinquish his employment. In April of last year, he commenced trading on his own account, the premises being taken on a lease for three years at a commencing rental of £55 per annum. According to the books, the purchases during the period of the trading had been £909, with sales of £1 116, and there was a gross profit of £316. The expenses, however, exceeded £300. A resolution was passed confirming the deed of assignment already executed, conditional upon certain cash creditors withdrawing their claims. A committee was also appointed consisting of the representatives of Metro-Vick Supplies and B.N.B. Wireless, Ltd. The following are creditors: Beardsall (W. E.) and Co., Ltd., Manchester, £80; Marconiphone Co., Ltd., London, £30; Revo Electric Co., Ltd., Tipton, £26; General Electric Co., Ltd., Liverpool, £25; Hollindrake (H.) and Sons, Ltd., Stockport, £20; B.N.B. Wireless, Ltd., Liverpool, £25; Robinson and Hands Electric Co., Birmingham, £16.

JONES, Percy, and MERCER, James Henry, lately trading as the NORTHERN WHOLESALE ELECTRICAL SUPPLY, 266 and 268, Holloway Road, London, N.7. A circular has been issued to the creditors herein by Mr. C. G. Sunderland, of Sunderland, Mountstephen and Co., 15, Eastcheap, E.C., stating that in January last the above executed a deed of assignment in his favour. At that time the liabilities were estimated at £1 050, against assets expected to produce £1 248. The estate has been realised and has produced £1 197, and a first and final dividend of 20s. in the £ has been paid. Mr. Sunderland, in his report to the creditors, states that under the deed the creditors were entitled to interest at the rate of 4 per cent. A request, however, was received to the effect that the creditors should forego the interest and accept a dividend of 20s. in the £ in full and final settlement. A committee of the principal creditors recommended that that dividend should be accepted.

London Gazette, etc.

Company Winding-up Voluntarily.

ELECTRIC FACTORS (BLACKPOOL), LTD.—By reason of its liabilities, May 11th, J. Todd, 18, Birley Street, Blackpool, chartered accountant, appointed as liquidator.

Winding-up Petition.

RADIO ELECTRIC CO. (BOURNEMOUTH), LTD.—A creditors' petition for winding-up has been presented and is to be heard at the Law Courts, Stafford Road, Bournemouth, on Tuesday, June 18th, at 2 p.m.

Bankruptcy Information.

HUNT, Sydney Everest, 8A, Torwood Street, Torquay, electrical engineer and contractor. Receiving order, May 17th. Debtor's petition.

SKIPPER, Sydney Harold, 35, Broad Bridge Street, Peterborough, lately trading as S. H. SKIPPER AND CO., electrical engineer. Receiving order, May 25th. Debtor's petition.

Notices of Dividends.

HORSFALL, William Miles, electrical engineer, 7, Redcross Street, Liverpool. Fifth dividend, 4¾d. per £, payable May 31st, Official Receiver, Government Buildings, Victoria Street, Liverpool.

WESTNUTT, Josiah, described in the Receiving Order as John Victor Westnutt, High Street North, Dunstable, electrical engineer. First and final dividend, 9s. per £, payable May 31st, Official Receiver's Offices, The Parade, Northampton.

Notices of Intended Dividends.

EDWARDS, William Houston, the Docks, Milford Haven, electrical engineer. Last day for receiving proofs, May 31st. Trustee, H. W. Thomas.

JENKINS, Edward Charles, 124, Cheltenham Road, Bristol, wireless dealer. Last day for receiving proofs, June 4th. Trustee, H. Ashton, 26, Baldwin Street, Bristol, Official Receiver.

Bankruptcy Proceedings.

PEOVER, Harry, Market Lane, Newcastle-upon-Tyne, electrical apparatus and tool merchant. The first meeting of creditors was held on May 22nd when a statement of affairs was submitted showing liabilities of £1 869, against assets of £235. It would seem that the debtor's stock, which had been valued less than a month ago at £612, had realised only £140. It was reported, in support of the debtor's statement, that the stock had been sacrificed, that the Official Receiver had in his possession a letter from a business friend of the debtor who had been prepared to offer £300. The case, being a summary one, remained in the hands of the Official Receiver as trustee of the estate.

METAL AND CHEMICAL PRICES.

TUESDAY, May 28th.

		Price.	Inc.	Dec.
***Copper*—**				
Best Selected ..	per ton	£74 10 0	—	£1 10 0
Electro Wirebars	,,	£84 10 0	—	2s. 6d.
H.C. Wires, basis	per lb.	11¾d.	—	⅛d.
Sheet	,,	1s. 0d.	—	—
***Phosphor Bronze*—**				
Wire (Telephone) basis	per lb.	1s. 2¾d.	—	⅛d.
***Brass* 60/40—**				
Rod, basis ..	per lb.	9d.	—	—
Sheet ,, ..	,,	10¾d.	—	—
Wire ,, ..	,,	11¾d.	—	—
***Pig Iron*—**				
Cleveland Warrants	per ton	£3 12 6	—	—
Galvanised Steel Wire, basis 8.S.W.G. ..	,,	£14 15 0	—	—
***Lead Pig*—**				
English	per ton	£25 0 0	—	5s. 0d.
Foreign or Colonial	,,	£23 15 0	—	2s. 6d.
***Tin*—**				
Ingot	per ton	£196 5 0	—	10s. 0d.
Wire, basis ..	per lb.	2s. 7¾d.	—	—
Aluminium Ingots	per ton	£95 0 0	—	—
Spelter	,,	£26 17 6	2s. 6d.	—
Mercury	per bottle	£22 5 0	—	—

***Sulphur*—Flowers, Ton £12 0 0** ***Sulphuric Acid*—**
,, Roll ,, £10 10 0 (Pyrites, 168°) Ton £6 15 0
Copper Sulphate ,, £25 to £25 10 0 ***Sodium Chlorate*** per lb. 2¾d.
Boric Acid (Crystals),, £30 0 0 ***Sodium Bichromate*** per lb. 3¾d.
***Rubber*—Para fine, 11¼d.; plantation, 1st latex, 11¼d.**

The metal prices are supplied by British Insulated Cables Ltd.

THE LEAD MARKET.

Quiet conditions have prevailed in the market and, with only a small demand, prices have, according to James Forster and Co.., sagged daily and closed at the lowest. The American price remains at 7 cents.

Closing prices on May 24th were £23 12s. 6d. for May and June, £23 10s. for July, and £23 7s. 6d. for August, 3s. 9d. to 7s. 6d. lower on the week.

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PATENT RECORD.

The following information is prepared from the Illustrated Official Journal (Patents) by permission of the Controller of H.M. Stationery Office. Printed copies of full Patent Specifications, when accepted, may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at 1s. each.

Specifications Accepted.

309 049 S. J. Harley. Electric distant recording system and apparatus therefor, applicable for use in connection with various phenomena. (28/9/27.)
309 052 B. Bleasdale, P. V. Johnston, and W. E. Denison. Thermionic amplifier circuits. (3/10/27.)
309 093 F. A. L. Billerey. Electric heating. (5/10/27.)
281 668 International General Electric Co., Inc. Regulating-devices for prime movers. (30/11/26.)
309 056 J. Stone and Co., Ltd., F. J. Pike, and C. J. Lyth. Apparatus for use in the electrolytic deposition of metal on metal tubes. (30/11/27.)
309 059 J. Birch and sons, Ltd., and G. E. Taylor. Junction-box for electric cables. (3/12/27.)
309 209 Graham Amplion, Ltd., and P. K. Turner. Voltage-controlling means in systems for supplying electric consuming devices. (5/12/27.)
309 232 Enclosed Motor Co., Ltd., and P. A. H. Mossay. Cooling systems of enclosed electric motors and other dynamo-electric machines. (15/10/28.)
309 096 C. H. V. Pate. Electromagnetic relays for use in telephone systems. (23/12/27.)
283 134 Telefonaktiebolaget L. M. Ericsson. Electrical rectifying-devices. (4/1/27.)
308 960 Automatic Telephone Manufacturing Co., Ltd., J. E. Ostline, and C. H. Evans. Indicating-devices, particularly for use in telephone systems. (30/12/27.)
287 841 Westinghouse Brake and Saxby Signal Co., Ltd. Motor-controlling apparatus. (26/3/27.)
289 866 Westinghouse Brake and Saxby Signal Co., Ltd. Apparatus for rectifying alternating electric currents. (5/5/27.)
290 238 Westinghouse Brake and Saxby Signal Co., Ltd. Remote-control arrangements for alternating-current circuits comprising metal-sheathed cables. (11/5/27.)
285 804 Associated Telephone and Telegraph Co. Arrangement for controlling an operation depending upon whether a device is in motion or stationary. (21/2/27.)
283 116 G. W. Pierce. Magnetostrictive vibrator. (3/1/28.)
309 015 W. J. Davis. Electric condensers. (3/1/28.)
283 121 British Thomson-Houston Co., Ltd. Radio receiving systems. (3/1/27.)
309 109 British Thomson-Houston Co., Ltd., and J. G. Wellings. Bushings for use with electrical apparatus. (3/1/28.)

Secret Signalling Systems.

309 063 Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories, Inc.). Secret electric signalling systems. (3/1/28.)
309 064 A. Reyrolle and Co., Ltd. W. J. Cook, and D. Kingsbury. Electric switchgear. (4/1/28.)
290 558 Electrical Research Products, Inc. Devices for damping vibrations in acoustic apparatus. (14/5/27.)
283 176 Dr. S. Loewe. Electron-discharge devices with high-emission cathodes. (6/1/27.)
309 219 O. Fulton. Feeler devices used in the transmission of pictures. (5/1/28.)
283 215 Compagnie Pour la Fabrication des Compteurs et Material D'Usines a Gaz. Measuring or protecting apparatus for electric circuits. (7/1/27.)
309 221 General Electric Co., Ltd., H. W. B. Gardiner, and M. S. H. Hunt. Electric switches. (6/1/28.)
290 264 Electrical Research Products, Inc. Electromagnetic devices for recording sound and reproducing sound from records. (13/5/27.)
293 847 Electrical Research Products, Inc. Electromagnetic devices for recording sound and reproducing sound from records. (14/7/27.)
290 559 Electrical Research Products, Inc. Electromagnetic device for reproducing sound waves. (14/5/27.)
309 224 General Electric Co., Ltd., and N. R. Campbell. Manufacture of photo-electric cells. (7/1/28.)
283 853 Associated Telephone and Telegraph Co. Telephone systems. (17/1/27.)
309 233 Standard Telephones and Cables, Ltd. (Western Electric Co., Inc.). Signalling systems. (11/1/28.)
309 234 J. Stone and Co., Ltd., and A. E. Honey. Automatic switch devices for electric train-lighting and similar installations. (11/1/28.)
287 153 Associated Telephone and Telegraph Co. Telephone systems. (17/3/27.
288 234 Electrical Research Products, Inc. Television systems. (6/4/27.)
309 240 H. Rhodes. Electric lamp-locking device. (14/1/28.)
309 241 A. A. J. Crowne. Electric discharge devices. (16/1/28.)
287 543 Siemens and Halske Akt.-Ges. Time-recording apparatus. (24/3/27.)
309 284 L. H. Reid. Clip connections for electric conductors. (8/3/28.)
309 286 Igranic Electric Co., Ltd., and A. D. Hodgson. Radio apparatus. (14/3/28.)
309 290 W. T. Gray, S. Griffiths, and Associated Electrical Industries, Ltd. Electric motor control systems. (21/3/28.)
291 371 Siemens and Halske Akt.-Ges. Circuit arrangement for the control of clocks over the lines of a telephone installation. (31/5/27.)
309 294 M-L Magneto Syndicate, Ltd., and E. A. Watson. Dynamo-electric machines. (27/3/28.)
309 295 S. G. Brown, Ltd., and A. M. H. R. Brown. Sound reproducing or transmitting instruments. (28/3/28.)
309 303 Pirelli General Cable Works, Ltd., and R. E. Horley. Joints for electric cables. (2/4/28.)
309 305 H. Leitner. Electric miners' lamps and the like. (4/4/28.)
290 290 Electrical Research Products, Inc. Electromagnetic sound-recording devices. (13/5/27.)
290 977 International General Electric Co., Inc. Means for equalising the electrostatic stresses in armoured cables. (21/5/27.)
309 329 Soc. Genevoise D'Instruments de Physique. Prepayment electricity-meters. (28/4/28.)
309 330 Soc. Genevoise D'Instruments de Physique. Prepayment electricity-meters. (28/4/28.)
309 338 Landis and Gyr Soc. Anon. Induction-measuring instruments. (16/5/28.)
292 999 Siemens-schuckertwerke Akt.-Ges. Arrangement of core segments in the casings of dynamo-electric machines, rotary transformers, and the like. (29/6/27.)
294 217 Associated Telephone and Telegraph Co. Telephone systems. (17/3/27.)
309 358 Telefonaktiebolaget, L. M. Ericsson and O. I. H. Ekman. Automatic circuit-breakers for fire-alarm systems. (21/7/28.)
294 612 General Electric Co., Ltd. Feeding wires. (27/7/27.)
294 988 Associated Electrical Industries, Ltd. Vacuum pumping systems. (3/8/27.)
300 905 International General Electric Co., Inc. Chamber furnaces. (19/11/27)
309 376 A. J. Rhodes. Electric heating-elements. (20/11/28.)
302 239 Electrical Research Products, Inc. Television and like systems. (6/4/27.)
306 840 Dr. B. Schwarz. Alternating-current induction motors. (29/11/26.)
306 841 Dr. B. Schwarz. Alternating-current commutator motors. (29/11/26.)
309 415 A. E. White (Bastian-Morley Co.). Electric switch structure and mechanism for actuating the same. (10/10/27.)
309 416 A. E. White (Bastian-Morley Co.). Electric liquid-heaters. (10/10/27.)
286 283 K. Meyer. Rontgen-ray photography. (11/10/27.)
309 386 B. Krausse. Electric winding-up mechanism for clockworks. (7/11/27.)
309 514 G. L. Porter, and Ferranti, Ltd. Variable-resistance shunts. (12/12/27.)
309 615 J. Solomon. Electrical relays and relay systems. (14/12/27)
309 388 Creed and Co., Ltd., F. G. Creed, and R. D. Salmon. Electric telegrapich receiving and retransmitting or reproducing apparatus. (24/12/27.)
309 515 Nalder Bros., and Thompson, Ltd., and C. L. Lipman. Relays and controlling apparatus energised by alternating electric currents. (4/1/28.)
283 185 Trub, Tauber and Co., and A. Imhof. Device for feeding low-tension measuring-instruments from high-tension systems. (6/1/27.)
309 422 O. Aldinger. Electric devices for drying the hands. (7/1/28.)
309 463 R. Lomax, J. R. Garner, and P. C. Walker. Electrical fuses. (7/1/28.)
309 393 General Electric Co., Ltd., and W. Singleton. Process for coating metals. (9/1/28.)
309 394 General Electric Co., Ltd., W. Singleton and G. C. Marris. Manufacture of cores for electromagnets or the like. (9/1/28.)
309 397 E. E. Greve, and Oil Well Supply Co. Electric differential drive for drilling. (9/1/28.)
309 398 J. Stone and Co., Ltd., and W. R. Chaplin. Automatic electric current regulators. (9/1/28.)
309 426 J. E. Pollak (Hermsdorf-Schomburg-Isolatoren Ges.). Electrical insulators or the like. (9/1/28.)
291 045 Associated Telephone and Telegraph Co. Telephone systems. (25/5/27.)
290 998 Associated Telephone and Telegraph Co. Telephone systems. (23/5/27.)
309 431 E. Y. Robinson, and Associated Electrical Industries, Ltd. Vacuum electric tube devices. (10/1/28.)
309 520 E. Y. Robinson and Associated Electrical Industries, Ltd. Vacuum electric tube devices. (10/1/28.)
309 434 T. W. Ross, C. Ryder, and Associated Electrical Industries, Ltd. Speed-matching devices. (10/1/28.)
283 489 Soc. Anon. Fonderia Milanese di Acciaio. Process for obtaining steel from electric furnaces. (10/1/27.)
309 469 W. J. Rickets, and A. H. S. MacCallum. Telephonic receivers. (10/1/28.)
309 472 J. E. Pollak (Hermsdorf-Schomburgh-Isolatoren Ges.). Lead-through insulators. (11/1/28.)
284 601 A. A. J. Briois and P. F. R. Betrand. Electrical rail-connectors. (12/1/28.)
309 622 S. D. White and R. J. Jones. Electrolytic rectifier. (13/1/28.)
285 365 Associated Telephone and Telegraph Co. Telephone systems. (14/2/27.)
288 539 Electrical Research Products, Inc. Light-sensitive discharge devices. (6/4/27.)
309 631 S. G. S. Dicker. (N. V. Philips' Gloeilampenfabrieken. Voltage-regulating devices for supply systems comprising variable-speed dynamos. (14/1/28.)
309 645 W. Fennell. Prepayment meters. (23/1/28.)
284 333 Siemens and Halske Akt.-Ges. Automatic telephone systems. (29/1/27.)
284 334 Siemens and Halske Akt.Ges. Automatic telephone systems. (29/1/27.)
284 335 Siemens and Halske Akt.-Ges. Automatic telephone systems. (29/1/27.)
309 652 Walker, Hunter and Co., Ltd., and J. Walker. Doors for electrically-heated ovens. (28/1/28.)
309 653 Walker, Hunter and Co., Ltd., and J. Walker.—Heating-elements, particularly for electrically-heated ovens. (25/10/28.)
288 246 Siemens and Halske Akt.-Ges. Luminous reproductions of circuits. (6/4/27.)
287 895 Dr. C. F. Von Siemens, Dr. H. Von Siemens, and Dr. A. Franke (trading as Siemens and Co., Geb.). Process for manufacturing dynamo brushes. (29/3/27.)
309 669 J. H. Runbaken. Electric lighting systems of motor-cycles and the like. (15/10/28.)
309 670 Coventry Automatic Telephones, Ltd., and C. W. Wilman. Automatic or semi-automatic telephone systems. (16/2/28.)
309 681 J. A. Crabtree. Electric switches. (29/2/28.)
309 688 A. L. Davis. Electric lamps. (2/3/28.)
309 690 Wolseley Motors (1927), Ltd., and O. Boden. Dynamos for use on motor vehicles. (3/3/28.)
289 424 De Forest Phonofilms, Ltd. Construction of cathodes for electric discharge devices. (27/4/27.)
309 698 Revo Electric Co., Ltd., and F. H. Reeves. Electric fans. (10/3/28.)
309 699 G. Meikle. Electromagnetic switches. (10/3/28.)
287 089 British Thomson-Houston Co., Ltd. Electric vacuum tubes. (14/3/27.
309 704 W. Layhausen. Overload circuit-breaker. (19/3/28.)
309 711 Relay Automatic Telephone Co., Ltd., and B. B. Johnston. Automatic telephone systems. (21/3/28.)
309 714 General Electric Co., Ltd., and W. Manchester. Electric switches. (23/3/28.)
309 720 Automatic Telephone Manufacturing Co., Ltd., and P. N. Roseby. Protective arrangements for electrical heating-apparatus. (26/3/28.)
309 721 Ceag, Ltd., and R. J. Plummer. Safety electric lamps. (28/3/28.)
309 733 S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). Electric discharge tubes. (10/4/28.)
309 748 Lissen, Ltd., and R. P. Richardson. Variable-electric condensers. (27/4/28.)
301 792 I. E. McCabe. Mercury-tube switches. (5/12/27.)
309 766 T. W. Ross and Associated Electrical Industries, Ltd. Protective gear for alternating electric current systems. (22/5/28.)
291 105 Westinghouse Electric and Manufacturing Co. Photographic recording and reproduction of sound. (26/5/27.)
309 772 J. Andvig. Fastening-devices for electrical leads or conductors. (30/5/28.)
292 949 R. B. Hunter. Controllers for electric motors. (27/6/27.)
309 780 Siemens-Schuckertwerke Akt-Ges., K. Kurda, W. Wernicke, and C. Oertel. Tap-changing switches for electric transformers. (10/6/28.)
294 887 International General Electric Co., Inc. Electric lamp holders. (30/7/27.)
296 069 Associated Telephone and Telegraph Co. Telephone systems. (14/3/27.)
296 070 Associated Telephone and Telegraph Co. Telephone systems. (14/3/27.)
299 394 British Thomson-Houston Co., Ltd. High-tension cables. (25/10/27.)
299 472 Marconi's Wireless Telegraph Co., Ltd. Aerial systems. (28/10/27.)
299 814 Associated Telephone and Telegraph Co. Telephone systems. (25/5/27.(
302 238 Electrical Research Products, Inc. Television systems. (6/4/27.)
302 240 Electrical Research Products, Inc. Television systems. (6/4/27.)
309 436 A. E. White (Bastian-Morley Co.). Electric apparatus for heating liquids. (10/10/27.)
309 529 K. Mayer. Rontgen diaphragm. (11/10/27.)
304 218 Trub, Tauber and Co., and A. Imhof. Device for feeding low-tension measuring-instruments from high-tension systems. (10/8/27.)

Applications for Patents.

March 9th.

7 750 General Electric Co., Ltd. Power apparatus for dairy farms.
7 751 General Electric Co., Ltd. Control apparatus for electric power devices.
7 720 H. Lewis. Automatic electric switch for fire alarms, etc.
7 729 Dr. S. Loewe. Multiple electron tubes. (9/3/28, Germany.)
7 757 W. G. Patterson and Siemens Bros. and Co., Ltd. Telephone systems.
7 780 Siemens and Halske A.G. Distant control apparatus. (10/3/28, Germany.)
7 739 J. R. Stevenson. Mountings for electric switches, etc.

March 11th.

7 909 R. Ambroun. Electrically exploring the ground. (20/3/28, Germany.)
7 947 Associated Electrical Industries, Ltd. Elevators, etc. (15/3/28, U.S.)
7 798 J. D. Bernal. Apparatus for electrical transmission of pictures.
7 929, 7 932 R. F. Collinson. Apparatus for electrical transmission of pictures.
7 955 A. Davis. Burglar alarms, etc.
7 974 J. C. N. Eastick and C. W. Loveridge. Electrical insulators, etc.
7 852 Eclipse Machine Co. Electric apparatus. (13/3/28, U.S.)
7 912 Elevator Supplies Co., Inc., and H. W. Shonnard. Electric door operator.
7 948 W. E. Evans (Allgemeine Elektricitats Ges.). Electric cut-outs.
7 937 E. A. Fagerlund and H. T. Tillquist. Electric switch.
7 878 Fiat Soc. Anon. Transmission gearing for driving electric dynamos. (12/12/28, Italy.)

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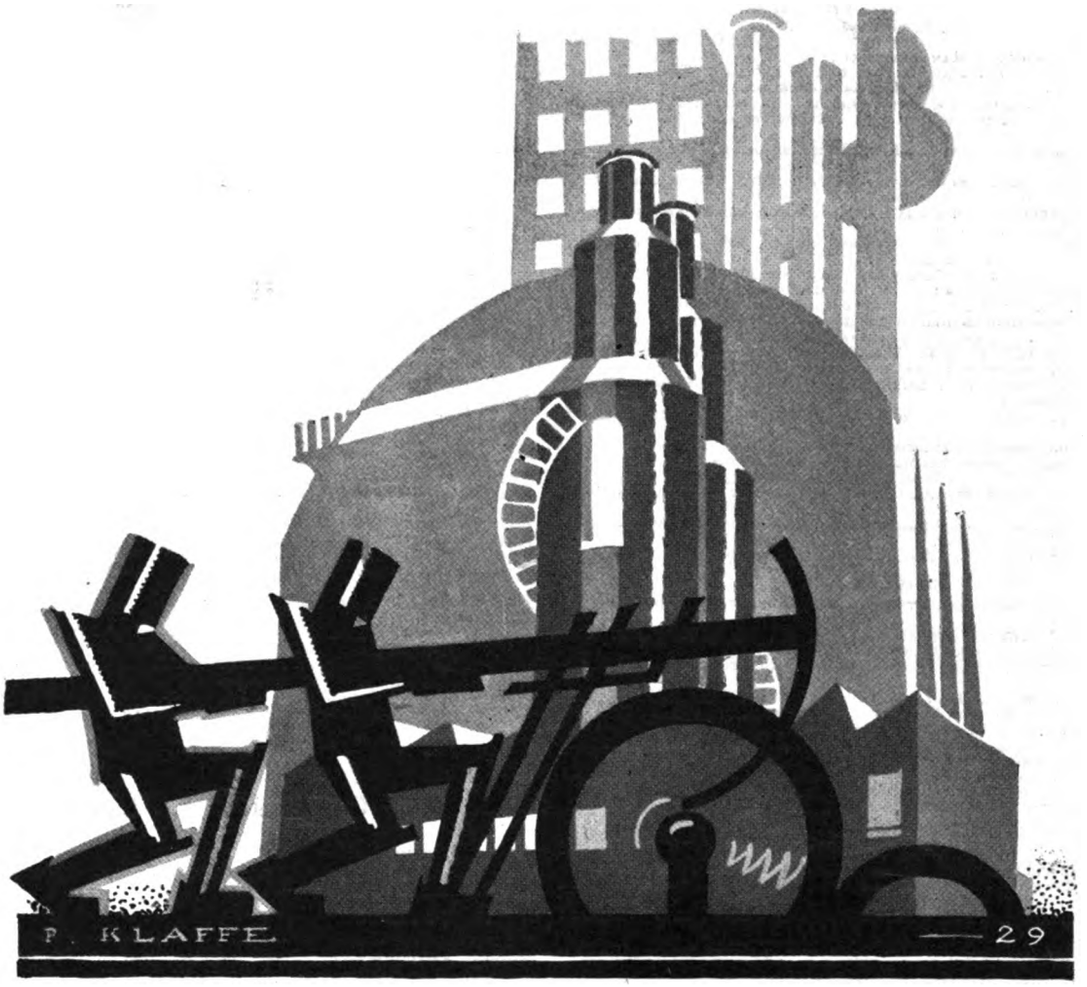
HACKBRIDGE TRANSFORMERS FOR THE MAIN LOAD OF THE METROPOLIS



The Hackbridge Electric Construction Co., Ltd., has received an order from the Central Electricity Board for over half a million of kVA of Transformers for the London Area Stations. The units are 45,000 kVA and 30,000 kVA capacity and are fitted with On Load Tap Changing Equipment.

Advertisement of the Hackbridge Electric Construction Co., Ltd., Walton-on-Thames, Surrey.

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7 794 A. V. Garrod. Electric heaters for hair waving.
7 906 J. Hallet. Electric hair brush.
7 928 I.G. Farbenindustrie A.G. Increasing conductivity of electric arc atmospheres, etc. (14/3/28, Germany.)
7 927 J. B. Langley and J. R. Spink. Variable resistances.
7 968 K. E. Latimer and Standard Telephones and Cables, Ltd. Telephone transmission systems.
7 873 G. and J. T. Nichols. Wireless apparatus.
7 882 H. S. Ryland and J. Vielle. Connecting light sensitive devices.
7 883 H. S. Ryland and J. Vielle. Light sensitive cells.
7 939 E. Savill. Holders for flexible conductors.
7 890 F. S. Smith. Cooling means for insulated electrodes.
7 977 Standard Telephones and Cables, Ltd. (C. Chechelovsky and C. Lardot). Electromagnetic relays.
7 970, 7 971, 7 972 Standard Telephones and Cables, Ltd. (G. Deakin). Telephone exchange systems. (13/6/28.)
7 872 Telefonaktiebolaget L. M. Ericsson. Circuit arrangements of coupling transformers. (13/3/28, Sweden.)
7 905 Telefonaktiebolaget L. M. Ericsson. Load regulating systems in electric installations. (14/3/28, Sweden.)

March 12th.

8 100 Alloy Welding Processes, Ltd. Electrodes for arc welding, etc. (12/3/28, France.)
8 032 T. Aoyagi. Electric space heaters.
8 107 Associated Electrical Industries, Ltd., and E. Barlow. Laminated structures for dynamo-electric machines.
8 077 Automatic Telephone Manufacturing Co., Ltd., and C. E. Beale. Automatic switches for telephone systems, etc.
8 078 Automatic Telephone Manufacturing Co., Ltd., and T. R. Rayner. Voltage control equipment for electrical apparatus.
8 039 C. R. Belling, H. J. Osborn, and A. Wright. Electromagnetic devices.
8 056 British Thomson-Houston Co., Ltd. Alternating current transformers. (12/3/28, U.S.)
8 057 British Thomson-Houston Co., Ltd. Detection of high frequency oscillations.
8 058 British Thomson-Houston Co., Ltd., and F. J. Lane. System for indicating fault location on transmission lines.
8 049 Dubilier Condenser Co. (1925), Ltd. Electric valves for amplifying. (12/3/28, Germany.)
8 026 F. H. Farrer and Villier's Engineering Co., Ltd. Electric lighting systems.
8 112 Felten and Guilleaume Carlswerk A.G. Submarine cables. (11/4/28, Germany.)
8 082 H. Fischer, W. Kunze, and Radiofrequenz Ges. Means for switching current consuming units from main voltage. (7/1/29, Germany.)
8 022 R. H. Freestone. Coin-controlled electric circuits, etc.
8 016 T. Harden and H. A. Mepham. Sheathing lead-covered cables.
8 057 T. H. Kinman. Detection of high frequency oscillations.
8 043 N. V. Philips' Gloeilampenfabrieken. Manufacture of incandescent bodies. (13/4/28, Holland.)
8 044 N. V. Philips' Gloeilampenfabrieken. Electrolytic rectifiers. (13/4/28, Holland.)
8 005 C. Pressland. Iron-cored inductances, etc.
8 068 H. R. Rounebeck. Means for producing electric currents.
8 081 L. F. Savage. Mains supply unit for wireless apparatus, etc.
8 063 Siemens-Schuckertwerke A.G. Switch apparatus for distributing systems. (25/5/28, Germany.)
8 064 Siemens and Halske A.G. Arrangement for coupling rotating parts in correct phase. (14/3/28, Germany.)
8 065 Siemens and Halske A.G. Transformers. (14/3/28, Germany.)

March 13th.

8 214 Alloy Welding Processes, Ltd., and E. J. Clarke. Electrodes for arc welding, etc.
8 209 Associated Electrical Industries, Ltd., and E. Y. Robinson. Grid electrodes of vacuum electric tubes.
8 180 R. W. Biles and A. Reyrolle and Co., Ltd. Electric protective arrangements.
8 127 British Brass Fittings, Ltd., and A. Logan. Electric immersion heaters.
8 203 British Thomson-Houston Co., Ltd. Electric heating. (3/5/28. U.S.)
8 156 W. A. Burns. Casing for portable wireless receivers.
8 170 D. A. Christian, C. L. Peters, and Siemens Bros. and Co., Ltd. Automatic telephone systems.
8 172 Elliott Bros. (London), Ltd., and G. F. Shotter. Current transformers.
8 228 H. Elsner. Accumulators. (17/3/28, Germany.)
8 149, 8 150 J. H. Erskine, Falkirk Iron Co., Ltd., H. J. Kennard and A. Kinnes. Electric cooking apparatus.
8 160 Felten and Guilleaume Carlswerk A.G. High tension cables. (22/3/28, Germany.)
8 169 E. J. Gachet and Siemens Bros. and Co., Ltd. Electrical contacts.
8 171 W. E. Goodwin and Siemens Bros. and Co., Ltd. Transmitters for telephone systems.
8 238 L. B. Haigh and Standard Telephones and Cables, Ltd. Telephone systems.
8 201 International General Electric Co., Inc. Electric relays. (13/3/28, Germany.)
8 116 Loewe Radio Ges. Radio receiver supply unit for electric mains. (23/1/29, Germany.)
8 153 C. Michahelles. Switch system for electrical apparatus. (13/3/28, Germany.)
8 216 N. V. Philips' Gloeilampenfabrieken. Voltage indicators. (14/4/28, Holland.)
8 247 J. P. Naylor. Reflectors for electric lamps.

March 14th.

8 324, 8 325 British Thomson-Houston Co., Ltd. Manufacture of dynamo-electric machines. (14/3/28, U.S.)
8 294 P. Doig. Telephone and signal system for fire alarm, etc.
8 300 G. F. Dutton. Loud speaking telephones.
8 350 Electrical Research Products, Inc. Electro-magnetic devices. (13/5/27, U.S.)
8 383 L. Emanueli and Pirelli General Cable Works, Ltd. Electric cables.
8 312 Ferranti, Ltd., and J. Turner. Electrical condensers.
8 363, 8 304 M. Gill. Electrical apparatus for production of sound.
8 357 J. Gunning. Automatic time-control-switches, etc.
8 332 A. E. Heath. Wireless receiving sets.
8 377 G. Thornton-Norris. Time controlled switch devices.
8 356 Siemens-Schuckertwerke A.G. Fastenings for electric installation fittings. (23,11/28, Germany.)
8 331 Siemens and Halske A.G. Transmitter for printing telegraphs. (23/3/28, Germany.)
8 365 Siemens and Halske A.G. Resistances.
8 280 G. Turncock. Cord grip for lamp holders, etc.
8 372 E. J. Ward-Watkinson. X-ray apparatus.
8 399 G. P. L. Wells. Electric lampholders.

March 15th.

8 463 A. E. Angold and General Electric Co., Ltd. Electric switches.
8 443 J. D. Bernel. X-ray tubes.
8 483 British Talking Pictures, Ltd., and W. A. Chambers. Coupling thermionic valves.
8 506 W. R. Bullimore. Thermionic valves.
8 447 G. F. Dutton and Siemens Bros. and Co., Ltd. Transmitters for telephone systems, etc. (24/8/28.)
8 462 A. H. Howe. Manufacture of thermionic valves.
8 428 E. V. Hudson. Electric switches.
8 518 W. Lambert, J. Stone and Co., Ltd. and R. W. Wild. Electrolytic deposition of metal.
8 425 Dr. S. Loewe. Manufacture of glowing cathode for electron discharge device. (16/3/28, Germany.)
8 525 Marconi's Wireless Telegraph Co., Ltd. Radio receiving systems. (15/3/28, U.S.)
8 513 A. Preen. Adjusting devices for radio instruments.
8 526 Seabrook Accessories Co., Ltd., and R. Silver. Electric batteries.
8 470 Siemens and Halske A.G. Arrangement for alternate connection of testing circuits, etc. (16/3/28, Germany.)
8 454 A. J. E. Welch. Indicators for orienting portable wireless receivers.
8 455 A. J. E. Welch. Accumulators.

March 16th.

8 549 British Insulated Cables Ltd. and J. L. Packer. Electric cables.
8 567 W. S. Burge and C. E. Jones. Electric cooking apparatus.
8 596 A. Della Riccia. Automatic operation of controllers of electric traction outfits, etc.
8 547 S. Hemsley. Electric lighting apparatus.
8 610 Mullard Radio Valve Co., Ltd., and C. R. G. Waite. Thermionic valves.
8 504 J. E. Noeggerath. Electrolyser. (16/3/28, Germany.)
8 579 F. E. Raike. Electric switch.
8 619 S. W. Sambouroff. Electromagnetic separation.
8 580 Soc. de Constructions d'Appareils Mecaniques et Electriques pour Automobiles. Electrodes. (16/3/28, France.)
8 582 Western Electric Co., Ltd. (Bell Telephone Laboratories, Inc.). Telephone transmission.

March 18th.

8 713 Associated Telephone and Telegraph Co. High frequency telephone systems. (30/3/28, U.S.)
8 711 British Thomson-Houston Co., Ltd. Signalling systems. (17/3/28, U.S.)
8 679 E. H. Croft, General Electric Co., Ltd., and A. C. Price. Electric power supply systems.
8 715 S. G. S. Dicker (N. V. Philips' Gloeilampenfabrieken). Low frequency resistance amplifiers.
8 680 General Electric Co., Ltd., and R. J. Kaula. Electric coupling elements.
8 699 C. Hanel. Electrically operated automatic delivery machines.
8 639 J. H. O. Harries. Reception of signals by wireless, etc.
8 657 J. H. O. Harries. Television, etc.
8 661 J. Jerike. Electric iron conductor support.
8 636 Dr. S. Loewe. Manufacture of mains heated cathodes for electron valves. (19/3/28, Germany.)
8 765 A. H. Midgley. Electrical apparatus.
8 714 N. V. Philips' Gloeilampenfabrieken. Wehnelt cathodes. (13/4/28, Holland.)
8 662 W. G. Pipkin. Electric terminals.
8 690 A. A. Price. Frame aerials.
8 693 Standard Telephones and Cables, Ltd. (W. Hatton, C. de Uriendt and E. J. Rousseau). Telephone exchange systems.
8 678 M. Surjaninoff. Induction motors. (28/3/28, Austria.)

March 19th.

8 794 H. P. H. Anderson. Electrical connector, etc.
8 836 H. C. Atkins and A. Reyrolle and Co., Ltd. Electric protective arrangements.
8 859 W. O. A. W. Baggally. Electrical reproduction of sound.
8 935 C. B. Bartley and V. H. Dake. Electromagnetic devices. (19/3/28, U.S.)
8 839 T. W. Bennett and G. A. Eagles. Electric switches.
8 894 British Thomson-Houston Co., Ltd. Electric protective devices. (19/3/28, U.S.)
8 895 British Thomson-Houston Co., Ltd. Magnetic insulating materials. (19/3/28, France.)
8 807 P. Burns. Electrically interlocked railway system.
8 808 J. H. O. Harries. Reception of wireless signals, etc.
8 833 T. O. Harries. Apparatus for generating power from tides.
8 794 A. Henderson. Electrical connector, etc.
8 853 G. C. and P. A. Lundberg and A. P. Lundberg and Sons, Ltd., and G. Pegg. Contact tubes for electrical connectors, etc.

COMING EVENTS.

Monday, June 3rd.

Incorporated Municipal Electrical Association.—Torquay Annual Convention. President's Reception. 8.15 *p.m.*

Tuesday, June 4th.

Incorporated Municipal Electrical Association.—Torquay. Annual Convention. Presidential Address by Mr. A. Nichols Moore. Paper on "Whitleyism in the Electric Supply Industry," by Ald. W. Walker. 10 *a.m.* Official visit to Exhibition, 2.30 *p.m.* Reception by Mayor and Mayoress of Torquay, 8.30 *p.m.*

Electrical Contractors' Association (Derby Branch).—Ordinary meeting. 5 *p.m.*

Electrical Contractors' Association (Bournemouth Branch).—Ordinary meeting.

Electrical Development Association (North Midland Area). Third Area Sales Conference, 45-53, Sunbridge Road, Bradford. Paper by Mr. C. E. Allsopp on "The Development of the Electric Cooker."

Wednesday, June 5th.

Incorporated Municipal Electrical Association.—Torquay. Paper by Mr. J. H. Rothwell on "Some Notes on Recent High Court Cases in Connection with the Generation and Supply of Electricity." 10 *a.m.* Paper by Mr. G. Porter on "The Heavy Oil Engine and its Application in Electricity Supply Undertakings." 2.30 *p.m.*

Polytechnic School of Engineering.—307-311, Regent Street, London. Lecture IV. (course of six lectures) on "Thermionic Valves," by Mr. W. H. Date. 6.30 *p.m.*

Electrical Contractors' Association (Irish Branch).—Dublin. Ordinary Meeting.

Electrical Contractors' Association (London Branch).—Committee Meeting.

Electrical Contractors' Association (Cardiff Branch).—Ordinary Meeting. 2.30 *p.m.*

Electrical Contractors' Association (Bath Sub-branch).—Ordinary Meeting.

Thursday, June 6th.

Incorporated Municipal Electrical Association.—Torquay. Paper by Mr. E. J. Jennings on "Standardisation of Methods of Charge." 10 *a.m.* Women's Day.—Lecture by Miss M. Partridge on "Women's Work in Connection with Rural Electrification in Devonshire." 10.45 *a.m.*, followed by visits to Longpark Pottery Co. and Widecombe-in-the-Moor.

Electrical Contractors' Association (Newcastle Branch).—Ordinary Meeting. 11 *a.m.*

Electrical Contractors' Association (Bristol Branch).—Ordinary Meeting. 3.15 *p.m.*

Friday, June 7th.

Incorporated Municipal Electrical Association.—Torquay. Annual General Meeting. 10.30 *a.m.*

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THE ELECTRICIAN

Established 1861. The Oldest Weekly Illustrated Journal of

Electrical Engineering, Industry, Science and Finance.

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[Closed on Saturdays in accordance with the "Five-Day Week" plan adopted by Benn Brothers, Ltd., and its associated organisations.]

No. 2662. [No. 23. Vol. CII.] Friday, June 7, 1929. Annual Subscription, 25s. Overseas, 30s.

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Current Topics.

Importance of Distribution.

THE dominant feature in Mr. NICHOLS MOORE'S I.M.E.A. Presidential Address was the author's insistence on the need for a properly co-ordinated scheme of distribution on some national basis as broad in its conception and as practical in its application as the national scheme of generation and main transmission. This is not, of course, the first time the importance of the matter has been ventilated, but it evidently needs constant repetition if some of those who are engineers "first, last and all the time," are to realise the personal import of the changes that are almost imperceptibly, but inevitably, taking place in the electricity supply field. The day of the "juice merchant '—to use a "Purseism "—quickly draws nearer, and as it approaches the scope for the purely generating engineer will be correspondingly diminished. We do not think for a moment that this change will detract from the interest of work in the supply industry, for there are many technical considerations connected with present and future distribution practice which will provide ample opportunity for the exercise of ingenuity. But there must also be revolutionary development on the sales side to permit the fullest possible use of the facilities which co-ordinated generation, transmission and distribution will make universally available. The sooner supply engineers as a whole busy themselves in considering these questions the better equipped will they be when the not far distant time arrives for them to deal with them in a practical way. Few of our readers can have been surprised at Mr. NICHOLS MOORE'S outspoken expression of opinion on the work of the Electric Fittings Statutory Committee, as disappointment at its apparently negative policy has more than once been the subject of remark in these columns. While one reason is to be found in the difficulty which the Committee appears to have experienced in reaching agreement as to its main functions, there are two other factors outside the Committee itself which have acted as a brake on progress. One is the slowness of some of the local authorities in making use of the provisions of Sec. 48 of the 1926 Act, which conferred trading powers on those undertakings which did not already possess them. The other feature, the existence of which we should beg leave to doubt if the statement were not made with such authority—is what Mr. NICHOLS MOORE described as "the disinclination of the contracting interests to give full effect within the Committee and outside to the definite intentions which were clearly conditions precedent to the acceptance of the Section." We have no wish to take sides in this matter; there should be no sides on a matter which is the subject of an "agreed" clause. We will merely say to the obstructionists on the contractor's side that the old municipal trading hatchet was buried with their consent, and that even moral obligations are worthy of observance; and to some municipalities, that in accepting the "agreed" clause the contractors voluntarily sacrificed a principle for which they had fought long and strenuously, and that they are for this, if for no other reason, deserving of sportsmanlike treatment.

The I.M.E.A. Exhibition.

THOSE visitors to Torquay who have not yet visited the exhibition being held in the Old Torbay Hospital would be well advised to do so. The majority of the stands include a number of new items, descriptions of which are given elsewhere in this issue. The exhibition as a whole gives one the impression that manufacturers have considerable hopes of developing the water heating side of domestic sales, for the number of electric storage water heaters to be seen, is, if we remember rightly, larger than was the case last year. Electric washers and boilers are also well in evidence, and since many supply authorities include these appliances in their hiring schemes, this is as it should be. Many of these devices are shown for the first time, and those visitors to the convention who are members of electricity committees should, with their engineers, make a special point of acquainting themselves with the progress made in the manufacture of this class of labour-saving appliance. The industrial exhibits, which are probably of more concern to the technical visitor, are also of interest, for many of them have not been exhibited before, while the E.D.A. and E.L.M.A. also offer much of educational value to those connected with undertakings with window and showroom facilities. The lady visitors should make a special point of calling at the exhibit of the Electrical Association for Women, where they will learn how, by joining the Association, they can best serve the cause of electrical development, and at the same time enter into the social activities of the association. After attending at the meetings and entering into the discussions, a visit to the exhibition will prove to be, not only a contrast, but

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a change in occupation likely to bring one closer in touch with the apparatus and equipment available for developing and improving individual opportunities.

The General Election.

THE one certain result of the General Election is the formation of a Labour Government. The uncertain factor is how long the Labour Party, now the largest single party in the House of Commons for the first time in its history, will govern the country. That will depend upon the nature of the measures which its members may introduce, for they are in a minority of the whole House and can be out-voted if any act of theirs outrages the feelings of the other two parties. For the present, however, the business world has got to face a change of Government and to adapt itself to different conditions from those under which it has laboured for nearly five years. There has been a very natural fear among business men that the absence of a clear majority for any one of the three parties may precipitate a second General Election within a few months. That would be a very disturbing factor to trade and industry, and there is a certain reassurance in the efforts attributed to more than one of the party leaders to ensure that there shall not be another appeal to the country for at least two years.

The View of the Business Man.

THE average man of business takes the view that a very definite responsibility rests upon the politicians to make the Constitution work, notwithstanding the obstacles which the three-party system of their own invention has put in the way of its effective operation. If trade and industry are to have a fair opportunity to develop and expand, moderation in speech and action is demanded from the representatives of the nation sitting at Westminster, and more particularly from the new Government and their supporters. It would be idle to deny that there are elements of anxiety in the position. A change of Government, with the substitution of one set of principles for another, can have a very decided influence on the course of business in Great Britain. If the business man faces the future with fortitude, it is not on account of the success or failure of any political party but because of his belief in himself and in the ability and courage of his associates.

The B.I.F.

THOUGH these are early days in which to speak of the next British Industries Fair, it is nevertheless interesting to note that arrangements for the forthcoming Heavy Section of the Fair are even more advanced than at the corresponding stage of the organisation for the last Fair. It was reported at a meeting of the Council last week that more than 60% of the space has already been let, and the reason for the present advanced state of the booking was said to be found in the fact that the period at which current exhibitors could exercise their option to retain the same sites was on this occasion limited to some ten weeks after the close of the last show. It is understood that approximately one-fifth of the firms have already taken advantage of the opportunity now offered to secure their stands for five consecutive years. This early reservation of the major portion of the space greatly facilitates a policy of grouping kindred industries which was put partly in operation last February, and which is to be considerably extended in 1930. Meanwhile, as we have already pointed out, there is still the question of the date of future fairs.

Floodlighting Stained Glass.

THE scheme, referred to in our last issue, of floodlighting the stained glass windows at Stationers' Hall, London, offers a number of suggestions which should not escape the lighting engineer. Throughout the country there must be many beautiful windows which, through lack of some special lighting scheme, cannot in every case be fully appreciated even during hours of daylight, and which, in consequence, do not receive the admiration they deserve. We have in mind as one practical application of a general scheme the floodlighting of church windows, for, though we are, almost every week, hearing of extensive lighting schemes being installed within such buildings, none of them, to the best of our knowledge, makes any special effort to reveal the beauty of the windows to those attending the services. We suggest that this form of lighting and the development of some scheme for its general adoption receive the careful consideration of the E.L.M.A., which, with its wide experience and ability to make the most of any lighting opportunity brought to its notice, could no doubt do much to promote further sales in floodlight equipment and high wattage lamps. Demonstrations of the effectiveness of floodlighting stained glass could possibly be arranged at many of the London churches, the attention of the congregations could be drawn to the displays, and since the cost of such installations is relatively small, their adoption may become widespread. Incidentally, electricity might thus get to its credit the much-needed revival of public interest in stained glass.

Electrical Patents.

SOME interesting details relating to the activity in inventions during 1928 are given in the annual report of the Comptroller-General of Patents, Mr. W. S. JARRATT. The main activity was in connection with the development and improvement of loud speakers, electrical reproducing equipment, and apparatus concerned with "talkie" films. The Central Electricity Board appears to have had a marked effect on the development of high tension distribution equipment, a large number of applications for protective systems and switchgear being recorded. Picture transmission, both by wire and wireless, was responsible for considerable activity, while automatic telephony, television, and electrically-driven gramophones have all made their mark. In spite of an increase in applications for patents of 3 087 when compared with the last report, the number of trade marks registered decreased by 715. It is interesting to note that the total number of applications received by the Patent Office during 1928 was the largest for any year in the history of the department. These figures show that though in present practice the various electrical designs installed for commercial purposes appear to give every satisfaction, they will in a few years' time become obsolete and uneconomical. Equipment in connection with television, the talking film, etc., is changing in design almost daily, but since a large percentage of the patents applied for concern high tension switchgear it may be assumed that activity in our research laboratories is not confined to any one particular interest.

An Electrical Achievement.

AN interesting example of the progress made with the transmission of pictures by wire and wireless, and perhaps one of the most remarkable feats of its kind, was accomplished recently when a photograph of the scene of the hospital disaster at Cleveland, Ohio, was sent to Berlin. The first stage of its journey, from Cleveland to New York, some four hundred odd miles, was accomplished over the land telephone line by means of an American system of picture transmission. The three thousand odd miles from New York to this country were covered by the "beam" wireless service, an entirely different method of reproduction, the Marconi, being used. From London to Berlin the picture was sent by the Fultograph process, the final six hundred miles of the journey being made over telephone lines and the submarine cable. The photograph was sent for a group of newspapers in Germany, and the fact that after having been handled by three quite different methods of transmission, the picture was still suitable for reproduction is a tribute to the efficiency to which the sending of pictures by electrical means has now been brought. The relaying of the picture over all three stages without undue distortion was a performance with which the electrical engineering world may be justly pleased.

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THE I.M.E.A. CONVENTION.

Heavy Oil Engines—Legal Problems—Standardisation of Tariffs—Whitleyism in the Supply Industry.

A Full Report of the Association's Thirty-fourth Annual Conference at Torquay this Week.

ALL previous records were broken by the attendance at the thirty-fourth annual convention of the Incorporated Municipal Electrical Association which opened in the delightful surroundings of Torquay on Monday and continued until to-day.

As nearly 900 delegates had arrived over the week-end, the attendance at the President's reception on Monday evening was phenomenally large, and it was evident that this was to be a record I.M.E.A. Convention.

As usual, a number of special lighting effects were provided by electrical manufacturing firms, but such efforts, splendid as they were, were probably the less remarkable to the local residents by reason of the ambitious decorative lighting effects which have been developed by Mr. H. F. G. Woods as a permanent attraction.

Despite the comparative coldness of the weather at the beginning of the week, many of the visitors turned out for an early morning swim each day.

The Convention proper opened on Tuesday morning, when the Association was given a civic welcome by the Mayor of Torquay. Mentioning that the delegates to a recent conference at Torquay had derived from it sufficient energy to form the largest political party in the land and to cause the Government to resign, he thought it not improbable that municipal electrical engineers might cause similar action on the part of their electricity committees. Speaking as an engineer and a lawyer, he thought the Electricity Act of 1926 might provide a good deal of future work for lawyers. He was glad to say that Torquay was one of the few parts of England over which the tentacles of the grid had not spread their devastating influence.

Mr. A. Nichols Moore then read his Presidential Address, which furnished considerable food for thought, and drew special applause for his linguistic ability in reference to a German organisation.

Ald. W. Walker's paper on "Whitleyism in the Electrical Industry" was next read and discussed, the discussion being particularly noteworthy by reason of the fact that the whole of the speakers were committee members.

Tuesday afternoon was spent in an official visit to the Electrical Exhibition in the Old Torbay Hospital. The general opinion of the visitors was that it was, if possible, a better show than ever, but one heard many "asides" concerning the dim, religious lighting of the corridors, while some of the exhibitors were full of practical knowledge of the surprisingly high lighting voltages needed to make an effective show in an exhibition area from which daylight is not excluded.

In the evening there was a reception by the Mayor and Mayoress of Torquay at the Town Hall.

Two papers were read and discussed at Wednesday's morning session, when Mr. J. H. Rothwell gave "Some Notes on Recent High Court Cases and Current Legal Problems in Connection with the Supply of Electricity." Mr. G. Porter then gave a very interesting account of "The Heavy Oil Engine and Its Application in Electricity Supply Undertakings."

Thursday morning was devoted to the reading and discussion of Mr. E. J. Jennings's paper on "Standardisation of Methods of Charge." Special provision was made for the ladies, who had a morning meeting, at which Miss M. Partridge described "Women's Work in Connection with Rural Electrification in Devonshire." The annual dinner was held on Thursday, and the annual general meeting on Friday morning.

PREVIOUS I.M.E.A. CONFERENCES.

Year.	President.	Place.
1896.	*Mr. Arthur Wright*	*Brighton.*
1897.	*Mr. C. H. Wordingham*	*Manchester.*
1898.	*Mr. A. H. Gibbings*	*London.*
1899.	*Mr. H. Faraday-Proctor*	*Bristol.*
1900.	*Mr. A. B. Mountain*	*Huddersfield.*
1901.	*Mr. W. A. Chamen*	*Glasgow.*
1902.	*Mr. J. H. Rider*	*London.*
1903.	*Mr. John F. C. Snell*	*Sunderland.*
1904.	*Mr. T. P. Wilmshurst*	*Derby.*
1905.	*Mr. F. A. Newington*	*Edinburgh.*
1906.	*Mr. J. E. Edgecombe*	*Kingston-on-Thames.*
1907.	*Mr. S. E. Fedden*	*Sheffield.*
1908.	*Mr. H. Talbot*	*Nottingham.*
1909.	*Mr. S. L. Pearce*	*Manchester.*
1910.	*Mr. W. W. Lackie*	*Glasgow.*
1911.	*Mr. J. Christie*	*Brighton.*
1912.	*Mr. G. Wilkinson*	*Harrogate.*
1913.	*Mr. C. E. C. Shawfield*	*London.*
1914.	*Mr. R. A. Chattock*	*Birmingham.*
1915.	*Major H. Richardson*	*London.*
1916.	*Mr. A. C. Cramb*	*London.*
1917.	*Mr. F. M. Long*	*London.*
1918.	*Mr. S. J. Watson*	*Manchester.*
1919.	*Mr. Frank Ayton*	*Ipswich.*
1920.	*Mr. Thomas Roles*	*Bradford.*
1921.	*Major H. Richardson*	*London.*
1922.	*Mr. S. T. Allen*	*Wolverhampton.*
1923.	*Lt.-Col. W. A. Vignoles*	*Scarborough.*
1924.	*Mr. S. E. Britton*	*Chester.*
1925.	*Mr. W. C. P. Tapper*	*Brighton.*
1926.	*Mr. R. B. Mitchell*	*Glasgow.*
1927.	*Mr. R. W. L. Phillips*	*Buxton.*
1928.	*Mr. F. W. Purse*	*Bath.*

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PRESIDENTIAL ADDRESS.

Supply Undertakings and the Cost of "Grid" Switchgear—Work of the Electric Fittings Statutory Committee—A National Co-ordinated Distribution Policy Advocated—Rationalisation not Nationalisation.

THE business of the Convention opened on Tuesday morning, when Mr. A. Nichols Moore (borough electrical and tramways engineer of Newport), read his presidential address.

The work of the Association during the past year had, he said, not been distinguished by any new matters of outstanding importance to the future of the electricity supply industry. The past year had, nevertheless, been an exceedingly busy one, and the work of the Association had steadily increased in both volume and variety.

The Mayor and Mayoress of Torquay who held a reception at the Town Hall on Tuesday.

Possibly none of these allied associations was of greater importance to the future of the electricity supply industry than the British Electrical Development Association, in the formation of which the I.M.E.A. took a leading part. It could only raise for publicity and propaganda, in an industry which on the supply side alone represented a subscribed capital of some £350 000 000, the paltry sum of £40 000 per annum, and until it was financially stronger it was unable to fulfil its essential purpose in the electricity supply industry. The President therefore urged those municipal electricity authorities who had so far declined to subscribe to reconsider their decision and give the Association their active support.

Referring to the British Electrical and Allied Industries Research Association, Mr. Nichols Moore submitted that electrical research was never of such importance as it was to-day, and the Research Association was deserving of greater support.

The Electrical Association for Women needed little commendation for support. It had rich possibilities for service and, under the directorship of Miss Haslett, was making progress much greater than some anticipated or believed possible.

Two other associations to which the President made a passing reference were the British Engineering Standards Association and the Conjoint Conference of Public Utility Associations. The work of the former was so well known that further reference was unnecessary. The work of the other association was not so well known. By tactful and co-ordinated effort the Conference rendered valuable assistance in composing the divergent views and requirements of the various public utility services, and, when the occasion arose, was able to exert a useful influence in legislative work affecting those services.

One matter of great importance to all local authority and private company undertakings whose stations were "selected," and to which during the year the Council had given careful consideration, was the Draft Regulations issued under Section 51 of the Electricity (Supply) Act, 1926, for the technically correct and equitable allocation of production costs between fixed and running costs and for the adjustment of the price in accordance with the power factor.

Another matter arising out of the operation of the Act, and to which the Council had given consideration, was the important issues involved in the provision of the necessary switchgear in all stations to be connected either directly or through secondary lines to the "grid" for controlling the bulk supplies, and for protecting the individual undertaking's existing plant and distribution system.

The technical requirements of this switchgear were such as must in most cases involve heavy capital expenditure, and, in the case of many of the smaller undertakings, quite possibly constituted what was relatively a considerable increase in their capital commitments. The Council had deemed it their duty to take all possible steps to protect the interests of municipal undertakings and to ensure an equitable adjustment in respect to the meeting of the cost.

In the case of those authorities whose stations were "selected" the issue was probably clarified by the provisions of the Act, i.e., the providing of the necessary monies would appear to be an obligation placed upon the Central Electricity Board. It was more in the interests of the vast majority of "non-selected" stations that the Council had deemed it necessary to endeavour to secure from the Central Electricity Board an assurance that, directly or indirectly, undertakings would be relieved of the burden which might otherwise fall upon them.

Referring to the work of the Electric Fittings Statutory Committee, as one who had taken an active part in its deliberations, Mr. Nichols Moore said that the underlying intention of Section 48 of the Act was to confer trading powers upon those undertakings who did not already possess them. It was believed that the inclusion in the Section of an agreed clause, which in a considerable measure was made possible by a friendly compromise between the electricity supply authorities and the Electrical Contractors' Association,

The "scene" at the opening of the Convention in the Pavilion on Tuesday morning, showing the members of the Council assembled.

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would dispose of the long-outstanding differences that existed between them and retarded development.

One would have supposed that, with an agreed clause to work upon and with admirable intentions, the Committee would have been able to achieve in a year some definite progress, and to have found some common basis for giving effective assistance to the industry. In his own personal opinion, the results to date could only be regarded as almost negative in character, for it appeared to him that beyond confirmation of an agreed working constitution little had been done, and indeed it could scarcely be claimed that the Committee was yet in agreement as to its main functions and the duties presumably imposed upon it by the Section.

He held the view that at least one cause for this lack of progress was the disinclination of the contracting interests to give full effect within the Committee and outside to the definite intentions which were clearly conditions precedent to the acceptance of the Section. Whilst it was true that the operation of the Section placed upon local authorities definite statutory obligations to which they must conform, but which were not obligatory upon the contracting interests, it was unreasonable for the latter, as a party to the agreement, to be unwilling to recognise that there was at least a moral obligation upon them to observe, so far as possible, a similar basis in their commercial operations. He was glad that within the Committee now there was apparently a disposition to recognise the necessity for so doing.

At the same time there was evidence that some local authorities also were not yet prepared to give effect to the provisions of the Section, and so avail themselves of the opportunities provided for securing greater development by exercising their trading powers to the fullest extent. Admittedly it was a domestic matter that each undertaking must settle for itself, the adoption of the Section being permissive and not obligatory.

It might be argued that the functions of the Committee were in the main negative, but it must not be forgotten that it was clearly laid down that one duty of the Committee was to advise and assist all concerned as to the method of giving effect to the provisions of the Section. It was difficult to give helpful advice unless there was in the first place an agreed policy and a clear and definite understanding within the Committee.

The avowed objective of those responsible for the introduction of the Bill which became the Act of 1926 was to provide cheaper electricity. Whilst this was one of the intentions in view, it was, the President contended, not the main intention, which was rather to meet the ever-increasing demands of the community by providing adequate supplies of electricity more generally in all parts of the country.

Whether the political assurance of cheaper electricity supplies were likely to be realised within the next few years, if at all, was a matter of opinion. Such results were not possible of complete realisation until legislation had also been enacted upon a collateral basis for the whole system of distribution.

Shortcomings of the 1926 Act.

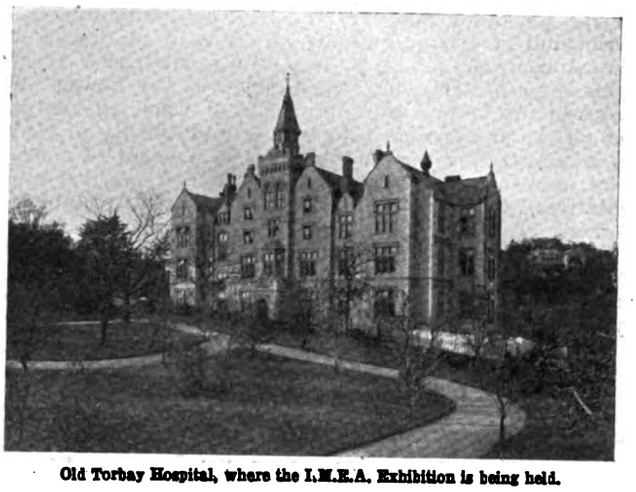
However much the 1926 Act might assist in securing economic generation, it would not alone solve the problem of the provision of an ample and economic supply throughout the country. In what other direction were we to look for an improvement? Now that we were rapidly establishing a system for the national generation of electricity, was it within the realm of practical politics to evolve a scheme as truly national in character and as co-ordinated in practice for distribution?

Municipal authorities were proud that more than half of the electricity supply industry was being municipally financed and developed successfully under municipal control and administration, and to-day it could be shown, generally, that the municipal system had resulted in the provision of adequate supplies at more economic rates than for the most part obtained under private enterprise. Whilst this was so at present, was it a condition that would necessarily continue to obtain?

Encouraged by Parliament, authorised undertakers were greatly extending their electricity areas and obtaining the control of electricity supplies in those areas. The obtaining of these extended areas carried with it great and increasing responsibilities.

In considering upon what terms and conditions a supply should be given in a particular part of an area, would not the local authority have more regard to the financial liabilities and to the beneficial results which might accrue than to the requirements and interests of the extended areas?

Moreover, the local authorities' financing schemes for areas would naturally have considerable regard to the views of those in their own area who provided the security for the loans. These factors made it difficult for local authorities to



Old Torbay Hospital, where the I.M.E.A. Exhibition is being held.

hold a detached view and always act impartially. There was, again, the disadvantage of an ever-changing representation on the local councils, making difficult a continuity of policy.

Another disadvantage under which municipal electricity undertakings laboured is in respect to the administrative policy of the corporate body. An electricity undertaking was essentially a trading concern, and should be regarded strictly as such. Unfortunately, there was a great tendency to-day to treat the undertaking merely as a branch of the corporate organisation, and as such one which must be regulated by the same detailed administrative policy and procedure that governed the non-trading undertakings.

A further consideration which under existing conditions must have a material bearing on the development of electricity supplies, perhaps more particularly in those areas administered by the smaller local authorities, was their disinclination to accept the ordinary commercial risks attendant upon schemes of development that in the early stages must clearly be non-productive.

Another aspect of the problem which must have a deterrent effect upon the speedy and complete development on any national basis of distribution was the very large number of authorised undertakers existing to-day. At the present time there were 667 authorised undertakers independently exercising their powers as distributors, and under two alternative methods of organisation and control.

Whilst all these authorised undertakers would, within a comparatively short period, only be able to obtain their supplies in bulk through the Central Electricity Board, each undertaker would still retain its autonomy as a distributor in matters of policy and administration, in methods of charging, and as to the rates to be charged, restricted only by the statutory maximum and the common law of supply and demand.

Mr. Nichols Moore then suggested that it might be profitable to consider in what direction an improvement in this respect was possible. In other words, was it possible for all existing interests to be merged into a scheme working upon a unified policy, administration and technical direction, and under a central governing control whose aim would be the rationalisation of the electrical supply industry? By "rationalisation" he meant, not the creation of a monopoly or the maintenance of prices, nor the extinction of public and private enterprise as such, but rather the setting up of a community of interests to regulate and develop the industry under efficient and economical conditions. Whilst realising the difficulties, he suggested that such a scheme was within the bounds of practical politics.

It appeared evident that with such a large proportion of the supply industry already under municipal control, the municipal position in any such scheme must be safeguarded. Their right to a general control over their affairs must be retained, but supplemented by a greater freedom and permanency of operation. It was obvious, also, that the whole question must be taken out of the realm of local politics, and that those responsible for the business of distribution must be freed from the necessity to weigh carefully the possible conflict of local

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and personal interests which might be affected by a determined effort to deal with electricity supply on a sound technical and commercial basis.

A similar scheme was already being studied, and in a limited degree tried out, in Germany. The scheme now in operation for the generation and distribution of electricity supplies in Berlin and in a large outlying area was in the hands of a central controlling body, the Berliner Städtische Elektrizitätswerke Atkiengesellschaft, designated the Bewag. The status of this body was in effect that of a holding company, but all the shares were held by the municipality of Berlin. Its administration was in the hands of a board of management, assisted by a supervisory board of municipal representatives, technical experts and representatives of the workers.

One could perhaps visualise the possibilities of holding companies formed for the further development of electricity supplies and especially distribution, financed and controlled by municipalities and possibly private companies interested in distribution in a particular area, and administered by a permanent board of directors who were expert on the technical and commercial sides of the electricity supply industry, and who, together with their supervisory staffs, would in effect be the employees of the holding companies, and not of any individual local authority or private company. Such a plan would facilitate the development of a common continuous policy within a large area, and the control and administration, if not entirely separated from political influence, would at least be permanent and capable of definite and independent action. With such bodies it would obviously be more simple for the Central Electricity Board or other authority to deal, and the control which these bodies would have over distribution within the extended areas, and jointly over all areas, would only be limited by their capacity to deal with the requirements from a national as well as from a local point of view. Such an arrangement would wipe out existing and avoid future overlapping, it must obviously result in economies in both administration and operation.

WHITLEYISM IN THE SUPPLY INDUSTRY.

Conditions before the Adoption of the Scheme—The Strike of 1926—Absence of Critical Disputes—The Management Point of View.

By ALD. W. WALKER.

IN his paper presented on Tuesday after the Presidential Address, Ald. Walker recalled that during the war many consultations took place between the Government and representatives of the organisations of both employers and workmen of various industries. Good results followed, and it was felt that it would be well worth examining whether some method could be devised to put the practice on to a permanent footing. In 1916 the Government appointed a Committee under the chairmanship of the Rt. Hon. J. H. Whitley, M.P. (then Speaker of the House of Commons), and it was from his name that the term "Whitleyism" was derived.

Ald. W. Walker.

It was usual to speak of "the" Whitley Report, as though there was only one, whereas the Committee issued four, the particular one to which allusion was generally made being an interim report, dated March 18th, 1917.

The whole scheme was to be voluntary, and it was intended that the Joint Standing Industrial Councils should take into consideration matters beyond wages and hours.

In order to realise the effect on the electricity supply industry of the adoption of the Whitley scheme, it was necessary to recall what the conditions were before it came into operation. There was no uniformity of either conditions of service or rates of pay; the wages of some men were regulated by "the district rate," but these were a small number, and of skilled men only, the rest being paid in accordance with agreements made between the management of the particular undertaking and the representatives of the various trade unions to which the men belonged. This practice (it could not be called a system) occupied far too much of the time of the chief engineer and manager, and was a cause of friction. Wages and conditions differed greatly, even between undertakings which were near neighbours and which were alike in almost every respect, the natural result being that dissatisfaction existed at all times. It became the practice to play off one undertaking against another, and there was no machinery whereby a common standard could be obtained.

So great was the need felt for a better way that an attempt to secure some organisation was made during the war by forming an Employers' Joint Standing Committee, consisting of nominees of the I.M.E.A. and the various power companies.

After the publication of the Whitley Report an attempt was made to put its recommendations into force by making use of the Standing Joint Committee as the employers' side and twelve trade union representatives for that of the employees. Six of the employers' representatives were to be nominated by the I.M.E.A. and six by the Power Companies' Association. This constitution continued until 1921, when the I.M.E.A. resigned its connection on the ground that labour matters did not properly come within its functions. Following certain conferences it was decided to set up thirteen District Joint Industrial Councils, covering the whole of the United Kingdom, each Council to consist of twenty-four members, twelve representing the employers and twelve the trade unions.

The National Joint Industrial Council was to consist of a maximum of fifty-two members, twenty-six of these to be employers and twenty-six trades unionists. The National Joint Council delegated to each of the District Councils the duty of negotiating a schedule of conditions of work and rates of pay for its area. The National Joint Council tried to secure some amount of co-ordination and equality as between the schedules for different districts, but found this difficult because after the two parties (employers and trades unions) comprising a District Joint Council had, as a result of many meetings, agreed on a schedule of rates and conditions, there was naturally a desire to put it into operation at once.

The conditions and wages having been settled by agreement, copies were available in all electricity undertakings, so that every workman could know what the conditions were under which he was engaged. It was agreed on all sides that these conditions gave a general improvement throughout the industry, together with the asset of continuity of employment.

A test of the value of the agreement to the industry had been the absence of critical disputes and stoppages and a general improvement in the relationship between the management and the men. When the District Joint Councils were being set up it was realised that despite all the care taken in arranging the terms of the schedule, anomalies would be found when it was brought into operation, therefore a means of dealing quickly with these anomalies was provided by each District Joint Council appointing a small anomalies committee cosisting of eight members (four from each side).

Giving a short outline of the work of the Councils since their formation, the author pointed out that the early days were given to adjusting anomalies and to perfecting the organisation of the National and District Councils.

The first departure from the programme of leaving to each of the District Councils the negotiations for the alteration of wages was in 1920, when the N.J.C., after full discussion, recommended a general increase of wages for all grades of workmen within the schedule by two stages of 3s. each. In 1921 the N.J.C. arranged for two reductions to take place of 3s. each and for stabilising rates after the reduction until November, 1921.

On November 21st, 1921, a Negotiating Sub-Committee of the N.J.C. submitted to the full Council a draft agreement

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Mr. J. Christie in his famous panama. To the right of him, Mr. R. W. L. Phillips, a past President of the Association, and on the right of him, Mr. A. W. Blake of Willesden.

Not coming out of church but leaving the electrical exhibition, at the old Torbay Hospital, on Tuesday.

regarding wages which was unanimously accepted. This established the principle of a sliding scale of wages based on a datum figure of 120% above an adjusted rate for 1914, and varying up or down in accordance with the Board of Trade index figure of the cost of living. It provided for an increase or decrease respectively of ½d. per hour for every complete six points calculated from the datum figure. This also was a national agreement. In 1922 the employers representatives on the National Council proposed "That in lieu of the existence of a sliding scale agreement a variation be made on the basis of taking the actual basic rates of each district (as shown by the schedule) and adding thereto the cost of living figure."

Another scheme put forward by the workmen's representatives both in the District and National Council was for grading undertakings according to the capacity of plant installed. The national application asked that power stations should be divided into four grades and that for each grade a section of the men should be paid 10s. per week and the remainder 7s. 6d. per week more than the next lower grade. The result of this would have been that in the highest grade stations 40s. per week to some workmen and 30s. per week to the remainder would have been paid in addition to the schedule rates. The same principle and amounts were asked for sub-station attendants. The claim was not agreed to because the impossibility was realised of justifying an all-round increase whenever additional plant was installed irrespective of whether or not additional duties or responsibilities were placed on the men. Instead of the plan put forward the National Council favoured additions to the rates of pay to certain specified workmen when appointed to take up duty on new large units.

When the report came before the N.J.C. for confirmation some of the trades union representatives asked for a short postponement, to enable them, as a matter of form, to refer the report to their members. It was ominous to find after this had been done that these representatives, including those who had served on the sub-committee and who had signed the report, were instructed not to vote for it, on the ground that it did not give an all-round advance to the whole of the men in the station. On other occasions the failure of some of the trades union representatives on the District Councils to accept responsibility had been equally marked, and it was a matter for serious regret that after prolonged negotiations recommendations were turned down by some other set of persons whom the employers had not met, and, who had not heard the arguments and facts which led up to the decision.

The Test of 1926.

The most critical event since the introduction of Whitleyism into the industry was the General Strike of 1926. It was regrettable to find that despite agreements, and without having regard to the good feeling and amicable relationship which had existed between the two sides, certain trades unions represented on the N.J.C. broke their agreements and tried to involve the industry in the stoppage. Owing to this happening employers refused to continue their association with the N.J.C. until some guarantees could be given by the trades unions, and finally a series of resolutions regarding the constitution of the N.J.C. were agreed to providing that nothing in the nature of a "lightning stoppage" can now take place, as any matter in dispute must be referred to the District and/or National Councils, thus giving time for consideration and adjustment if possible; and giving to undertakers the right to require that each employee shall sign an agreement that his service is in accordance with the terms and conditions agreed by the National and District Councils.

A Surprise for Employers.

In 1928 the trades union representatives on the N.J.C. gave notice to the employers that it was their intention to ask for a revision of the sliding scale, and this description of their intended claim was used in all subsequent discussions and correspondence when arrangements for dealing with the matter were being made. The employers were therefore surprised to receive, a day or two before the September meeting of the N.J.C., a letter from the secretary of the trades union side giving notice to terminate the agreement, together with claims for a 10% increase of all wages, double times for Sundays for shift workers, increased holiday and sick pay allowance and increased wages and improved working conditions for certain specified grades.

The employers called a National Conference in London of the employers' sides of every District Council, and after full discussion it was resolved unanimously that the employers' representatives on the N.J.C. should resist the application, and they were also empowered to give notice of an application for a decrease of one penny per hour, which, it was urged, was fully justified and overdue. The employers acted in accordance with this resolution and gave the necessary notice. Eventually the workmen's representatives reported that their National Conference had resolved that:—

"The notice to terminate the agreement should be withdrawn; the application for an advance of 10% should not be proceeded with, and that the portion of the notice relating to switchboard and sub-station attendants should be maintained."

After discussion it was agreed unanimously that the agreement of December 17th, 1927, was to be continued and extended for twelve months ending December 21st, 1929.

The chairman intimated on behalf of the employers that in view of the above resolution of the trades unions the employers would not proceed with their application for a penny per hour reduction.

The remaining claim was that the grades of switchboard and sub-station attendants and assistants should receive material increases in wages and be given conditions such as holidays, sick pay, etc., similar to those granted to the technical staff. To elucidate the real nature of the claim the chairman of the trades union side was asked by the employers at the first meeting of the negotiating committee whether they were to understand that it was a demand that all workmen, whatever their training or status, were to be classified as engineers and also as members of the technical staff, and Mr. Rowan's reply was that this was what was intended. The unreasonable nature of such a claim was argued by the employers, and the absurd conditions which would arise in practice if it were granted were cited. Eventually this part of the claim was modified.

The draft heads of agreement on demarcation were accepted on March 14th last, and were now awaiting incorporation in the general report. The clauses are:—

"Employees engaged as sub-station attendants and

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switchboard attendants shall be subject to the conditions and schedules of the National Joint Industrial Council,

"Unless they have a supervisory status and are engaged on supervisory duties; or are responsible for the control of load distribution; or control sub-stations other than the one in which they are actually engaged; or who, for a temporary period of their training as technical engineers, are engaged on a switchboard or in a sub-station.

"The number of trainees working as switchboard attendants or as sub-station attendants shall not at any time exceed

Mr. A. Nichols Moore (President) leaving the Conference. Mr. F. W. Purse, the immediate past President is on the left. Between them is Mr. J. W. Simpson, the new secretary. To the right and behind the President is Ald. W. Walker, whose paper was extremely well received.

25% of the total number of switchboard and sub-station attendants employed at that time."

This out of the way, there was left only the question of increased remuneration. This was subjected to a separate and detailed examination by the employers, and a statement was prepared showing 1914 rates of pay, present rates and the rates claimed. The claims sought to establish a scale of pay very much in advance of anything previously paid, and substantially more than was being paid to qualified engineers.

A feature of the many claims made by the trades union representatives was that those making them had in nearly every case a small proportion only of their members employed in the electricity supply industry, the greater number being otherwise engaged. Agreements governing conditions in those other industries had been negotiated and signed by the same representatives who served on the Councils in the electricity supply industry. In the case of the former industries they had made agreements embodying lower rates of pay, no holidays and other conditions generally much less favourable than those for the electricity supply industry, yet their main efforts appeared to be concentrated on getting more still from the electricity supply industry instead of trying to bring the others nearer to that standard.

Although a number of electricity committees had sharply criticised the holidays given under the schedule as being excessive when compared with those in other industries, or other departments of the Corporation, employers, as a whole, had declined to support any reduction. A plea had been made that six consecutive days' holiday did not allow a complete week-end, therefore that only short journeys could be made, and that the Saturday was lost. To meet this a suggestion was made by the author that the public utility services might consider a uniform scheme for holidays for inclusion in the national agreement:—

"After 12 months' continuous service each man shall be allowed an annual holiday of ten consecutive days made up on the following basis:—'He shall commence his holiday as from stopping time on Friday night and shall return to work on the second Tuesday morning thereafter and shall be paid for all normal working hours (i.e., 60 hours) falling within that period.'"

The author also suggested for discussion the question of making the areas of the District Councils coincide with the electrical areas set up, or to be set up, by the schemes of the Central Electricity Board.

There were many questions of principle in connection with Industrial Councils which still require solving. One of these was whether or not the decisions of a J.I.C. should be compulsory on the industry. The employers had always said they were prepared to adopt this as part of the constitution, but they would make no move until the trades union side intimated that they wished the question to be discussed. If adopted it must obviously be by general agreement, and it was interesting to note how rapidly the question had advanced, the greatest step being the vote in favour at the Trades Union Congress at Scarborough. A Bill had been drafted and was known as the Industrial Councils Bill. It would be an adoptive measure, so that each industry would have to decide whether or not it wished to work under the conditions laid down in the Bill.

Whether or not support from the electricity supply industry should be given to the Bill was in the first place a matter for each side of the Industrial Councils to consider separately, and then, if agreed, joint action could be taken. It was important to note that even if the Bill became law it would not be compulsory for any industry unless adopted by a resolution of the two sides forming the Industrial Council.

In the author's opinion such a measure was the logical outcome of the Whitley scheme. It provided a means for healing the sore caused by a few concerns refusing to conform to the conditions under which the remainder had agreed to work, whilst at the same time safeguards against tyrannical use were ample. At present the means for getting an outside undertaking to honour the Industrial Council's scheme were two. The first is for the National Council to send a joint deputation to meet and persuade the recalcitrant body; the other for the trades unions to declare a strike.

In the electricity supply industry the number of undertakings outside the Industrial Council was small and is becoming less. The apparent reason for some of these being outside was to avoid having to pay their share of expenses.

In connection with zoning it had been noted that many times claims had been made, in different districts, to zone undertakings solely on the size of the station, whereas other considerations altogether should decide the question. If size only were to be the factor we should have the wages of a supply station which had been located because of water facilities in an agricultural area, where rents, food stuffs, taxes and rates were at the lowest, paying wages considerably higher than those paid in a smaller undertaking situated in a town or district where all the foregoing items were at the highest.

Since the Industrial Council was established for our industry there had been no serious dispute and no stoppage, the relationship between the two sides had certainly improved, the representatives had got to know and to understand each other, and the exchange of opinions and arguments had widened their views. There had been created a body expert in the knowledge of labour conditions and able to understand the correct bearings of various problems which arose.

The other application of Whitleyism to the electricity supply industry was that of the National and District Joint Boards for dealing with all matters relating to the technical staff. A salary scale had been arranged and conditions of service agreed, these being national in extent, and provision having been made in them for all grades and sizes of station.

As a result of changed and changing conditions brought about, or to be brought about, in connection with generation by the schemes of the Central Electricity Board, and the changes in the problems and methods of distribution, it had been realised for some time that an alternative way of fixing the basic salary would have to be found, as the present method did not meet the altered conditions. Both sides had been considering the problem separately, and the E.P.E.A. had prepared a draft schedule and handed it to the employers.

THE DISCUSSION.

COUN. WALTER GRIFFITHS (Newport) in opening the discussion, said he had had experience in the railway industry both under the old and Whitley conditions. In the old days much of the time of the managerial side was taken up in considering individual applications with regard to wages and conditions of service. The Whitley machinery had largely removed that burden. It had more or less standardised the wages system, and thus removed a great cause of dissatisfaction amongst the employees. Being a more satisfied body of workers they naturally gave more efficient service. Further, by relieving the managerial side from the worry and responsibility of dealing with individual claims, this side had more time to devote to improving its service to the public.

In spite of what had been accomplished, demands were still being received from the employees' side which were in some instances very extravagant and irresponsible. There must be some reason for this, and he thought that if the management made the employees feel that the aim was to get the maximum

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amount of work out of them, their reaction would be to try to get the utmost farthing from the management. It was most desirable that the employees should be made to realise that they could not get out of an industry more than they put into it.

One of the best ways of achieving this was to invite the employees to take some share in the control and management of undertakings. To some this might appear revolutionary, and in the railway world it had required a national railway strike to bring it about. By 1928, however, the position had so changed that when the railway companies were in financial difficulties such mutual confidence existed that the companies invited the men's representatives to consider a voluntary wages reduction in order to help the railways out of their trouble. There could have been no greater evidence of the mutual goodwill than in the fact that a voluntary wages reduction of 2½% was agreed to without so much as a ripple on the industrial surface. If employers expected their employees to realise their difficulties they must take them into their confidence and make them take a share in the responsibility.

ALD. E. HUNTSMAN (Nottingham) thought that the essential objects of the Whitley Council movement had mainly been realised in the electricity supply industry. With regard to the author's suggestion for setting up an expert body to deal with matters from the employers' viewpoint a lot depended on the way it was done. Too often the expert was more concerned with making out a good case than with abstract justice. Mutual friendship was the keynote of the present relationship, but if the expert knowledge could be incorporated without prejudicing the good feeling that had grown up it would be an excellent thing. Financially the cost was so reasonable as to be hardly worth consideration.

District Councils.

Similar principles also applied to the proposal to make the districts compare to the areas delimited under the Central Electricity Board's schemes. The District Councils could not have sat continuously for ten years without engendering a considerable degree of local patriotism and confidence. They had met as friends, and in his own experience there had not been uttered a single unkind or discourteous word on either side. The question was, should this valuable feature be sacrificed, when it was obvious that time would be required for the growth of this tender plant in a new and wider body.

One serious omission from the paper was the author's neglect to refer to the time he had devoted for years past to the development of this great work. To his task Ald. Walker brought a cool temperament, a clear mind, and an unrivalled knowledge of conditions in the electricity supply industry. He was a firm, clean, and tactful negotiator, and the industry owed him a debt which it could never repay.

ALD. G. CROOT (West Ham), speaking as a representative on the board to District Council for the past ten years, and from the trade union point of view, thought that employers should be sympathetic towards trade union requests for assistance in persuading men to join the appropriate trade unions. It was often found that the non-unionists were the cause of far more dissension than the trade unionists, and though it was not for the employers to insist that their employees should become trade unionists there were many ways in which they could encourage them to move in this direction.

At West Ham and elsewhere it sometimes happened that the shop stewards tried to work independently of their unions. This was quite wrong. It was imperative that all matters should go through the trade union concerned.

A Bristol Grievance.

ALD. A. A. SENINGTON (Bristol) put forward a grievance applying to the Bristol area, claiming that certain elected representatives of the employees' side had not been acceptable to the other side. This procedure was quite wrong and was contrary to the maintenance of the democratic spirit which was so essential to the success of Whitleyism.

COUN. TOM SNOWDEN (Bingley) said that his own experience, both as an employer and as a member of the trade union movement, was against the system of compulsory agreements as advocated by the author. It was far more satisfactory to convince both parties of the rightness and equity of a proposal than to compel them to act one way or another. It was a commercial proposition to treat the workers as human beings, and it was the mutual jealousy and suspicion of the past that had so hampered progress.

There was no gainsaying the fact that both strikes and lock-outs had failed. He was convinced that in the past the employer was more to blame than the worker because he had not in prosperous times extended participation in that prosperity to his workpeople.

ALD. W. WALKER, in replying to the points raised, said that in the constitution of the councils in the electricity supply industry special provision had been made for the institution of works councils, and it was open to any undertaking in the industry to establish such a council should it so desire.

He agreed with Ald. Huntsman that the type of "expert" interested chiefly in fighting a case would be quite hopeless. All he had in mind was the creation of machinery to assist the employers by way of research into facts and statistics. Corresponding organisations were in existence on the trade union side. He would certainly not stand for anything which would detract in any way from the goodwill which had been built up

He was sorry that Ald. Senington had emphasised what was a local squabble concerned with the constitution of the local body. To equalise anomalies which might arise in appointing representatives, other districts had divided themselves into groups according to the size of the undertakings which they represented and he hoped that by altering their constitution in a similar way Bristol would end their troubles.

Mr. Snowden seemed to have misinterpreted the meaning of compulsion as used in the paper. It had already been explained that the Bill would only be adoptive and its provisions could, if desired, be put into operation for only a trial period. The whole matter was entirely in the hands of the industry, and agreement on both sides would be necessary before anything could be done.

A hearty vote of thanks to Ald. Walker was proposed by Mr. J. K. BRYDGES, and seconded by Mr. A. J. FULLER.

Some well-known faces outside the Pavilion "appreciating" the weather.

Front, left to right: Mr. J. K. Brydges (President-elect), Mr. R. W. L. Phillips (Bedford), and Mr. W. E. Affleck (Guildford). Behind, from the left: Mrs. Hammer and Major Hogan, between Messrs. Brydges and Phillips.

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CURRENT LEGAL PROBLEMS.

Replacing Apparatus on Change of System—Hire-Purchase Agreements—Public Supplies—Prepayment Meters—Rate Aid.

By J. H. ROTHWELL.

THE first paper to be read on Wednesday was one by Mr. James H. Rothwell, the Association's honorary solicitor, and was entitled "Some Notes on Recent High Court Cases and Current Legal Problems in Connection with the Generation and Supply of Electricity."

Mr. J. H. Rothwell.

The author gave a short account of the more important of recent legal decisions of common interest, and also indicated some of the legal problems he had considered during his period of office.

Dealing with cases in the order of their importance, the first was Farnworth *v.* Manchester Corporation. This action was first tried at the Manchester Assizes, and, upon the plaintiff's appeal, was heard by the Court of Appeal last December. The author had reason to believe that the case would be taken to the House of Lords.

After commenting on several features of this case, Mr. Rothwell said the only conclusion one could arrive at at this stage was that in order to resist an injunction or damages for such a nuisance as was proved in this case, the undertakers must prove to the satisfaction of the Court that it is the inevitable result of operating a generating station that it should damage adjoining agricultural land by sulphur deposits, notwithstanding that they may have taken all reasonable precautions to explore the cause of and remedies for that damage, or adopted all reasonable precautions to prevent it.

It was interesting to note that the operation of the injunction was suspended for a year to enable the defendants to adopt measures to terminate or mitigate the nuisance.

Lord Justice Scrutton also made this significant remark: "The case showed the necessity for Parliament and other authorities concerned giving more careful attention to the provisions for compensation for damage caused by those enormous developments of electrical power stations. Promoters should not be allowed, by abstaining from asking in express words, for the exclusion of any duty to make compensation for damage done—a privilege which in his judgment they would not get if they had asked for it expressly—to argue afterwards that their duty to compensate had been indirectly excluded by obscure inferences.

Whatever might be the result of the final appeal, it was obvious that the liability under which undertakers might be in working statutory undertakings efficiently and without negligence should be more precisely defined, so that they might know what their obligations were before committing themselves to enormous capital outlay.

The second case referred to was that of the Attorney General *v.* London and Home Counties Joint Electricity Authority. Consideration of the facts clearly pointed to the necessity when establishing an *ad hoc* authority that the purposes for which it might be entitled to promote a Bill in Parliament should include all the purposes which it must seek to obtain in order to secure it functioning completely for the purposes for which it was set up. In the absence of such a power, immediately such an authority found that the obligations or activities which were legitimately within its province were not conferred by its then existing powers, either Parliamentary powers must be sought, or the instrument of its incorporation, be it a scheme or charter, must be amended by the authority which created it.

One could not help but sympathise with any authority placed in such a position as revealed in this case, because the power companies or other bodies or persons had ample opportunity of combating their proposals either on second reading of the Bill, or before the Select Committee to which the Bill was referred. The only remedy of the Authority now appeared to be to seek an amendment of its scheme under Section 7 of the Electricity (Supply) Act, 1919.

The next case, which was of general interest, although the facts of it were rather special and might never recur, was G. Scammell and Nephew, Ltd., *v.* Attlee and Others. The plaintiffs in this case were engineers in Stepney, who brought an action against seven individual members of the Electricity Committee of the Stepney Borough Council, claiming from the defendants damages for the effect of an alleged conspiracy whereby, in breach of a contract, the supply of electricity for power was unlawfully cut off from their premises during the general strike in May, 1926. The plaintiffs succeeded in the court of first instance, but the defendants appealed successfully, and judgment was entered for them with costs.

The important point of general interest emerging from this case was that where a defendant, whether he be an individual member of a committee or council of a local authority, or an official of the local authority, pleaded the six months' limitation imposed by the Public Authorities Protection Act, 1893, as the period within which an action must be brought in respect of his conduct, the plaintiff could defeat that plea by proving on sufficient evidence that the defendant was not really intending to act in pursuance of his statutory authority, but was using his pretended authority from some improper motive, such as spite, or for a purpose entirely outside statutory justification.

Where defendants were purporting to execute a statute, as in the case in question, the burden of proof was on the

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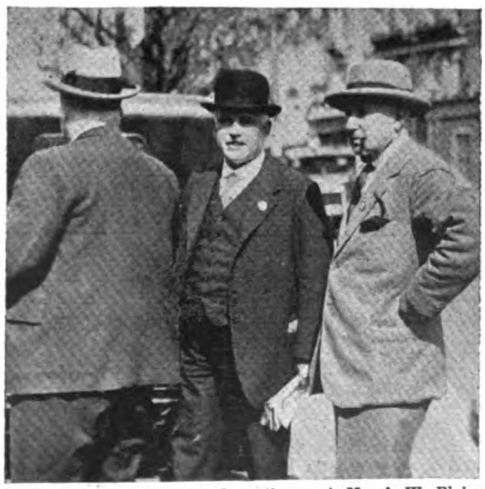

Mr. H. L. Howard (as seen from the rear), Mr. A. W. Blake (Willesden) and Mr. H. W. Watts who was unfortunately unable to be at his usual post on Wednesday.

The President with Dr. S. Z. de Ferranti posing for "The Electrician" photograph.

"Crysaloo" discussing matters not connected with lamps.

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Mr. P. Green and Coun. W. Chipchase.

Messrs. W. G. Suffield, F. Garside, and H. Craske.

The President engaged with Mr. W. Sutcliffe.

Mr. F. V. L. Mathias, Ald. F. Huntsman, Mr. H. G. Fraser, and Ald. H. B. Vorley.

Drama and the lighter side. We were glad to see Mr. V. W. Dale (E.D.A.) looking himself after his illness.

plaintiffs if they alleged the existence of a dishonest motive and the absence of any honest desire to execute the statute, and such existence and absence would only be found to be proved on strong and cogent evidence.

On the facts of the case in question, the Court of Appeal held, after a careful review of the facts, that there was no evidence on which the jury could find that the members of the Committee were not intending to carry out their statutory duties when they determined to get a supply of light by sacrificing a supply of half the power.

The only other case of comparatively recent date was that of the Caerphilly Urban District Council *v.* Griffin, decided in December, 1927. The plaintiffs sought an injunction to restrain the defendant from supplying electricity to certain consumers in the area. The defendant had primarily two businesses, his draper's business and the business of developing his property. In the course of those businesses he provided plant to light his shop and residence, and he afforded a supply of electricity to one of his shops which he had leased to Messrs. Woolworth, and also to a covered market for the purpose of attracting tenants and developing his property.

The Court held that the supply of electrical energy in this case was only incidental to the defendant's two businesses and was not his primary business. The action therefore failed and was dismissed.

Dealing with some current problems, Mr. Rothwell first referred to the replacement of apparatus on a change of system.

The Association realised, of course, the importance of the principle that if undertakers chose to alter their system, frequency or pressure for their own purposes, the interests of consumers must be adequately safeguarded, but the Council, he believed, still thought that the form of consent to the alteration given by the Commissioners might be improved without injustice to consumers. Take, for example, the expense involved in replacing d.c. wireless apparatus with a.c. apparatus, expense which was altogether disproportionate to the amount received in revenue, and, secondly, the possibility that some persons might seek to gain personal financial advantage out of the impending change.

It appeared clear that the Commissioners had a somewhat free hand to modify their consent in such manner as they thought fit; and the measure of control which undertakers had by Statute over apparatus connected to their systems would appear to entitle them to insert in their agreements with consumers a clause requiring notice to be given before any new apparatus, other than lamps, was connected to the supply. The undertakers could not reject any intended apparatus which would not be likely (*a*) to cause damage, (*b*) to interrupt the supply to other consumers, or (*c*) to cause the consumer to exceed his declared maximum demand, and any condition in an agreement purporting to confer upon them this right would be unenforceable and void. Moreover, no consent of the Commissioners could impose as a condition precedent to compensation a condition that apparatus should have been approved.

It might be suggested that a further proviso should be added to the form of consent to the effect that if a consumer installed any apparatus after the date of the newspaper advertisement of the intention to apply for the Commissioners' consent to the change, such consumer should not be entitled to require the undertakers to alter such apparatus or to pay compensation in respect thereof, if the arbitrator should determine that the installation of such apparatus was not necessary, or was made with a view to obtaining compensation from the undertakers. It was hoped that the efforts of the Council in this direction would be successful.

A considerable amount of time had been devoted to settling a model hire-purchase agreement. The members of the Conference would recognise that the very nature of an electrical installation did not lend itself readily to hire-purchase terms, and considerable care had to be exercised to avoid the agreement being construed as one for sale and purchase. It would be an advantage if all undertakers embarking on the hire-purchase policy would adopt this model form with as little amendment as possible.

Touching on the bearing of Sect. 12 of the Electricity (Supply) Act, 1926, upon existing and future supplies of electricity in bulk to other authorised undertakers, the author said that with regard to contracts entered into before the

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passing of the Act, Sect. 12 did not affect these at all, and therefore unless there was a clause in the agreement making some provision for variation of charges, the agreement must be left to expire or be determined before any modification could take place, except, of course, where the parties voluntarily agreed to modify the terms.

With regard to contracts entered into since the passing of the Act where there was a clause as to variation of prices : in these contracts Section 12 would apply when the bulk supplier took energy directly or indirectly from the Board, as must happen sooner or later. When this came to pass it would be open to authorised undertakers taking the bulk supply to demand Sect. 12 prices, and in default of agreement to refer the matter to the Electricity Commissioners for decision. Pending Sect. 12 coming into full force each undertaker must act according to the prices clause in the agreement.

Where there was no clause as to variation of prices, the authorised undertakers taking the bulk supply must wait until Sect. 12 came into force before they could demand any alteration, other than by agreement with the bulk suppliers.

As to contracts not yet entered into, it was competent for the contracting parties to arrange their own terms, but before doing so they should consider the model clauses which had been specially settled, having in view the early operation of Sect. 12.

Recently the point had been put, as to who was liable in case money was stolen from an electricity prepayment meter. In a reported case the money was stolen through no negligence on the part of the consumer, and the Court held that the consumer by putting the money into the box had paid, and was not liable to pay again. The law report did not indicate that there was any special agreement between the consumer and the undertakers, and in the absence of any such agreement one must accept the position as laid down in that case as being good law.

Mr. Rothwell thought the liability would be the same in regard to damage to the meter where it was caused without negligence of the consumer, and in the absence of a special agreement.

In Brighton, and possibly in many other towns, the application form which all consumers were required to sign contained the following among other conditions :

"Where the supply is through a prepayment meter, the consumer shall pay for all electricity registered by the meter at current rates, notwithstanding any insufficiency of prepayment, and, in addition, one halfpenny for every unit of electricity consumed, in lieu of meter rent. Should the meter be tampered with and money unlawfully extracted therefrom, the consumer shall make good the amount missing, and also pay for any damage which may be done to the meter, lock or fittings."

The reported case would not, of course, apply where a condition of this sort had been entered into by the consumer, and it appeared the obvious course to avoid this liability.

A point of financial interest had been considered arising out of a proposal to vote money out of the funds of the Electricity Undertaking of the years 1929-30 before the completion of the year where the reserve fund was not up to the required limits provided for in the 5th Schedule of the Electricity (Supply) Act, 1926.

In this case one had to point out that a grant out of electricity funds before the completion of the year was not "net surplus" within the meaning of these words as used in the 5th Schedule of the Electricity (Supply) Act, 1926. The power in this Schedule was now the only one existing which enabled an undertaking to apply money in aid of local rates ; and it applied only to the net surplus, which of course could not be ascertained until the end of the financial year, and if, after March 31st, 1930, the reserve fund did not amount to more than one-twentieth of the aggregate capital expenditure on the undertaking, the net surplus must go to the reserve fund until that condition was fulfilled.

In conclusion, the author referred to a somewhat technical problem which arose in the carrying out of the South-East England Electricity Scheme, 1927, and presumably other schemes throughout the country. Under Sect. 8 of the Electricity (Supply) Act, 1926, the Central Electricity Board were to construct the main transmission lines required for the inter-connection of selected stations one with another, and with the systems of authorised undertakers in accordance with the Scheme. Sect. 51 defined "transmission line," whilst "main transmission line" was defined by Sect. 36 of the Act of 1919.

In carrying out the Board's functions under Sect. 8 the following circumstances had arisen, which necessitated defining both technically and legally whether certain switchgear was part of a main transmission line, the cost of which was to be borne by the Board.

Existing switchgear was installed by a Corporation (whose station was a selected station) controlling their generating plant and outgoing feeders, and was designed to meet all requirements for years to come, but not in contemplation of a connection to a main transmission line of the Board's system.

Before the generating station was connected to the grid under

PERSONALITIES AT TORQUAY.

Group showing Messrs. B. Darby, J. B. Hudson, Coun. T. R. H. Tetley, and Mrs. Hudson.

Ald. and Mrs. Cassells and Mr. H. H. Denton enjoying the air on one of the fine days.

A further group, including Mr. J. Edgar, Mr. C. V. Wedderburn, Mr. Henry Adam, and Coun. F. Young.

Mr. C. A. Blaschcek with Ald. G. Pope arriving at the Pavilion.

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the Scheme, it would be necessary to instal switchgear of much higher disruptive capacity, or to supply other means of controlling the power in the main transmission line in order that it would not damage the station in the event of a fault, either on the Board's side of the busbars, or on the station's side of the busbars.

The estimated cost of installing the necessary gear was upwards of £20 000, and it had been assumed that this expense would be borne by the Board, the gear being necessary for the control of the Board's transmission line within the meaning of Sect. 36 of the Act of 1919.

The Board, however, contended that the gear was required, not for the control of their line, but solely for the protection of the Corporation's system, and in fact would form part of the Corporation's system, and were therefore not prepared to provide and pay for the gear.

In the case of a selected station the financial result of this decision of the Board would not be serious as the interest and sinking fund upon the extra capital expenditure would be borne by the Board under Sect. 7 of the Act of 1926, and the local undertaking would be able to protect itself from having this expenditure charged upon its price for energy for distribution purposes by the provisions of the Act of 1926.

It was for the technical experts of the Association to agree that gear of this nature, whether provided in a selected station or in connection with any system of an authorised undertaker (whether selected or not), was primarily " switchgear necessary to and used for the control of " the main transmission line within the meaning of Sect. 36 of the Act of 1919. The case seemed to be one eminently suitable for the joint considered opinion of the engineers to be placed before and discussed with the technical advisers of the Central Electricity Board, and this course was suggested.

THE DISCUSSION.

Councillor H. K. BEALE (Birmingham) said the Manchester nuisance case was of the greatest importance to all electricity supply undertakings, and though it was impossible to deal with that case, it being still under discussion before the House of Lords, the general question was deserving of careful consideration. The new power stations that were being put up constituted a serious potential nuisance to the public. Loud and bitter complaints had been raised against the emission of grit and dust from Birmingham's new power station. A sum of approximately £60 000 had already been spent in seeking to remedy matters, but, even so, the trouble was only partially cured. With stoker-fired furnaces the trouble had been practically overcome, but pulverised fuel firing still permitted a quantity of fine particles to escape into the surrounding atmosphere. These particles went farther and were generally more widely distributed than the usual grit, but they were bound to come down somewhere.

He rather feared that unless a remedy were found soon restrictions would inevitably be placed upon the permissible size of our generating stations, or operations of the stations would be subject to such conditions as would seriously advance the price at which undertakings would be able to furnish a supply of electricity to the public.

The problem was of immediate importance to the big power stations, and it was up to our engineers and chemists to provide a solution. The strength of public opinion which had made itself evident in regard to the proposed new power station at Battersea was by no means confined to that one case, and already similarly strong complaints were coming from the neighbourhood of other large stations.

Even though there might now be complete legal immunity against actions for nuisance, it was not, in his opinion, safe to rely upon a continuance of that immunity.

Under the Public Health Act of 1875 certain trades were exempted from prosecution for causing a nuisance, it being thought at that time that it was impossible for these operations to function without interference with amenities. In spite of that legal immunity, under which, as one instance, the railway companies had escaped liability for damage caused to growing crops, hedges, etc., by sparks emitted from locomotives, public opinion eventually became too strong to permit perpetual immunity, with the result that, in 1905 an Act was passed under which the railway companies were made liable for such damage, though the extent of that liability was limited to £100 in each case of damage; this limit was later raised to £200. The instance thus quoted was a direct case of a statutory undertaking being held responsible for damage done even though it had taken every reasonable precaution to prevent its commission.

Another point which was of more interest to committee members was the matter of contributions in aid of the rates. The provision that after March, 1930, no money should be appropriated for rate relief until a reserve fund of 5% had been reached was a very useful piece of legislation. In places where it was customary to take money in this way there was continual friction between the trading committee, anxious to improve its service and reduce the cost thereof, and the finance committee, generally backed by the whole corporation, determined at all costs to get money to enable it to reduce general rates. In this matter Parliament seemed for once to be wiser than the local legislators.

Relief of Rates.

In view of the provision referred to some local authorities would be trying to find a way to benefit next year's rates from this year's trading profits. He had heard the opinion expressed that these authorities could not do such a thing, but he believed there was a way round. It was laid down that no payment was to be made after March 31st, and also that such contribution must come from the next surplus. This had been construed by some people as meaning that as the net surplus could not be determined until after the date mentioned it would then be too late to appropriate the money. Even so there was no reason why municipal authorities should not follow the practice of commercial firms and pay an interim dividend. The approximate size of a surplus could be estimated before the close of the period and the amount handed over in good time. There would then, of course, be no final dividend.

It was, perhaps, hardly necessary to say that he had no intention to advise Birmingham to dodge the provisions of the Act in the way which he had described. On the contrary, he was most anxious to help to increase the reserve fund of the undertaking. The loophole, he added, had only been pointed out for the benefit of those local authorities who were sufficiently unscrupulous to take advantage of it.

Mr. O. T. MORGAN (town clerk of Newport) thought that though the Manchester case was *sub judice*, the general question of nuisance was appropriate for discussion. The liability for creating a nuisance of this kind could be brought home to the electricity supply undertakings in two ways, i.e., damages and injunctions. While it was unlikely that a utility would have an injunction granted against it, it might well be that the damages for which it had been made responsible would be of such magnitude and so continuously leviable as to have the ultimate effect of an injunction.

Replacement of Apparatus.

Regarding Mr. Rothwell's point about the replacement of consumers' apparatus on a change of system, he thought it would be preferable to fix the limiting date to that on which the Electricity Committee decided to ask the Council to authorise applications to the Electricity Commissioners. At present advance information regarding the Council's intentions would become available to the general public through the publication of the Council's minutes in the columns of the local Press, and this knowledge led to abuse.

Mr. F. W. PURSE remarked that as chairman for the past four years of the Association's Law Committee he had gained a considerable insight into the complexity of the legal side, and this enabled him to appreciate the great work which Mr. Rothwell had done for the Association. He desired to focus the attention of the meeting on the tremendous amount of legal work that was carried out by the Association, and of the great benefit of this work to its members. If this were properly understood members would soon realise that on the legal side alone their Association subscriptions would be repaid many times over.

It was important also that undertakings should appreciate that unless the law as to what they could or could not do were very clearly set out they would need to act cautiously.

Referring to the case of the London and Home Counties Joint Electricity Authority, Mr. Purse pointed out that the exact position was that in that area about 80 local authorities possessed purchase rights over company undertakings maturing at various times. The Bill asked that these rights should be transferred to and collectively held by the Joint Authority. It was of interest to note that the Joint Authority already possessed complete power to take over any of these undertakings by agreement if desired.

Mr. Rothwell's reference to disturbance of road surfaces was of interest, for it seemed that even if a highway authority

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gave permission to an unauthorised undertaking to open a road the authority could be proceeded against.

With regard to the replacement of d.c. wireless equipment on changing over, it was worthy of note that in view of the recent considerable developments in rectifiers many undertakers would very seriously ponder the advisability of incurring the heavy expense of changing over.

The question of special protective clauses in Private Bills was of interest, and when the 1926 Act was promoted the I.M.E.A. had tried to get several useful general clauses included, though they were only successful in getting one through.

There were many apparently trivial details the omission of which might seriously prejudice the operation of an undertaking. It was important to have a clear definition of such a simple thing as the area of supply, though the matter was not tested until recently, when the question arose whether a supply could be taken from an undertaking in its own area and actually used in a contiguous authority's area. This and similar matters made apparent the necessity to go to the length of providing that the boundary might be the centre of a particular road.

Legal Position Uncertain.

It was necessary, too, to have clauses empowering an electricity supply authority to construct a sub-station.

Generally, the legal situation was so uncertain that it was vital that Corporations promoting Bills should include clauses which would definitely permit them to carry out what was desired. Unless they had such definition it was impossible to tell what the ultimate position might be, without taking the matter right through to the House of Lords.

It was important that local authorities should have power to safeguard the public in regard to installation work by getting sanction for special by-laws. Various undertakings had tried to make such provision, but so far West Ham was the only one that had had these by-laws approved by the Electricity Commissioners, and, therefore, was the only authority whose regulations were legally enforceable.

In drawing up such by-laws it was very desirable to indicate that they would apply not only to premises supplied, but also to those to which it was proposed to give a supply. Obviously, this authority should be applicable before a supply was given, but, without the precaution indicated, they would have the ludicrous position that they would first have to connect an installation to the supply before cutting it off for failure to comply with the by-laws. This was but one case which clearly emphasised the importance of giving scrupulous attention to details. It was very desirable that some of the special protective clauses should be standardised. Until the passing of the 1926 Act very few undertakings had any real authority to adopt even a two-part tariff.

The position in regard to prepayment slot meters was also curious, for unless the consumer signed an agreement taking responsibility for the custody of the money in the meter, a supply authority would have no means of recovering any cash that might be missing.

Re-codification of Electrical Law.

Mr. W. M. SELVEY suggested that one could draw a striking analogy between the present state of our law and the Jewish law as it obtained in Biblical times. In each case there was built up on a solid foundation of common justice a superstructure of fanciful decoration, which became so top-heavy that an entirely new codification of the law, comprising principles rather than details, was urgently required. It was only a matter of time before we arrived at this stage.

The matter had already been referred to in the President's address, but he wanted to put forward the definite suggestion that the legal brains in the electrical industry should now turn their attention to the codification of all the existing electrical legislation in one simple form.

Dealing with the Manchester case, Mr. Selvey thought that the quantity, rather than the composition of the material causing the nuisance, was regarded as the important matter by those who were adjudicating on the case. The problem was thus confined to the large stations, and, as increased size of generating plants was an integral feature of the Central Electricity Board's schemes, the matter needed the most careful attention.

He could assure Coun. Beale that the time and expense devoted to this problem was already colossal, though this was not to say that an economic solution was yet to hand. On the other hand, the great part of the problem would, he believed, be solved at a very early date.

Another suggestion was that all branches of the electrical industry should initiate means for evolving some body powerfully to represent the industry as one indivisible organisation. This suggestion, of course, presupposed close working contact between the I.M.E.A., the B.E.A.M.A., the C.M.A., and the E.C.A.

Mr. R. A. REAY-NADIN (Town Clerk, Sutton Coldfield) agreed with Mr. Rothwell's remarks regarding contributions to rate relief. His own opinion was that all local authorities owning electricity undertakings got an indirect but valuable contribution to their rates, and that its extent depended on the intelligent development of such undertakings. Where electrical development went forward they also developed the whole area and thus got a valuable indirect contribution to the rates. In any event the electricity supply industry was of such importance to the well-being of the community as to warrant development of the electricity undertaking on sound lines.

Councillor COUSTON (Edinburgh) thought that the clause making the consumer responsible for money in prepayment slot meters was based on a misconception. As a magistrate, he had to deal with such cases. If a consumer's premises had been burgled and money taken from the slot meter the charge against the defendant would refer to the stolen money as "the property of —— Corporation," and only the Corporation, and not the consumer, could sue.

As he saw the position, the consumer was not concerned with the money once he had paid it into the place in which the Corporation had instructed him to put it. He had no control over the construction or the position of the box. If the supply authority was not prepared to go to the expense of collecting the money daily it must take the risk involved in leaving its collection to a time convenient to itself. He did not think that any judge would hold that an agreement of the kind referred to was good in law.

Mr. Rothwell Replies.

Mr. ROTHWELL, in a brief reply to the discussion, thought that the Town Clerk of Newport had made a good point regarding the notice of a change of system. It was inevitable that reports of the authority's intentions should appear locally beforehand, and if there appeared at the same time a notification that the governing date would be that of the Council's decision to make the charge there would be no injustice to the honest citizen.

Mr. Purse's examples of points to look for in special clauses was particularly helpful. Many corporations were finding the bulk of local legislation so enormous that consolidation of the local Acts was inevitable in the near future. It was therefore valuable to have the opportunity of considering the inclusion of clauses which had already proved useful in practice elsewhere.

Councillor Couston had been most entertaining on the meter question, and one could imagine that the question of dealing with the abstraction of money from meters was of much greater concern in Scotland than its was here. He would suggest that a grave risk of that kind could be covered by insurance.

Sir J. R. BROOKE (Electricity Commissioner), in proposing a vote of thanks to Mr. Rothwell, thought it was pertinent to remark, in view of the legal nature of the paper, that when the London and Home Counties Joint Electricity Authority wanted help they did not consult a legal luminary, but appointed an extremely able electrical engineer. On the other hand, he must admit that legal ability such as had been displayed by Councillor Beale would see its way through any Act of Parliament.

Alderman H. B. VORLEY (Islington) seconding, referred to one difficulty experienced by chairmen of Electricity Committees. They all had two advisers, the electrical engineer and the town clerk. If they asked the former whether a certain thing was practicable he would invariably say that it could be done. The town clerk would hold the opposite view, and after discussion he would recommend them to take counsel's opinion. In his own council they had taken counsel's opinion twice in three months. He was recently informed that he was contravening the provisions of the Gas Works Act of 1847. On investigation he found that this was incorporated in the Electric Lighting Act of 1882, and had never been repealed yet. It was certain that we had not yet reached finality in electrical science. It was equally certain that we had not reached finality in electrical law.

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THE HEAVY-OIL ENGINE.

Its Application in Electricity Supply Undertakings—Properties of Fuel Oils—Types of Plant—Working and Capital Costs—Possibilities for Extended Use in Power Stations.

By G. PORTER.

FOR the second paper on Wednesday morning Mr. Geoffrey Porter, borough electrical engineer of Worthing, chose the title "The Heavy-Oil Engine and its Application in Electricity Supply Undertakings." The Diesel engine, he said, had languished under the shadow of the achievements of the designers of the steam turbine and the high pressure water-tube boiler. Moreover, the performance of the few examples of the engine in England was not impressive.

Mr. G. Porter.

While the war of 1914–18 did nothing to ameliorate the conditions of life, it had an extraordinary effect upon the fortunes of the heavy-oil engine. The stress of the times called for an intensive study of materials, design and manufacturing method which, applied to the heavy-oil engine, bore rapid fruit. Curiously enough the chief development had occurred in ship propulsion, a branch of engineering where conservatism was of the most deep-rooted order. The success of the engine at sea had revived the earlier interest on land to some extent. The total power of the heavy-oil engine employed at sea exceeded four million horse power in ratings up to about 10 000 B.H.P. in individual units. On land it was difficult to ascertain a corresponding value of the total heavy-oil engine power employed. In the United States of America there was about two million B.H.P. and in the United Kingdom about one million B.H.P. Adding a reasonable power for the use in other countries throughout the world, an estimate of about six million total B.H.P. in use was probably not excessive.

The author dealt in some detail with the properties of fuel oils, and said that of a number of fuel oils of similar type those of the lowest viscosity would ensure the lowest specific fuel consumption and the highest thermal efficiency. The calorific value alone was not a safe guide to the value of an oil in use. The speed of engine, cycle time and cylinder temperature at the moment of injection exerted a marked influence.

Effective combustion varied approximately as the speed and as the temperature of the combustion chamber walls; or as the intensity of compression and the degree of oxygenation of the injected oil charge.

Other factors, such as the efficiency of cooling and the stroke/bore ratio, depending, more particularly, upon design, influenced combustion to a marked extent. Viscous oils burned more readily in a slow running large engine than in a fast running small engine. A high maximum temperature and pressure, though objectionable if in excess, aided in burning contained substances of a heat resisting nature.

At first sight the paraffin base oils would appear to be preferable to the asphaltic base oils. Refiners, however, blended the latter so effectively that there was little to choose between the two classes of fuel oil in practical use. Moreover, the great demand for lubricating oils which were generally distilled from the paraffin crudes, tended more and more to the production of lower grades of fuel oil for heavy-oil engine use. The heavy-oil engine of the future must look to a fuel oil of about 0·95 sp. gr. and a viscosity up to about 200 Redwood (No. 1) seconds as the standard.

The author was satisfied that the light grade furnace oil is a perfectly satisfactory engine fuel, subject to the question of "digestion." Knowledge of a recent fuel oil contract had also satisfied him that a "Diesel" oil can be obtained in large quantities at prices very much below those ordinarily quoted to the user of comparatively small amounts.

The principal types of heavy-oil engine designed for power station purposes were classified very roughly as low compression and high compression engines.

(1) The low compression, airless injection engine known as the "Semi-Diesel" or "Surface Combustion" engine. The latter description had been adopted by B.E.S.A. The former name had a wide commercial use and appeared to be founded upon the fact that the compression pressure adopted is about one half that of the genuine, high compression "Diesel" engine. In general such engines were less efficient than the high compression types of the Diesel class and its derivatives. The most recent development of this design, in which the hot bulb had almost disappeared and the cylinder head was entirely water-jacketed, approached very closely the so-called "cold-starting" type of heavy-oil engine. The retention of the crank case for scavenging purposes necessarily limited the permissible cylinder power rating.

(2) The high compression, air or airless injection, slow or high speed engine, commonly known as the "Diesel" engine.

This type of heavy-oil engine was capable of high power ratings in a multi-cylinder design. At the present time the largest engine of the kind, in which fuel was injected by air pressure and the rotational speed was 94 r.p.m., developed 15 000 B.H.P. in 9 double-acting cylinders. The engine was direct coupled to a 3-phase 6 600 V 50-cycle alternator. In interesting contrast to this engine was a pair of 11 700 B.H.P. 10-cylinder double-acting engines running at 215 r.p.m., each coupled direct to an 8 000 kW alternator. Some particulars of these engines were given in the original paper.

The tendency of the times to abandon the air compressor and the air blast system of fuel injection in favour of the high pressure fuel pump and airless (hydraulic) injection method was very decided. The object of the change was to simplify operation and construction and at the same time to cheapen first cost and improve thermo-dynamic and mechanical efficiency. The well known M.A.N. Aktien Gesellschaft in Germany was building at least as many airless injection engines as those of the older type.

In its modern forms the Diesel engine included double-acting and opposed piston designs in addition to the older single-acting 2- and 4-stroke cycle designs.

Coun. J. Wheeldon, Mr. W. H. Robins and Coun. A. Whitehouse in serious mood.

The power rating of single acting engines had probably reached its commercial maximum at about 400 B.H.P. per cylinder in 4-stroke cycle examples and about 600 B.H.P. per cylinder in the 2-stroke cycle. In either case the cylinder dimensions will be about 27 in. by 55 in. at a running speed of 100 r.p.m. and a piston speed about 900 f.p.m.

The double acting type of engine permitted much larger power ratings to be adopted. The problem of designing the lower combustion chamber had been solved in several ways. Most commonly the mean brake pressure below the piston was less than that used above it. Cylinder bores up to 33 in. are in commercial service.

A successful, but experimental, 35 in. double acting cylinder had been built, and developed 2 000 B.H.P. on the test bed.

The development of the heavy-oil engine had proceeded on lines more or less parallel to that of the reciprocating steam

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engine. The essential requirement was to obtain the most economical power to weight ratio. The weight of engine per B.H.P. had been gradually reduced from 3 cwt. to 2 cwt. to about 1 cwt. in slow and medium speed engines. In high speed engines the lowest weight per B.H.P. was about 15 lb. for special railway service, and some 30-40 lb. in engines designed for driving electric generators.

In 4-stroke, double acting designs in service, slow speed cylinders were developing 650 B.H.P.; and in 2-stroke cycle engines as much as 1 600 B.H.P. (*vide* the 15 000 B.H.P. engine already mentioned). The 2-stroke cycle, double acting, airless injection engine constructed by the M.A.N. Co. developing 11 700 B.H.P. was rated at 1 170 B.H.P. per cylinder.

In general the mean pressure rating of cylinders remained at a conservative value, from 65 to 70 lb./sq. in. referred to brake horse power. Mechanical efficiencies ranged from 75 to about 80%. One recent double acting, 2-stroke cycle engine, slow speed and airless injection, had achieved the remarkable mechanical efficiency of 90%. In this instance, as is the case with the majority of the double acting engines, the average mean brake pressure in 27½ in. by 47½ in. cylinders was somewhat low at 54 lb./sq. in. In this engine the rate of fuel consumption per B.H.P. per hour was 0·38 lb.

Opposed Piston Engines.

The opposed piston type of engine, built usually as a 2-stroke cycle machine, had a successful record and was making good headway in land service. Developed from the designs of Prof. Junker and the Oechelhaüser and Fullagar variations, the method of securing the opposite piston motions in the cylinder was one of two kinds. In the well known "Doxford" design, each "line" had three cranks, one to operate the lower piston via the connecting rod, the other two to operate the upper piston. In the form manufactured by Messrs. Cammel Laird and Messrs. Palmer for marine service, and by the English Electric Co. for generator driving, the motion was obtained by rods connecting together the lower piston of one cylinder to the upper piston of the neighbouring cylinder.

The arrangement was good, the engine stresses being taken up very completely. The author's experience of a 6-cylinder engine of the kind running at 250 r.p.m. and developing 1 125 B.H.P. had been satisfactory over a period of nearly six years.

The opposed piston engine was, in effect, the equivalent of a double-acting engine. Up to the present time the cylinder bore of opposed piston engines for land service did not, within the author's knowledge, exceed 14 in.—in this country at any rate. A design employing cylinders of 19 or 20 in. was, however, under construction.

The demand for large engines in the United Kingdom had not approached that of the continent of Europe and other countries, with the result that British makers of land type engines had not seriously considered the extension of cylinder power ratings. An engine of 4 000 B.H.P. in the works of Messrs. Harland and Wolff in Belfast remained the largest heavy-oil engine in service in Great Britain and Ireland. This engine had been at work since about 1913.

It was noteworthy that the Doxford type of opposed piston engine was shortly to be built by a British licensee in England in power ratings up to the largest for land service.

A comparatively recent and very interesting advance in Diesel engine practice was the method of supercharging devised by Mr. A. Büchi.

The method adopted was to carry the exhaust gases discharged from the cylinders at about ⅞ lb. per sq. in. above atmosphere to a gas turbine coupled to a turbo blower. As the gases left the turbine at atmospheric pressure there was no loss of energy by this transfer, the inter-connecting pipes being very short. The blower supplied air to the engine cylinders during the "induction" stroke at a pressure about the same as that at which the gases left the cylinders at the end of the expansion period adopted. The quantity of combustion air and fuel oil mixed in the cylinder being larger than in the normal type of engine, a higher power rating was gained, while the pressure and temperature were not increased.

The "cold-starting" class of heavy-oil engine was singularly mis-named. The description arose from a commercial attempt to steal a march on the semi-Diesel engine which, as was well known, required the addition of heat to enable the first charge to be ignited in the cylinder. In point of fact, the first "cold-starting" oil engine was the Diesel engine itself, in which spontaneous ignition of the first charge occurred solely by reason of the heat generated by the compression of air in the working cylinder to a pressure of about 500 lb. per sq. in. immediately prior to injection.

The fundamental difference between this class of engine and the original Diesel engine lay in the nature of the heat cycle employed. The "cold-starting" engine was practically —if not entirely—a constant volume machine. The economy of the engine was good, if anything rather better than that of the Diesel engine of equivalent output owing to the nature of the design and the absence of an air compressor. In England this engine was extensively manufactured by Ruston, Hornsby and Co., Ltd., of Lincoln. At full load a fuel consumption of 0·396 lb. per B.H.P.-hr. was achieved, corresponding closely to a kWh consumption of 0·59 lb. The author did not know of any example of this type exceeding a total power 650 B.H.P. in 6 cylinders. In power ratings up to those of the equivalent Diesel engine this engine was a very close competitor of the older design.

Drawing a line at about 600 B.H.P. capacity per engine, it could be said that the "Diesel" engine in its modern form as an "air" or "airless" injection engine holds the whole heavy-oil engine field above that limit. The tendency of design was markedly towards higher piston and rotational speeds, higher brake mean pressures and lighter construction to reduce first cost. As a high speed engine could be sold at a price about three-fifths that of a slow speed engine of the same or similar power it was obvious that the problem of the efficient design of the high speed engine would be pursued with energy.

Mr. Porter thought it was unnecessary to say much about lay-out, as there was nothing simpler than the arrangement of the details of a heavy-oil engine lay-out in normal circumstances. Given a suitable site with an ample water service, a good sub-soil and easy access for the transport of fuel and all materials, the lay-out settled itself. The ease of oil storage required no elaboration and the complete absence of dust, noise and smell from the storage tanks eliminated at once nine-tenths of the possibility of "nuisance." Engine foundations must be very carefully carried out. A modern heavy-oil engine was so beautifully balanced that earth tremors seldom caused annoyance. The single-acting 6-cylinder engine represented perhaps the best example of balancing to be found in power plant practice.*

The cooling water question had nothing like the importance of the water supply in steam stations. A maximum of 7 lb. of water per kWh was an ample provision to make.

Fuel oil storage could be safely calculated on a basis of 3 500 kWh per ton of oil.

Floor Space Requirements.

The floor space required by the slow and medium speed heavy-oil engine was moderate. A maximum provision of 0·60 sq. ft. per kW of capacity was ample to ensure efficient working space round and about the engines. Expressed in the reverse manner the capacity density was about 1·7 kW per sq. ft. The height was least with engines of the trunk piston type and greatest with the double acting design. A single-acting cross-head type engine, 2- or 4-stroke cycle, was intermediate.

A recent paper read by Mr. Ricardo at a branch meeting of the Institution of Mechanical Engineers in Lincoln on December 19th last described a revolutionary lay-out of a 45 000 B.H.P. station in terms of 150 high speed engines of 300 B.H.P. each. His suggestions met with a not unfavourable reception in spite of their novelty, and the proposal was not so unwieldy or impracticable as at first sight it might appear.

When space was somewhat limited, as in a sub-station, and the dimensions of the generator might be inconvenient in width, there was no difficulty in arranging a geared drive between the engine and the generator. The levels of either engine or generator could be so chosen that they had a common centre line.

The author then gave details of heavy oil engine working costs.

The variations in engine cost were considerable and in this respect were comparable to the experience of steam users. Much, of course, depended upon the value of the "annual" and "running plant" load factors. There being no standby charges affecting the fuel consumption, the fuel cost was a function of "running plant" load factor. The other items depended mainly upon the "annual load" factor. Two

*The author dealt with this matter in considerable detail in a paper presented to the Diesel Engine Users' Association in 1920

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stations in the table in the original paper showed an engine cost less than one half-penny per kWh and eight did not exceed 0·7d.

An analysis of average fuel consumption, thermal efficiency and fuel cost of 23 stations equipped with engines varying in age between 19 years and one year, operated over a wide variety of load factor, was also illustrated in graphical form, and various conclusions were drawn.

In analysing heavy-oil engine station costs the Diesel Engine Users' Association had noticed an interesting fact in the position taken by a set of engines about 20 years old. These engines achieved the lowest average rate of fuel consumption per kWh in a list of 138 engines. That so low a fuel consumption as 0·665-lb. per kWh should be attained in the 20th year of an engine was a remarkable commentary on the sustained efficiency of the heavy-oil engine. Except on account of obsolescence due to insufficient generating capacity the question of depreciation from the point of view of economy hardly arose.

In concluding the section of his paper dealing with the actual results obtained in the United Kingdom by the use of the heavy-oil engine, the author mentioned the great benefit derived from this type of prime mover by the undertakings concerned.

The future of the undertakings in this country, undertakings of the "non-selected" type, was very uncertain from the financial point of view. The heavy-oil engine had served them so well that their share in the good things to be offered by the Central Electricity Board might well be less than that of their colleagues in the industry who had clung to steam generation—perhaps not in its best form. Up to the present time the bulk supply prices that had been arranged were not especially attractive when contrasted with local heavy-oil engine generation, especially in the areas where a power company was supreme. With increasing output the standing charges of the "oil" stations tended steadily to fall, so that the position of many of them, good as it might be to-day, contained the prospect of even better results were local generation to continue.

Their future depended upon the level of the bulk supply charges, even if they remained active for peak load work. These charges were an unknown quantity. Those that had been provisionally agreed during the intermediate period of the construction of the primary and secondary transmission systems were not based upon any definite method of accountancy. The ultimate charge might be something very different from the temporary charge, especially when it was remembered that the Central Electricity Board had power to suspend any contribution to the Sinking Fund for five years. In general rates of charge of the order of £3 per kW and 0·25d. or 0·30d. per kWh were too high to benefit a well established heavy-oil engine generating station where extensions of similar plant could be effected. In units up to 1 000 kW capacity an extension could be carried out for an annual capital charge of about 30s. per kw (interest and repayment being calculated at 5% for the normal periods as a simple annuity).

Results Abroad.

Abroad, the favourable results gained in small and medium power stations equipped with the heavy-oil engine had encouraged the use of engine units of far larger capacity than was customary in this country. The variety of use was considerable. Units of 1 500 and 2 000 kW capacity were numerous. They were used as the sole generating medium; in combination with steam installations and with water power plants; for peak load duty; for secondary base load purposes; for emergency duty; for local sub-station requirements.

The individual problems had been most carefully investigated and solved to the best advantage by engineers abroad where the heavy-oil engine was now regarded not so much as a competitor of steam, but as an ally to be utilised in effective combination to secure the most favourable economic result. In the United Kingdom we had not reached this stage. It was also clear that the total capacity of heavy-oil engine plant in power stations at home was so minute a proportion of the whole capacity that it could not influence the general position, though, where it existed, it might continue to do useful and valuable service. The amount of steam capacity to be made available for the purposes of the Central Electricity Board was so vast that the purchase of further prime mover plant of any kind outside the great bulk supply base load stations would be entirely unnecessary.

It cannot be a matter for surprise if some of the larger industrial concerns returned to "self" generation and looked favourably upon the simple, compact and highly efficient and handy heavy-oil engine as an excellent means of satisfying

Coun. F. W. Pratt, Mr. I. V. Robinson and Mr. G. Robson enjoying the latest joke.

their requirements. Should this possibility materialise it was not unlikely that the accelerated increase of output and demand upon which the 1926 schemes depended would fail to occur and the Central Electricity Board might be unable, whatever its intention, to sell energy at a rate low enough to enable the local distributor to retain his best class of business.

As illustrations of the result of "self" generation by means of the heavy-oil engine the author quoted the case of a factory plant with an output of 586 000 kWh and a plant capacity of 420 kW. The maximum load was 235 kW and load factor 28·4%; fuel costs were £850; oil, water and stores, £122; wages, £130; repairs and maintenance, £150 and capital charges £950. The cost per kWh was 0·901d.

This expenditure represented a saving of £549 per annum on the amount formerly charged by the local supply undertaking for the same service. The local rate was undoubtedly high in the light of the good load factor conditions. That the plant would be written off in ten years' time was a deciding factor in the decision of the firm to put down their own generating plant.

A department store under "self" generator paid 2·16d. per kWh. The rate charged by the local authority was 3¾d. The annual saving was therefore £1 677.

A comparison was then made of the capital and operating costs of a 20 000 kW capacity generating station equipped with heavy-oil engines or steam power—the latter being of good design such as was found in municipal power stations of the capacity chosen, but not equipped with the refinements incorporated in the largest base load stations at home or abroad.

The annual demand load factors were taken in succession as 35, 25 and 20%, approximating to the conditions obtaining in an industrial or a residential town.

Capital costs worked out at £21 and £15 per kW for oil engine and steam plant respectively, and the average cost per kWh at 0·158d. and 0·111d.

On the basis of the estimates the steam station was the more economical to the extent of 4, 4·2 and 5%, the maximum difference being of the order of £3 600 per annum. An increase of 10% in the price of coal (say, 1s. 6d. per ton on 15s. per ton) would place the annual cost of the two equipments on level terms.

Thus, the conclusion of engineers abroad that "there is nothing in it" between the two methods of generation when the output to be dealt with is considerable was borne out. There might, however, be factors other than cost bearing an important influence upon the choice of plant.

The use of the heavy-oil engine in the power station side by side with steam generating units or in distant sub-stations for peak load duty had been much discussed during the past two years or so. In Germany combinations of the kind were frequent and were undoubtedly satisfactory. In making any such arrangement cost was not the only consideration to be taken into account. Indeed, on a pure cost basis it was not

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always clear that a definite financial advantage could be obtained.

The heavy-oil engine possessed a remarkable advantage over the turbo-generator in its capacity for quick starting from cold, and without any kind of preparation charge other than the standing charge for attendance and capital. Formerly this disadvantage of steam power was felt not only in the turbine room, but in the boiler house as well. The advent of the pulverised fuel boiler had much improved the flexibility of the steam raising section. With a reserve of powdered fuel of far smaller quantity than the amount of larger coal required in stoker-fired boilers steam could be very quickly raised in emergency. On the other hand, the turbine lacked this degree of flexibility entirely. Careful adjustment of temperature was an essential before load could be applied. This consideration, among others, had weight in the decision of those responsible for the purchase of the 10 500 kW heavy-oil engine set in Hamburg. Other towns in Germany, Bremen, Kottbus and numerous others had found this favourable feature of the heavy-oil engine a great convenience. At first sight the cost of a Diesel engine, round about £16 per kW with its foundations and generator, would not appear to be justified for short hour use. The time factor might vary according to conditions from 200 hours to 1 000 and over. Normally 800 hours was not unusual.

Oil Engines and Peak Load.

In the author's opinion the heavy-oil engine either for peak or base load duty, at the main generating station, could not compete with the "high efficiency" base load type of generating plant with its large overload capacity and quick steam raising characteristics. Until the prevailing conditions of relative capital cost and relative fuel price were materially altered this conclusion appeared to be inevitable. Nevertheless, each case must be investigated separately.

With regard to sub-station duty the position was governed entirely by the capital cost of transmission from the generating station, by the annual value of losses in the cables or overhead line transmission, transformers and converting plant from a.c. to d.c. if employed, and the capital cost of the last two items. According to the capital cost of laying e.h.t. cables to a sub-station, it might or might not be desirable to provide additional cables, either in the form of radial feeders or as additions to a ring main system.

There were undoubtedly cases where the extension of a sub-station plant by oil engines would effect an economical result. The provision of a quick starting generating plant, entirely independent of the electrical system on the "incoming" side, in a heavily loaded district such as a shopping or theatre centre or a group of factories, would add to the safety, continuity and reliability of supply.

In a minor but not unimportant direction there was a strong case to be made out for the use of the heavy-oil engine as the primary source of energy for the internal auxiliary service of a steam generating station. The house-turbine system afforded a supply of energy independent of the main electrical source, but was still dependent on a common steam raising equipment. In the interests of safety and in a dire emergency a complete separate power station supply system was a necessity when the auxiliary service was as important as that of a large generating station now was. The provision of a separate battery of boilers for the auxiliary system or the sole use of one of the main steam raising units for the purpose was out of the question. The heavy-oil engine was admirably suited to this class of service and could be usefully and cheaply so employed.

THE DISCUSSION.

Mr. MELLOR (Fraser and Chalmers) said he could not quite agree that the oil engine in this country had languished under the shadow of progress in steam turbines. On the contrary, he submitted that the steam turbine designers had been spurred to valiant efforts to maintain relative progress on overall therms, efficiency and generating cost per unit with that which the modern oil engine could give. To-day we still had in service oil engines, which though 25 years old, were giving not only high thermal efficiency but also good mechanical behaviour.

Progress in metallurgy had reduced the cost of maintenance considerably, the correct blending of metals for fixed and moving parts, working on each other, having promoted longer life.

Pistons, cylinder heads, and cylinder liners had been the subject of years of research, and oil engine manufacturers were practically at the point where they could say that the trouble of cylinder liner wear on large cylinder sizes was now reduced to a minimum by correctly-designed piston rings.

To-day they could give a definite assurance that thermal and mechanical efficiency would remain at a higher level than in any other prime mover over a given number of years. Could this be said of a steam installation, the efficiency of which decreased as wear and tear on blades and nozzles took place. Continuity of service, which was so vital in any prime mover, could in the oil engine be said to have reached as high a standard as a steam installation.

The author had covered the question of fuel oils very thoroughly. Furnace oil with a low ash content of 0·05% could be used on a normal engine, and a trunk piston engine of 250 B.H.P. per cylinder had run satisfactorily for over 8 000 hours on this fuel. Only a few years ago the limiting power per cylinder was thought to be about 500, yet to-day 2 000 B.H.P. or more per cylinder with double-acting engines or opposed piston engines was not an altogether impossible achievement.

It was generally agreed that the large oil engine could now be used efficiently for peak load or standby plant, and the many arguments in favour of this had been substantiated by practical demonstrations in Germany and London. It would be a surprise to many to learn that in London there was over 10 000 B.H.P. in oil engine plant specially laid down to deal with peak load, and supplying special theatre mains. In an underground space in the West End of London was an oil engine station capable at present of dealing with 5 000 kW, and, eventually, 7 000 kW. The space was 120 ft. long, 36 ft. wide and 21 ft. high, and yet there was ample room for reconditioning and dismantling. All auxiliaries were in the same space, and switchboards and controls were on the floor above. Fuel storage, filtering and water softening plants, together with cooling tower and exhaust silencers found accommodation without the passers-by having any idea that such a plant was in operation. It was not difficult to visualise similar, but much larger underground stations of the kind advocated by Mr. Dykes, placed in similarly unobtrusive positions in crowded centres.

An Invitation to the Commissioners.

Statements of this kind would show many advantages over steam plants of similar size, if only the Electricity Commissioners would take the trouble thoroughly to investigate their virtues.

The author apparently favoured supercharging for obtaining additional power for a given swept cylinder volume. In his view the oil engine was already pre-eminent without burdening it with supercharging.

Dealing with lay-out, he thought Mr. Porter had put the cost of oil engines and generators too high. Whilst pulverised fuel was lessening the cost of coal for steam generation, parallel efforts were being developed for reducing the cost of fuel oil. It was high time that we obtained our fuel oil from coal. Surely the Commissioners could, not lessening their patriotism towards coal, delve more sympathetically into the economic status of the large oil engine power station, either as a bulk supply, peak load, or standby plant.

We in this country were the pioneers of the internal combustion engine, just as much as of the steam turbine. The Electricity Commissioners were the servants of the public, and it was their duty to perform their functions by thoroughly investigating whether large oil engine stations could be used efficiently for the public benefit.

Mr. I. V. ROBINSON (B.E.A.M.A.) said that though it had been stated that the heavy oil engine was very useful for peak loads, investigation of the economics of peak load supply showed that cheap plant was the principal requirement. It was, in fact, from ten to fifteen times more important than the cost of the fuel. All the capital charges had to be spread over a very small number of hours of operation, and it was absolutely essential to get the cheapest plant possible. This was where the Diesel engine failed, for it was not possible to put up an internal combustion engine of the same capacity as a steam station for the same cost. The author had indicated that the high speed type of engine could be sold at about 60% of the cost of the slow speed unit, and thus it appeared that the future of the internal combustion engine was based on the high speed engine.

Mr. GERCKE said that at Hamburg, by merely cutting the peaks of the load curve, a Diesel set saved some 5 000 tons of coal in the last winter season, and also several times saved the general situation when the electricity supply of Hamburg

(*Continued on page* 684).

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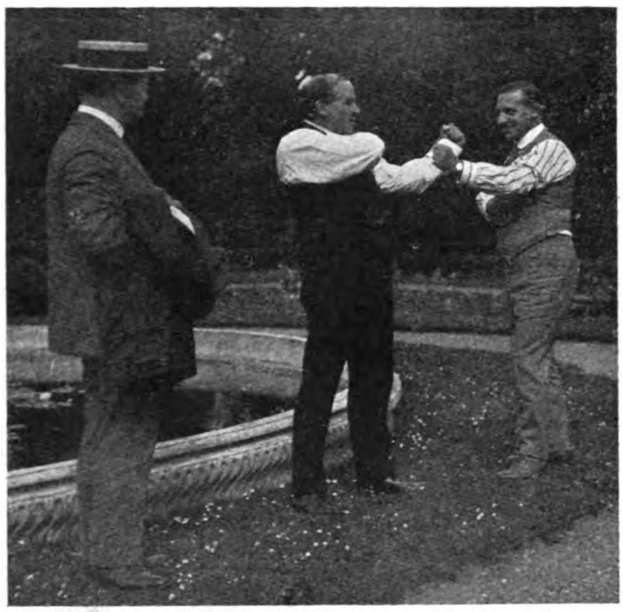

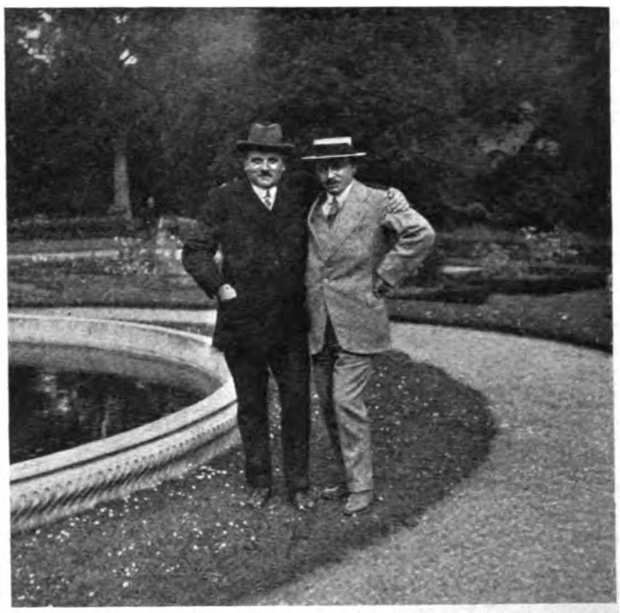

THESE interesting photographs, taken at the I.M.E.A. Convention in 1914, show, on the left, Mr. A. Nichols Moore (striped shirt), and Mr. J. Horace Bowden. They were at that time great antagonists and squared up in the grounds at Kenilworth to settle matters. Mr. E. E. Sharp, of Venner Time Switches, acted as second to both and may be seen holding the coats. The other picture shows the combatants reconciled.

was threatened by ice trouble in the condensers of the steam installation.

He advocated consideration of the possibility of producing the fuel oil for peak load Diesel engines in this country by utilising coal tar products. The production of coal tar was considerable in this country, and there would be enough to operate large peak load installations with coal tar oil, without increasing the importation of foreign Diesel oil.

Mr. J. CHRISTIE (Brighton) said he had watched with interest the gradual development of Mr. Porter's old and somewhat inefficient steam station and its ultimate replacement and extension by modern Diesel plant, which, for its size, was one of the most completely equipped and efficient Diesel engine stations in the country, with results which were second to none.

The author had made out an excellent case for Diesel engines and their more extended use as emergency and peak load spares, even on a big scale, for use in connection with super-power stations supplying the national " grid " system.

When such stations as Mr. Porter's were eventually shut down this efficient plant might well be used by the Central Electricity Board for developing the demand in outlying areas, until the demands justified the heavy capital expenditure of extending the " grid " with the e.h.t. switching stations, transformers, etc., and their attendant losses.

Lt.-Col. H. W. WATTS said that in the Epsom station a Diesel engine was installed in 1912, and it was interesting to compare it with the new and up-to-date engine now being erected, which was of the double-acting two-stroke type, 150% higher in power, and yet occupying less space than the older plant.

There was no doubt that the dice was loaded against the Diesel user, who had a very short loan repayment period compared with the steam user, and it was probably only due to this fact that the powers that be had found an excuse to withhold their sanction for further extensions of this type of plant. Col. Watts maintained that with its higher thermal efficiency the Diesel engine was a serious competitor against the very best steam plant. The paper exemplified the suitability of Diesel plant carrying peak loads, and there was no doubt that the schemes of the Central Electricity Board centralised the peak and showed it in a manner not previously recognised. It was a debatable point whether it would prove economical to transmit energy over long distances to meet these peaks, and it became a question of what type of plant would efficiently generate the energy required at a point as close as possible to the place of consumption. Being much greater in thermal efficiency than up-to-date steam plant, the Diesel was definitely suitable for this service. It was a fact that new plant could be installed for £11 per kW and at 8% for interest and depreciation; this worked out roughly at one pound per annum capital charge on Diesel plant. The tendency of bulk supply authorities was to often charge well over £4 per kW of maximum demand, so that with new Diesels there would be a saving of at least £2 yearly over steam plant. He had actually received quotations from British makers for a 5 000 kW Diesel set for £11 per kW, and had been offered a consumption figure of 0·47 lb. of fuel per kW. Whether electricity was generated locally or supplied in bulk it would continue to bear two or three profits before reaching the consumer. Of the steam stations in the south-east of England electricity district the highest thermal efficiency obtained in 1928 was 19·45% and there were seven stations in the district with less than 10%. The highest of all steam stations in this country was the Barton station of the Manchester Corporation for which the figure was 21·07%, while the lowest station was 3·03%. The highest figure for oil stations in this country was 28·23%, at Bognor. Another point was that the small quantity of fumes escaping from the exhaust of oil stations contained less than one tenth of sulphur that escapes from burnt coal. The author's figures for operating costs were too optimistic on steam fuel costs, as no steam station in any district could get such costs. At Epsom, however, the speaker was getting the fuel costs the author quoted for heavy oil plant, and any similar plant should easily produce these figures. He appealed to engineers with purely steam plant, and, particularly those who would control selected stations, to consider carefully the possibility of installing oil engines, more particularly for looking after peak loads.

Mr. C. M. JOHNSTON, of Shrewsbury, said the paper dealt with two types of plant, one running at 250 and the other at 750 r.p.m. The author advocated high speeds above 250, but the speaker had experienced sets at 350 with excellent results. Owing to low production cost, the oil engine plant made it possible to sell cheaply in Shrewsbury. In well balanced six cylinder engines there was no vibration and no smoke, while all smell was absent and at his own station water cooling plant was installed on the roof of the building.

MR. BERTRAM KELLY, of Douglas, said he had at his own station four heavy oil engine generators with an output of 2 500 000 kW, at a cost for fuel oil and water of 0·39 of a penny per unit. All agreed with the suitability of Diesels for the smaller stations, but it was the Commissioner's policy to use larger stations. In the Isle of Man where the Electricity Commissioners had ceased from troubling, and the Central Electricity Board were at rest, development was unrestricted but generally followed British practice, and his station would soon become the capital station for supplying the whole island. Though he was putting down a new steam station he was, nevertheless, confident that using Diesels for peak load would get much better results.

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MR. HOWARD, of Macclesfield, thought the question of fuel very important. If the engineer did not understand fuel they were not likely to make the best showing with Deisel plant. With regard to Mr. Gercke's reference to tar oil this was suitable only in Germany where there was surplus tar, but here there was not enough for the purpose. He deprecated the pleas of those people asking for a fair chance to be given Diesels. They needed no sympathy, having proved their ability. At his own station he would scrap Diesels if they were not the most efficient machines for his purpose. One set, now fifteen years old, is almost as good as new. The whole secret was careful and regular maintenance.

Mr. G. PORTER briefly replied and Mr. P. P. WHEELWRIGHT proposed a vote of thanks.

STANDARDISATION OF METHODS OF CHARGE.

Some Thoughts and Considerations—Allocation of Fixed and Running Charges—"Equity" a Fetish—The Doctrine of Expediency—Desirability of Two-Part Systems.

By E. J. JENNINGS.

MR. E. J. JENNINGS (Secretary of the Birmingham Electricity Undertaking) in presenting his paper read on Thursday, explained that it was mainly intended for the Committee members, and it raised afresh such ever-recurring questions to the newly-elected committeeman, as why, for instance, lighting supplies should be charged at four, six or eight times the price at which some power supplies were furnished, and how it was possible, when the average price of all supplies worked out at, say, 1½d. per unit, to supply under certain conditions at ¾d. per unit, and yet make a good profit on the deal.

Mr. E. J. Jennings.

Among the methods of charge at present in operation in various parts of the country were three flat rate systems, four two-rate systems, two-part tariffs, with ten different methods of calculating the fixed charge, and three other miscellaneous forms of charging.

Obviously such a diverse range could not be justified on any plea of diversity of local conditions, and it formed a striking contrast to the uniform system adopted hitherto by the gas undertakings.

The desirability of evolving some sort of order for the foregoing state of affairs was apparent, and the fact that within the next few years practically all electricity undertakers would cease to be generating authorities and would become purchasers of electricity in bulk from the Central Electricity Board, rendered it necessary to take stock of the position.

Mr. Jennings thought there had been rather too much tendency in some quarters to found tariffs on "scientific" principles.

A manufacturer aimed at making a profit on each of his products. The measure of that profit was determined by market conditions, competition and so forth, but prices were adjusted according to the character of the demand for his product and the whole of the circumstances in relation thereto.

In any survey of the tariff question, first principles as laid down by Dr. John Hopkinson must be restated, and it was a tribute to the vision of that great man that the "Hopkinson" theory, as enunciated 37 years ago, held good to-day to so large an extent, though its application called for certain limitations under present conditions.

The author then gave extracts from Dr. Hopkinson's Presidential Address to the Junior Engineering Society in 1892, on "The Cost of Electric Supply," from which it was clear that, shortly put, the Hopkinson theory is that the cost of electricity supply depends mainly on the rate at which it is taken, rather than on the quantity of energy supplied, or, put in another way, that the costs are of two distinct categories, viz.: (1) those that do not depend on the number of hours of supply, and (2) those that are directly proportional to the hours of supply.

Mr. Arthur Wright was the first to attempt to translate this theory into practice with his maximum demand system. In time, the limitations of the M.D. system became apparent as it was realised that an important element not catered for was "diversity factor," both as between the various descriptions of consuming appliances and as between different classes of consumer. Neither did it allow for the period of the day when supply was required.

The actual time of supply might be of more import than the number of hours of supply. For instance, a consumer with a load factor of 30%, if taking supply wholly during off peak hours, would be cheaper to supply, relatively, than one with a 100% load factor whose demand must of necessity cover the peak load.

Water heating during the night under these conditions came as a gift from heaven, and any margin in price that could be obtained over the actual cost (say 0·25d. per unit) of the extra fuel, etc., required to meet this type of demand would all be profit for the undertaking. In spite of this, how difficult it was sometimes to persuade the powers-that-be that a rate of 0·375d. or even 0·5d. for this type of "valley" supply was good business.

Simplicity and equity were both admittedly desirable considerations in framing any system of charge, but one of the first essentials was to get the consumer to realise why electricity could not be measured and charged at the same all-round price (with perhaps a commercial discount on quantity), no matter when or for what purpose required. The main reason for this, of course, lay in the fact that our commodity could not be stored and packed away or put down to stock like most other commodities. If it could, the task of the tariff maker would be simple indeed.

Hence it came about that the major portion of the total costs per unit of output was definitely of the order of "fixed" charges; that was to say, all this expenditure must be incurred in preparing to supply before a single unit was sent out from the works. Once this class of expenditure was provided for, any additional cost per unit of output was small.

On the balcony following the reception given by Mrs. Nichols Moore, showing, right to left, the wife of the President, Mrs. Ll. B. Atkinson, and Miss C. Haslett.

The precise apportionment of an undertaking's expenditure into two classes—"fixed" and "running" costs respectively—had been the subject of much discussion, and was obviously a matter on which there was room for more than one opinion.

The following, in the opinion of the author, represented a fair approximate apportionment for general purposes, though

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WITH "THE ELECTRICIAN" PHOTOGRAPHER AT TORQUAY.

The President with Mr. L. R. Morshead.

The President and another well-known electrical personality.

Delegates on leaving the exhibition receive a tip for the Derby. We wonder . . . was it good?

A special pose for "The Electrician," showing Mr. H. F. G. Woods, Coun. J. Taylor, Ald. W. Walker, and the President.

The Mayor of Torquay and the President.

it was not claimed as being " scientifically " accurate. Local conditions might quite conceivably vary some of the proportions named.

The cost components of the order of " fixed " or " standing " charges were :—

(i) Capital charges as a whole (interest and sinking fund, etc.).
(ii) 15% of the cost of fuel, oil, water, etc. (required in order to be "ready to supply ").
(iii) 90% of wages and salaries at stations.
(iv) 80% of repairs and maintenance costs (generation and distribution).
(v) Rates, taxes and rents as a whole.
(vi) Management and miscellaneous expenses as a whole.

leaving as " running " charges :—

(i) 85% of the cost of fuel, oil, water, etc.
(ii) 10% of wages and salaries at stations.
(iii) 20% of repairs and maintenance costs (generation and distribution).

As a concrete example, the figures relating to the Birmingham undertaking for the year 1927-28, analysed on the above basis, were set out diagrammatically. From this it was seen that the fixed costs represent 78·54% of the whole, leaving 21·46% of the expenditure as being dependent on the extent to which use was made of the plant and organisation.

Corresponding particulars tabulated for six of the largest municipal undertakings for the same year showed that the results could be accepted as indicating average general data so far as large undertakings in this country are concerned.

The segregation of " fixed " from " running " costs having been accomplished, the fixed costs could be related approximately to the different classes of supply—domestic, commercial and industrial—with due regard to their respective diversity factors.

It must be conceded that both legally and in equity charges *should be related* to costs to a large extent. In any case, the true import of costs as defined between those of a " *fixed* " and " *running* " order, respectively, must be understood clearly by all concerned with the framing of tariffs ; hence the extent of the consideration given to this aspect of the matter. But slavish adherence in the framing of tariffs to a " scientific " analysis of costs might well be fatal to any real progress in the development of undertakings.

The supply of electricity for lighting was in every way the most expensive section of an undertaking's business, and in equity should be made to carry as much of the standing costs as it would stand.

The practice obtaining in some towns of so arranging price and tariffs as to provide substantial surpluses for rate fund was much to be deprecated.

Whether under any circumstances a portion of realised profits from electricity supply should be paid over to the rate funds was a matter on which there was room for two opinions, but a deliberate policy of charging more than would otherwise be necessary in order that large amounts could be handed over, and the ratepayers' pockets, *qua* ratepayers, relieved, was wrong and contrary to the spirit of the Acts under which it was made possible for public authorities to become authorised undertakers.

It was well therefore that the Electricity (Supply) Act, 1926, definitely put a veto on any contributions to rate funds after March, 1930, unless and until there was a sufficient reserve fund accumulated to establish a reasonably secure position, and then only within clearly defined limits.

All the available evidence seemed to indicate that in any scheme of standardisation the ultimate general adoption of a two-part tariff was desirable.

A graduated scale of flat rates might admittedly be constructed with some regard to the incidence of fixed and running charges, but this at best could only be on the basis of averages for groups of consumers, and could not possess that degree of flexibility that adjusted the average price to individual consumers according to their load factor, which was inherent in a two-part tariff.

The arguments in favour of a two-part system of charge were reinforced by the undoubted popularity and effectiveness of such a tariff wherever it had been introduced. Another inherent advantage was that it enabled the consumer to know to a large extent what his annual bill would be.

This was far more important to the consumer than that he should know exactly how the actual fixed charge was arrived at.

After examination of the principal forms of multi-part tariffs in use, the author felt that a blend of rateable value and area as a basis, so far as domestic supplies are concerned, presented so many advantages over others as to provide the most likely solution of the problem.

The conclusions reached as the result of a general survey of the incidence of costs, experience of progressive undertakings,

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and the evolution anticipated under the 1926 Act, were therefore :—

(1) Standardisation of methods of charge is desirable in the larger interests of the industry, (*a*) because in future, practically all electricity supply undertakers will themselves be purchasing bulk supplies on a " common " basis, even though rates themselves may differ owing to differing conditions ; (*b*) because it will avoid confusing consumers, who move from one area to another, if a system of charge is universal throughout the country, as in the case of the telephone service.

(2) Equity and experience alike call for the general adoption of a two-part tariff with possibly two-rate meters in certain cases. Any tariff adopted must be sufficiently elastic to permit and encourage freely a policy of filling in the " valleys " in the demand curve.

(3) With regard to the basis for assessing the primary charge to cover standing costs, no universal standard, capable of meeting all requirements, has yet been evolved; but, as nearly as may be, this should be related to the size of the building and the character of its use (e.g., domestic or commercial), and in the case of industrial supplies it should be on the actual maximum demand.

(4) In any tariff or method of charge adopted every unit or output should bear some contribution, but not necessarily the same percentage contribution, towards fixed or standing costs.

(5) The difficulty of dealing with large undertakings developed on the basis of graduated flat rates should be met by the offer of alternative attractive tariffs of a two-part character, and a process of gradual change-over. Consumers should be given the option, for a limited period, of either two-part tariff or flat rate system, and reductions of charges should in future be confined to the two-part tariff rates.

THE DISCUSSION.

Mr. C. G. MORLEY NEW (Cardiff), discussing Mr. Jennings' paper, stressed that the paper was specially intended for committee members, but he thought if ever we got down to standardisation a technical consideration would have great weight. Expediency could be a good servant but bad master. He traced how differences in tariffs arose through starting out merely for lighting and developing other loads later. He agreed that standardisation of tariffs was necessary. It was often found that alternative rates were offered even by the same undertakings. He thought that the author might have aimed at simplification as well as standardisation. He suggested that the author should assume that those who dwelt in the higher rated houses would not object to a higher standing charge. The author might equally take into account habits of inhabitants and the number in family. He contended that in domestic tariffs no factor should be introduced which was left to the discretion of an official. There was too much separate bargaining. The paper would have been more opportune seven years ago, as the psychological time for drastic changes was now past. He thought that no compulsory two part tariff would command support either from the Commissioners or consumers.

Mr. ARTHUR WRIGHT, of London, the first president of the Association, who was received with great applause, said they wanted younger men to say what had been done during the last thirty three years on this subject. The author's paper was very complete and there was little to add. It was important to get lay members to study Hopkinson and get Hopkinson into their system. Hopkinson's scheme was perfectly clear and commercially understandable. Most of our troubles were due to wrong nomenclature. Electricity was not a commodity but a service—much more akin to telephone, police or water services. If considered just from the service point of view the problems would be much simpler and would have a simple charge for service. There was a danger in trying to meet the popular cry for some average charge which was fatal to further development. If they wanted the community to take electric service they must simplify the charges. The field for electrification here was tremendous. Amsterdam was quoted as a remarkable instance of the use of the Hopkinson principle. Some places were afflicted with tariffs and a different system existed almost for each.

The clamour for lower prices benefited those who could afford to pay more and left out the poorer classes. The business was to give a general supply on equitable terms to all choosing to take it. Some supply companies in this country had a monopoly and should be content to give a universal service and take a reasonable return. The monopoly also existed in the case of municipalities, and their duty again was to give electricity to the masses. There was a great danger of applying the doctrine of losing on the swings and gaining on the roundabouts. He had been unable to discover what terms authorities would get for supplies from the Central Board. He had asked members to find out how little it cost to continue a supply after arrangements had been made to supply. It was so startlingly low that some would suggest the use of special meters. The new grid electricity supply would have to be given at a much lower figure than any yet reported.

Mr. J. CHRISTIE (Brighton) said he had always advocated simple flat rates for light and power, each being as cheap as possible. The only fair way of operating a two-part tariff was a straight maximum demand. This was the only equitable method determining an equitable charge for every consumer. The flat rate system required an extra meter. But this was not a serious matter, and in his opinion we should abolish meter rent. He wholeheartedly supported flat rates.

Ald. W. WALKER (Manchester) urged all committee members not to bother with floor area and other fancy affairs. The author, after pleading for simplicity, had evolved a very complex method which was open to considerable criticism. It was not always so simple as Mr. Wright suggested, and it was more often necessary to evolve a special tariff if new business was wanted.

Dr. S. Z. DE FERRANTI said that he was, this year, president of the E.D.A., which association stood for more electricity and all going with it. The general public did not understand the business of charging for electricity, and the industry must try to make it easier for a better understanding. At the present stage of development there was no option but to adopt the two part tariff. The method of arriving at the fixed charge was not important, but must be high enough not only to cover standing charges but to supply metered units as cheaply as possible. The use of small labour-saving devices in the home was not only handicapped by the fairly high purchasing price, but when fully employed their consumption was often large and tariffs must allow for this. The time had arrived for simplification as far as possible. The public were puzzled by the wide fluctuation in prices throughout the country, and he was afraid that this was often due to want of commercial efficiency.

Mr. F. M. LONG (Norwich) said that the cost of mains was much greater for lighting than for power consumers, and this explained why bulk power rates could be cheaper than where the demand was spread over a wide area. He favoured the rateable value system for domestic consumers, as it appealed to such as being fair. A running charge of about a penny a unit was, in his opinion, about correct, but night water heating should be about a farthing.

Objection to Rateable Valve.

Mr. S. E. BRITTON (Chester) thought the paper valuable to engineers as well as to committee members. There were too many methods of charging, and the sooner they were cut down the better. He did not think it possible to supply for all purposes at a ½d. The principle of the two part tariff was that the highest possible charge for the standing charge be made and the lowest possible for consumption. One objection to rateable value was the difficulty of getting the rate fixed. He had got assessments of about 20 000 properties at a cost of about £25. Undertakings must be prepared to supply electricity for all purposes.

Mr. H. C. LAMB (Manchester) noted that nobody had attacked the author's views on equity, with which he heartily agreed. If they did not obtain business where there were profits to be got, progress would be delayed. He also referred to the strong competition in the industrial field from gas, and unless this was met with attractive rates we should not get more industrial consumers. The weakest part of the paper was that on standardisation, as the author failed to make any definite recommendation. The time was not ripe for standardisation, as it would not help progressive undertakings, though, on the other hand, it might speed up the backward ones.

Mr. E. J. JENNINGS, replying to the discussion, was deeply appreciative of the remarks of the speakers, but believed there had been too little criticism. Mr. Christie's attitude was one to get away from. He hoped to deal with the various points raised during the discussion, in the Association's proceedings.

Mr. NICHOLS-MOORE then announced the Council's decision to reprint the paper together with a full discussion for circulation to all committee members.

Mr. FRANK HODGES (Central Electricity Board) proposed a vote of thanks. Ald. G. WHITFIELD seconded, and said the paper was eminently understandable by committee members, being full of matter of interest to engineers as well.

Mr. Jennings briefly acknowledged. The President announced that no official photograph would be taken.

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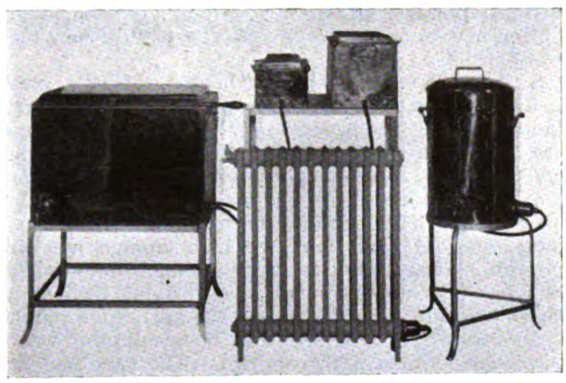
THE I.M.E.A. EXHIBITION.

First of our Brief Reviews of the Exhibits at Old Torbay Hospital—Comprehensive Display of Domestic Equipment—Wide Selection of Water Heaters.

THE I.M.E.A. Exhibition, being held in the Old Torbay Hospital, is again a popular feature of the Convention, including as it does many new power and domestic equipments, of interest to both engineers and others attending at Torquay. We commence below a brief description of the exhibits, and, since it is not possible to deal adequately with the exhibition in one issue, further space will be devoted to the subject next week.

The E.L.M.A. Lighting Service Bureau are responsible for three exhibits. The first consists of a series of display



A selection of apparatus shown by George Nobbs Ltd.

panels illustrating lighting effects for shop windows, showing the panels arranged to feature modern lamps; two panels demonstrating shop lighting; two panels illustrating home lighting; one panel demonstrating school lighting; and one panel illustrating industrial lighting. It is the intention of the Bureau to loan these panels free of charge in sets of four to supply authorities for periods of two or three weeks. The second display consists of a luminous sign situated on the front of the exhibition building reading "I.M.E.A. Exhibition." This sign has been specially built with a new form of letter which has great possibilities for shop fascia purposes and for all short-range sign lighting work. The third exhibit is devoted to special features in a room on the ground floor. The room is lighted by a large central fitting of modern construction conforming to the latest standards of architectural lighting, while supplementary lighting novelty is provided by two luminous columns installed at each side of the entrance doorway. Other interesting lighting features in this room are the lighted ornament display panel and the glareless lamp display cabinet.

The exhibit of the Electrical Development Association illustrates, by examples, the various services to members which the Association is able to render, while cinematograph film displays, special literature, examples of layouts and copy for electricity supply local advertising, window displays, including an entirely new design which the association hopes to produce in the coming autumn exhibition of posters, a collection of reports dealing with special subjects which have been prepared by E.D.A. Sub-Committees, on industrial electric heating, electric furnaces, rivet heating by electricity, electrical refrigeration, rural applications, hire and hire purchase and deferred payment schemes, etc., are also featured.

The Electrical Association for Women is also represented, the stand being devoted to the display of literature, explaining the objects and aims of the association.

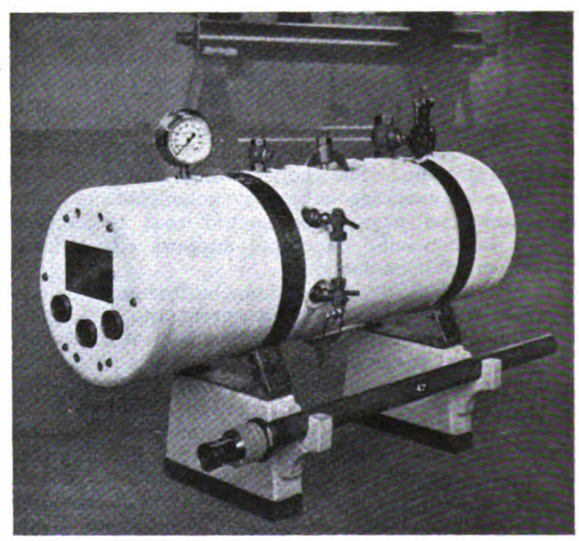
The REVO ELECTRIC CO., LTD., Britannia Works, Tividale, Tipton, is displaying a comprehensive range of electric cookers in standard and *de luxe* finishes, incorporating circular boiling plates, spring loaded drop doors to hot cupboard, improved door catches, improved and simplified switch boxes, larger ovens, etc. The "Superspeed" boiling plate, which was first introduced at Bath last year, is again exhibited. A further item of interest is a small patented device whereby the low loading of any boiling plate may be still further reduced to meet various culinary needs. This apparatus takes the form of a small subsidiary resistance mounted in conjunction with a tumbler switch, and can be adapted to existing cookers. Other exhibits are water heaters, automatic kettles, etc., together with a sample of the "Maisonette" cooker which is being supplied to Leicester Corporation.

In addition to a new design of Berry-McClary cooker, and new models of "Magicoal" fires, BERRY'S ELECTRIC (1928), LTD., 85-87, Newman Street, London, W.1, are exhibiting a domestic water heater of the storage tank type. The interior is built up from a unit system enabling the heating element and thermostat to be withdrawn without emptying the water from the container, and when necessary the whole of the internal gear can be removed for cleaning purposes, without interfering with the outer case. The heating element is of robust construction, with a single spiral wire, not coiled. The thermostat can be used on d.c. or a.c. In conjunction with the heating element there is a special circulating device which keeps the inner container more or less at equal temperature throughout, ensuring the full capacity of hot water.

BULPITT AND SONS, LTD., of Birmingham, are showing electric kettles fitted with a safety device which provides for the throwing off of the connector as the result of the softening of a low melting alloy. When the kettle has cooled it is only necessary to push on the connector again and this action resets the device. A range of immersion heaters for fixing into hot water tanks is shown for the first time, while a 15-gallon thermal storage tank having an external thermostat is another exhibit.

The INTERNATIONAL COMBUSTION CO., LTD., Africa House, Kingsway, London, W.C.2, includes amongst the many exhibits shown a model of the Barking power station of the County of London E.S. Co.

J. H. TUCKER AND CO., LTD., Kings Road, Tyseley, Birmingham, have a complete range of control units for electric cookers, water heaters, etc. These units are self-contained, and provide for a pilot light either enclosed in the case itself or showing through a bullseye lens, or for a lamp projecting through the lid which in the case of consumers on a flat rate



An electric steam raiser by A. Reyrolle and Co., Ltd.

can be used as a lighting medium, or for taking off any small apparatus such as toasters, etc. A sub-circuit is provided in the form of a socket point (either 2 or 3-pin in 5 or 15 A capacities), such sub-circuit being suitably protected by fuses inside the case. In one model this sub-circuit is controlled by an independent tumbler switch. Another model of the Cooker Control Unit is a competitive open type, specially designed for use with "baby" cookers. Included in the appliances for the control of heating circuits is the new 15 A. d.p. interlocked switchplugs. Other lines of interest include insulated lampholders in moulded bakelite, with automatic cord grips; types of sockets and plugs in 2, 5, and 15 A. capacities; tumbler switches in insulated telacite, in white, brown and black; sunk switches; metal clad lampholders and switch lampholders; ironclad switch and fuse gear generally. A new product is an ironclad fuseboard, consisting of totally enclosed units mounted on rustproof detachable battens. The case is fitted top and bottom with malleable detachable ends, which can be removed for drilling even after the board has been erected. Similar fuseboards are also available with teak boxes.

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A feature of the stand of the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, is a background to couple up central station operation with two supporting panels indicating the potential demand for current supply arising from the use of "Magnet" appliances. The breakfast cooker shown has a separate boiling plate, grill and oven elements, independently controlled by 3-heat reciprocating switches. The "Magnet" automatic cut-out safety kettle, a range of "Magnet" fires in special finishes, a new type of wash boiler, are among other items to be exhibited.

The latter operates on the thermo-syphon principle, and is mounted on three legs. The outer casing is of galvanised iron, and the container is of tinned copper. The boiler is fitted with a galvanised iron lid, which when reversed serves the purpose of a table. The elements are of the strip type each enclosed in a protecting copper sheath clamped to the bottom of the container. Control is effected by means of a 20 A 3 heat reciprocating type rotary switch mounted in a cast metal box with enamelled cover, which is connected to the wash boiler by a 4 ft. length of 4 core C.T.S. cable. This control box, as well as the boiler, is fitted with earthing terminals.

Another exhibit is a new type of electric storage heater, made in sizes from two gallons upwards and arranged for floor or shelf mounting. It is double-cased and has three inches of lagging between the outer and inner containers. The inner compartment is of steel or copper and is tested to withstand a pressure of 25 lb. per square inch. The heater, which is suitable for all voltages 200 upwards, is equipped with a thermostat of quick make and break bi-metal type, which can carry up to 5 A a.c. For d.c. and more than 5 A a.c. a relay switch must be added. The standard "Magnet" withdrawable type immersion heater is fitted. Still another new item shown is the "Minor" cooker fitted with oven, grill and hotplate, the respective loadings being 800, 1 500 and 1 200 W.

The JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, London, S.W.1, is showing a range of the No. 50 series cooking cabinets in "Marblon" all-enamelled finish, also series No. 50 J —the Jackson Junior Cooker, a small model being supplied to supply authorities for hire and hire-purchase purposes. The No. 51 cooker, which is similar to the No. 50 J. model, but has self-contained boiling plate in addition to a grill-boiler, is also exhibited. The No. 48 new table cabinet, built on the lines of the No. 46 model, but fitted with larger oven and additional boiling plate capacity, forms another item. A range of fires finished in the new Chinese finishes is to be seen on the stand and the makers believe themselves to be correct in claiming that it is the first time this particular finish has been applied to electric fires. A new wash boiler similar to the No. 154 model is also included.

SANTON, LTD., Dock Street, Newport, Mon., is exhibiting circulating immersion heaters, electric geysers, and electric tank belts. With regard to the circulator, this consists of a copper tube, of any required length, and two inches in diameter. This has a double shell, providing an air lagging between the cold water in the tank and the hot water passing through the circulator. The element tubes are fixed down the centre of this outer tube. The elements are nickel chrome wire, wound in porcelain tubes and encased in a metal sleeve. They are inserted into the circulator from the top, and can be withdrawn and replaced without interfering with the water in the tank, and are maintained at a dull red heat.

The latest addition to the range of products offered by METRO-VICK SUPPLIES, LTD., Trafford Park, Manchester, is a new electric iron-de-luxe. This is an improvement on all previous models, available in either nickel plate or blue vitreous enamel. A pressed steel table stand is supplied, the rating is 550 W and the weight 5½ lb. An improvement has been effected in the method of securing the flexible to the connector. A special cable clamp is fitted which takes all the pull off the actual connection and the risk of breakage of the flexible at this point is eliminated. The iron can also be supplied fitted with a new type earthing connector and 3-core asbestos braided flexible. The recently introduced self-regulating kettle and the well-known automatic kettle, both of which have already been described in detail, are also shown. Demonstrations are being given with the "Gyratory" washing machine, and the Model "A" wash boiler, while storage water heaters and various types of immersion heaters are also included in the exhibit.

The new Bakelite lampholders and ceiling roses recently placed on the market are worthy of inspection, and samples of these accessories are available for testing purposes. For the illumination of the stand several fittings of modern design have been installed, including panel type electroliers and brackets fitted with "Gilbert-Riley" glassware.

GEORGE NOBBS, LTD., 87/89, Cleveland Street, London, W.1, are making a special exhibit of automatic temperature controls for electric water-heaters, ovens, refrigerators, including the new type "M.B.R." room temperature control. The latter is suitable for low temperature convectors, heating panels, electric hot water radiators, tubular heaters, etc., though it is, of course, not recommended for luminous radiators, such as electric fires. The instrument is fitted with an adjustable temperature dial for normal conditions for 50/70 deg. types, types are also made for garages or private lock-ups. Electric heater tubes with current loadings for 25/70 W per ft. run are shown, while hot water calorifiers in 7 standard sizes from 5 to 50-gals. capacity are also exhibited.

The stand of MARCO REFRIGERATORS, LTD., Manor Works, Streatham Vale, London, S.W.16, are exhibiting a complete range of refrigerators for domestic and commercial purposes in various finishes.

The DOWSING RADIANT HEAT CO., LTD., Electrical Works, Bollo Lane, London, W.3, include on their stand at the exhibition a number of specialities. Amongst these may be mentioned the cordless electric ironing system together with irons, the "Solarium" luminous ray bath, and a new form of protective device for water vessels.

A wide selection of domestic equipment is to be seen on the stand of the MANOR ELECTRIC OVEN AND FIRE CO., of 303, High Road, Chiswick, including four types of cookers, water heaters, breakfast cookers, table heaters, three and six-bar fires, washer boilers (including one as supplied to Willesden Corporation), and three varieties of bowl fire.

(*To be continued.*)

MORE ELECTRICAL WOMEN AT TORQUAY.

Members of the Electrical Association for Women, showing Mrs. Nichols Moore, Mrs. J. Taylor, Mrs. Chattock, Mrs. Beale (Birmingham), Mrs Vignoles, Mrs. Purse, and Mrs. Morley New.

Group, including Mrs. S. Z. de Ferranti, Mrs. Nichols Moore, Mrs. Leese (Stoke-on-Trent), and Mrs. Hayward (Ashford).

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DESIGN AND CONSTRUCTION OF LARGE TURBO-GENERATORS.

Prospects of the 250 000 kW Set—Some Special Considerations—Aluminium for Rotor Windings—Replacing Air as Cooling Medium—Suggested Designs.

By W. SHARP, A.M.I.Mech.E., A.M.I.E.E.

IN accordance with the Electricity (Supply) Act, 1926, we are to have concentration of generation throughout the country in a few " selected " power stations. It is, of course, recognised that some time will elapse before this change can be made, particularly in districts where the frequency of supply is non-standard.

In Great Britain at the present time there are some 570 generating stations, the total plant installed being over 8 000 000 kW. It is probable that we shall ultimately depend only upon 100 power stations, and it follows that the areas concerned will be required to generate a much larger output.

These statements obviously create an atmosphere for thought, and provoke consideration of methods for the manufacture of much larger units in this country.

Larger Units Required.

If we consider the remarkable improvements in the electrical performance and the mechanical design of turbo-generators, coupled with the enormous demand for electricity supply, we shall not be surprised to find that larger units are urgently required. Machines with an output under 10 000 kW are practically obsolete. The order of to-day is between 20 000 and 50 000 kW, and it is comparatively safe to prophesy that the output of turbo-generators in the near future will be between 100 000 and 200 000 kW, and even 250 000 kW. These machines will be designed and manufactured as single unit generators.

To the average engineer no doubt a 250 000 kW turbo-generator sounds ridiculous, but let us consider some single unit machines of recent manufacture. For example, 40 000 kW at 1 500 r.p.m. for Barton power station, 75 000 kW at 1 800 r.p.m., and 85 000 kW at 1 200 r.p.m. for Hell Gate power station, and, of special interest, 160 000 kW at 1 500 r.p.m. for the East River power station, New York. It should, however, be stated that the generator of this last machine has two separate stator windings in alternate slots, each having a capacity of 80 000 kW.

While it may be admitted that in this country 100 000 kW in one unit will prove sufficient, yet there is no reason why we should confine our design and construction to manufacture for the home market. From the point of view of design these machines will require to receive special consideration, because much more progress will have to be made before such turbo-generators can be manufactured. The rotor winding for example, may be made of aluminium instead of copper, the insulation for the coils will have to receive more careful attention, and the cooling medium (air) may be replaced by either hydrogen* or some inert gas.

The sub-joined data may not cover such fostered ideas, but is simply given for example purposes, with the following conditions :—

Unity P.F. three-phase, 50 cycles, and 1 500 r.p.m.

K.W. ..	100 000	150 000	200 000	250 000
Volts ..	22 000	22 000	22 000	22 000
Amps. ..	2 625	3 940	5 250	6 560
D_a ..	180	180	180	180
A.S. ..	560	625	670	700
Z. ..	120	90	72	60
Φ_a ..	30×10^7	40×10^7	50×10^7	60×10^7
B_g ..	7 600	7 600	7 600	8 000
L_c ..	430	580	720	820
Rotor Weight (tons)	95	120	145	160
Bearings (dxl)	26 in. x 36 in.	30 in. x 42 in.	32 in. x 46 in.	32 in. x 46 in.
Shaft deflection	0.007 in.	0.009 in.	0.013 in.	0.028 in.

The voltage of 22 000 is proposed as an additional standard to those given in B.E.S.A. No. 77–1925. There are, however, h.p. transmission lines of 20 000 V at present in existence on the north-east coast.

The diameter of the stator bore D_a appears to be high but we have already built machines at 3 000 r.p.m. with a surface speed of 440 ft. per sec.

Some designers may prefer to limit A.S. to 630, and even make B_g 9 000. There may also be a difference of opinion as to sizes of the bearings, as can be observed in the following examples of two-30 000 kW sets at 3 000 r.p.m.

Bearings (dxl)	11 in. x 16 in.	13½ in. x 16 in.
Pressure (lb. per sq. in.) .	120	104
Velocity (ft. per min.) ..	8 560	10 600

It may be of interest, however, to note that, even in the case of ring oiled bearings, a pressure of 120 lb. per sq. in is not unknown, so that in the second example it is probable that trouble was expected with the deflection, and a stiffer shaft was found to be necessary.

The same remark can be applied to our designs where it is advisable to utilise large journals in order to get shafts with the strongest possible sections. It may be stated that there are limits, even in this direction, particularly when the critical speed upsets our determinations.

There are several types of stator windings which may be used in machines of this description :—

Chain or concentric winding (Fig. 1).
Diamond, i.e., two layer lap winding (Fig. 2).
Butterfly or single layer lap with involute ends (Fig. 3).

The chief advantage of the chain winding is that a single bar or conductor may be readily removed from the core in case of breakdown. The windings may be easily clamped and braced together to withstand short-circuit stresses.

A strong objection to this type of winding, however, is that it creates large eddy current losses in the stator clamp plates and end guards, due to the grouping of conductors belonging to the same phase. So serious are these losses that in order to reduce them it has been found necessary to fit bonding strips across each joint in the guard, and also between the guard and the stator frame.

In the case of the diamond winding quite a number of points can be put forward in its favour.

Open slots are invariably used, but the tooth ripple can be easily suppressed by judicious slotting of the rotor. It may be stated, further, that actual tests show the eddy current losses and short-circuit stray losses to be comparatively small, provided the correct end arrangement and chording factors are used.

Bonding strips are not necessary, owing to the fact that only the nose of each coil faces the guard, thus resulting in a much better distribution of flux, and consequently smaller losses.

Another factor in favour of this type of winding is that it lends itself to efficient cooling, as every coil is open to the ventilating air ; hence, in comparison with the chain winding, the coils are much cooler, and it becomes possible to increase the electrical loading of the machine.

The diamond winding with dropped-in coils has, in a measure, a disadvantage in the withdrawal of a coil—when this is necessary—because most of the winding must be disturbed to withdraw the damaged portion.

The butterfly or concentric type of winding embraces most of the advantages of the first arrangement, and some of the second, but is used more particularly for machines with very high current and low voltage.

Comparing this winding with the second arrangement, it will be seen that it is much easier to bend the copper, especially when very heavy strips are required. The design, however, is not capable of high loading, and for this reason is never used when a two layer lap winding can be adopted.

Rotor Shaft Design.

It now becomes necessary to consider the mechanical design of the rotor shaft, and also the rings which support the windings. It will be agreed that any slotting of the rotor shaft is detrimental to its strength and stiffness. Recent experience has shown that after machining a number of equally distributed ventilation slots in a particular rotor the core was out-of-truth with the horizontal centre line to the extent of 3 mm. Further experience emphasises the fact that all shafts bend after being subjected to the machining of deep radial slots. Later machines have been designed with only 4 or 5 radial slots at

* The " Electric Journal," 1929, Vol. XXVI, p. 127.

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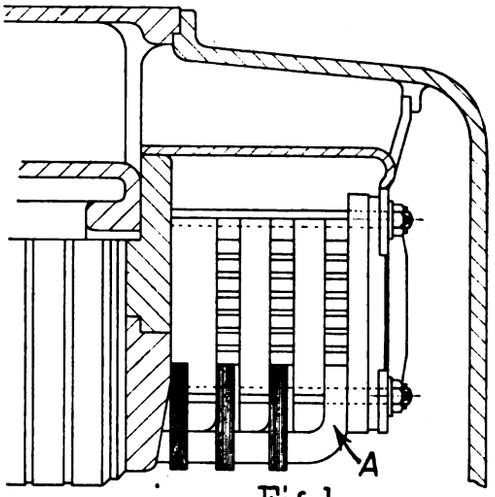
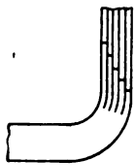


Fig. 1.



Detail of Joint A

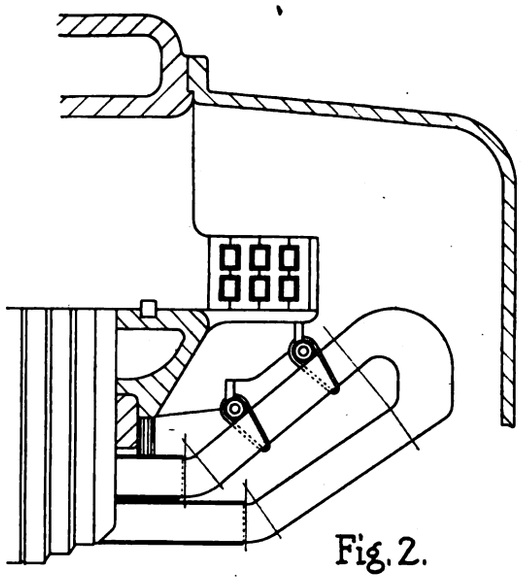


Fig. 2.

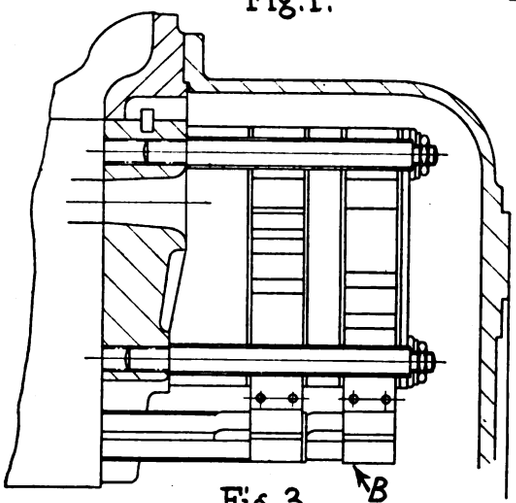
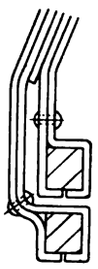


Fig. 3.



Detail of Joint B

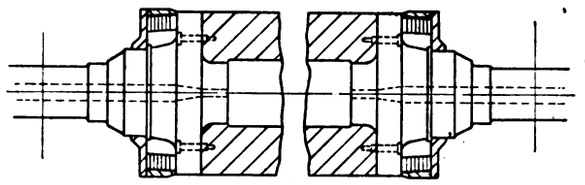


Fig. 4.

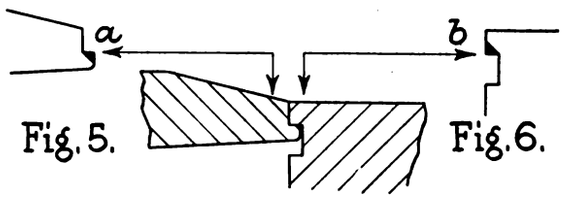


Fig. 5. Fig. 6.

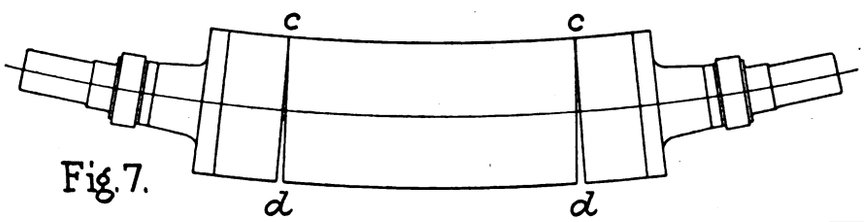


Fig. 7.

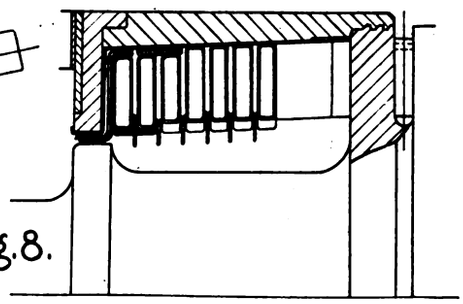


Fig. 8.

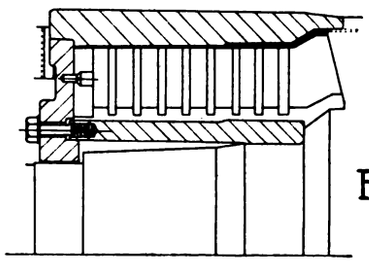


Fig. 9.

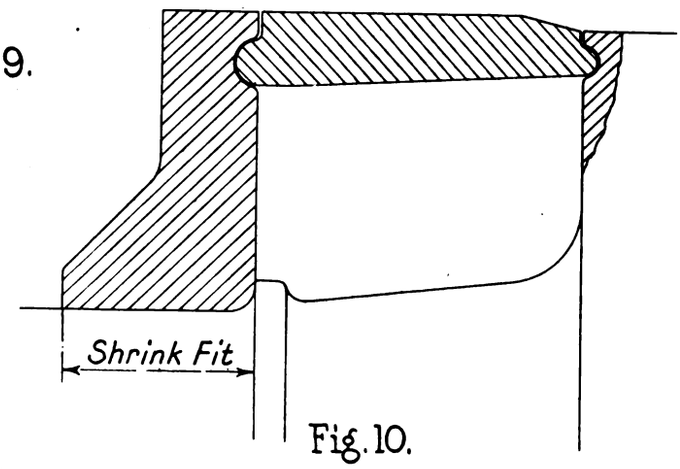


Fig. 10.

These drawings illustrate the accompanying article by Mr. W. Sharp. They show various types of stator winding for use in large turbo-generators and rotor shafts and indicate methods of dealing with the problem of relative movement between support ring and rotor core. Detailed reference to the figures is made on pages 690 and 692.

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each end of the core, with the result that previous trouble has been practically eliminated.

This procedure has also shown that the slotting of the central portion of the rotor for purposes of ventilation is not absolutely necessary, and consequently we are able to produce a much stronger shaft with an increased factor of safety. Slotting, other than that required for the rotor coils, is probably not essential, and subsequent experience might further modify present day design.

The rotor construction for machines of this type—100 000 kW to 250 000 kW—decides itself. Ingots above 170 tons have not yet been successfully cast in this country, and consequently (due in each case to the weight of the finished rotor) it is obvious that the shaft will have to be constructed in three parts. (Fig. 4).

In connection with the support rings various reasons have been given* why pieces have broken off as shown at (*a*) Fig. 5, and at (*b*) Fig. 6, i.e., where the support ring engages in the rotor core. The generally accepted reason is that owing to the deflection of the shaft (see Fig. 7) the support ring will be closed at (*c*) and open at (*d*) at any particular instant while the machine is running. This movement takes place at every point of the rim with each revolution of the shaft, and at a normal speed of 3 000 r.p.m. there are 180 000 movements per hour. As a result of this, it follows that fatigue of the metal can certainly be expected where the support ring is registered with the rotor core. Trouble of this nature demands immediate attention, and to prevent subsequent breakdown two distinct methods (Figs. 8 and 9) are in use. In each case the support ring is allowed to move in unison with the rotor core and probably each design solves the problem of relative movement between ring and core.

In the case of machines with a speed of 1 500 r.p.m. it is maintained that such a phenomenon operates only in a minor degree, and in our particular designs the relative movement will be negligible.

A suggested design is shown (Fig. 10) where provision is made for the fan plate—which is shrunk on—to sit upon a substantial surface. The support ring should be carefully machined with large radii, and clearance provided for each register, so that the ring will be free, if necessary, to adjust itself.

Other factors common to present-day practice will require to be reviewed to meet the more exacting conditions demanded with such large units. Further, from the manufacturing point of view, much larger workshops and plant will be required, and it is incumbent on British engineering works to provide the necessary accommodation.

THE BOILING PLATE OF TO-DAY.

The Present Position and the Probable Future Trend of Design—Reliability of the Modern Cement-filled Type—The Transformer-operated Plate.

By STANLEY F. BICKELL A.M.I.E.E.

THE rapidly growing popularity of electricity as a cooking medium prompts one to review the progress made to date in the development of electric boiling plates. So much criticism has been levied at this portion of electric cookers in the past, and so much of it has been justifiable, that it is interesting to note just where we stand in the matter of design to-day.

A striking feature of the display, staged for the I.M.E.A. Convention at Torquay, is the preponderance of enclosed type plates over the frailer open type. Having regard to all the advantages and disadvantages of each type, it is obvious that manufacturers, meeting the demands of supply engineers, have finally decided that reliability comes first, and to this end they have standardised on the enclosed pattern.

For fifteen years the two types have alternatively held the stage, each in turn being improved. Unfortunately for the trade itself, the only criterion by which a boiling plate can be judged is a protracted test over a period of time, and manufacturers, urged by the desperate need of supplying more reliable plates, have foisted on the consumer their latest idea. Instead, therefore, of the plates being thoroughly tested out in the laboratory, they have been rushed into the market and the consumer has been forced to bear the inconvenience of the experiment; the supply authority the expense. This method has had the only result to be expected, namely a general poor opinion of electric boiling plates as a whole, and this opinion is only now gradually being overcome by a universal retrenchment behind the reliability of the correctly designed enclosed boiling plate.

Temperature Limitations.

In considering the type of plate that has provided this relief from constant failures it is necessary to realise that the governing factor in boiling plate design is the maximum permissible working temperature of the resistor itself. Until some alternative medium to chrome-nickel alloy is found this temperature must remain in the neighbourhood of 1 000 to 1 050 deg. In order to ensure that this temperature is never exceeded, the design must be such that under no normal conditions can the energy input to the plate exceed the energy output. This rule limits the loading per sq. in. of dissipating surface to a definite amount, depending on the type of plate. For totally enclosed cement-filled plates this figure must not exceed 33 W per sq. in., if reliability is required, and any attempt to increase this figure can only result in the premature failure of the resistor.

Ordinary open-type plates, dissipating their energy by radiation, some convection, and slight conduction, may operate at a somewhat higher loading per sq. in., but in view of their fragile nature and high maintenance cost we can ignore them.

It has been proved empirically that at 33 W per sq. in., a cement-filled, enclosed-type boiling plate has an extremely long life, providing that the resistor and its cement covering form a homogeneous mass by virtue of a similarity of expansion coefficients, and their union made under suitable pressure, etc. These requirements ensure freedom from frictional movement between the two constituent parts, and limit the access of air to the metal resistor, thereby retarding oxidation.

While this surface density is not exceeded, and perfect and continuous contact is ensured between the wire and its cement dielectric, there is no reasonable limit to the life of the plate, though manufacturers state a guarantee period of two years. It is beyond question that on the score of reliability the present enclosed cement-filled plate meets the most exacting requirements, and cannot be further improved in this respect.

Freedom from Failure.

One large firm of cooker manufacturers who standardised on this type of plate three years ago, and who now have many thousands in commission, find that on a three years' basis the failures, from all causes, have amounted to less than 1% of the total number of plates in service. This is a tremendous and commendable step forward from the time when boiling plate failures alone sometimes accounted for as much as 25s. maintenance cost per plate per annum, and is surely sufficient answer to the critics of present day boiling plate reliability.

This desirable end having been attained, supply engineers and public alike are pressing for quicker boiling. The electric kettle, most efficient and rapid where water is concerned, cannot meet the needs where a half pint of milk or a boiled egg are required quickly, and the unfortunate designer is faced with the problem of satisfying the demand without increasing the loading per sq. in. on the plate beyond the safe limit.

Alternative solutions are to find a substitute for chrome-nickel alloy resistors (far easier suggested than done) that will operate safely at a temperature of about 1 400 deg. C.; or to reduce the mass that requires preheating. Danger of distortion under heat, and consequent failure lie ahead in the second case. The mass of the plate has been reduced already to a minimum consistent with safety, and any further thinning of the cast top plate must be accompanied by a strengthening of the metal's resistance to distortion, the selection of suitable metals being limited by their cost. In passing it is of interest to remember that circular plates, owing to their even expansion and contraction under heat, permit of the use of a thinner top plate than the square or rectangular pattern, and they therefore boil quicker with the same degree of reliability.

A plate that approaches this problem from an entirely new

* "Journal I.E.E." 1923, Vol 61, p. 453. "Journal I.E.E." 1929, "Recent Developments in Turbo-generators," by J. A. Kuyser.

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angle is the Revo " Superspeed " boiling plate which is transformer operated, and it would appear likely that future development will follow in this direction. To overcome the chief failing of the open type plate, viz., its proneness to break down due to damage of the comparatively fragile resistor, a low voltage, high amperage plate is adopted employing a robust resistor of about 0·2 in. dia. A transformer, double wound, naturally forms an indispensable adjunct to the device, stepping down from the line voltage to something in the order of 10 V on the secondary. The result is a boiling plate having a small mass to be preheated, showing a desirable red-hot appearance, and a robust resistor that can be operated at a density of 125 W per sq. in. of plate surface, and in close proximity to the base of the utensil. The heavy section of the wire prevents local hot spots developing by readily conducting the excess of heat from the particular point and dissipating it in the adjacent wire. At the same time an operating temperature of 1 000 deg. C. is maintained when the plate is covered by a utensil, so that oxidation after the primary coat has formed takes place extremely slowly. These attributes, coupled with the low potential of the plate, rule out all possibility of open, short or earth circuits developing in normal usage.

Test Figures.

Test figures obtained from this plate are given in Table 1 reproduced in the next column.

It should be borne in mind when comparing electric boiling with gas, that a gas ring after one month's use loses 25 % of its pristine output unless regularly and carefully cleaned, whereas an electric boiling plate retains its original efficiency throughout its life.

The greatest drawback to the enclosed type of boiling plate is the need for suitable utensils. Where transference of heat depends on conduction, machined flat bases are required if the utensils are to function efficiently, and a dead flat base is not easily acquired, without unduly increasing the weight of the utensil. At the same time, when a dead flat plate and utensil are brought together, it requires only a small amount of foreign matter between the faces seriously to retard the speed of boiling, and in ordinary kitchen usage this frequently happens. One of the attributes of open type plates, and particularly the " Superspeed " pattern, is the fact that no special utensils are required ; in fact, the best results are obtained when employing a sixpenny tin saucepan or kettle, the base of which may even be in a distorted condition.

The one outstanding disadvantage of the " Superspeed " plate is its inseparable adjunct, the transformer, and it is this which necessitates the comparatively high prime cost. Since the copper and iron used in its construction cannot be reduced beyond a certain safe limit, and whilst the present market price of these commodities is maintained, no reduction in this initial cost can be expected.

Against this first cost, however, we must weigh the freedom from subsequent trouble and expense due to failure ; the extremely rapid and efficient boiling of small quantities ; the red glow so much approved by the housewife and an incentive to economical use ; and the absence of the need for special utensils. A further advantage is the provision of low simmering heat in the neighbourhood of 300 W, which is obtained by tapping the primary of the transformer, and which can therefore be arranged to give any predetermined loading to suit local requirements. This question of simmering heat is one which will most certainly come to the front in the near future. For rapid boiling an enclosed-type plate requires a loading of some 1 600 to 1 800 W, and as they are at present constituted low heat is fixed at ¼ of full load, which is 400 or 450 W respectively. This is found in practice to be too high for many culinary requirements, 200 W being far more advantageous.

TABLE I.

COMPARATIVE TESTS ON BOILING PLATES, USING 5 IN. DIA. PRESSED ALUMINIUM SAUCEPAN OF STANDARD TYPE.

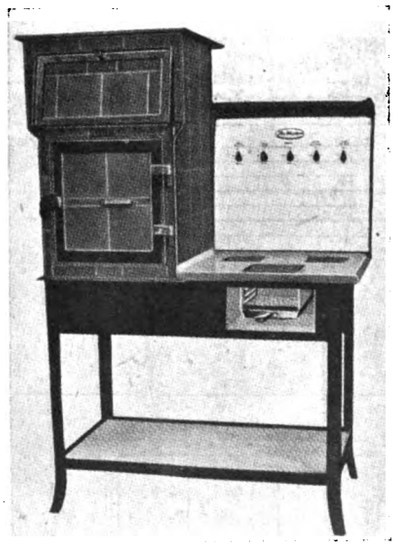
			½-Pint.			1-Pint.			
Type of Plate.	Loading.	Temp. Rise.	Time. min.sec.	Consumption.	Efficiency.	Time. min. sec.	Consumption.	Efficiency.
Enclosed cement-filled	1 600W	158° F.	6 50	182 W	16·1%	8 45	233 W	24·9%
Gas ring	15cu.ft./h N.T.P.	158° F.	2 52	0·717c.u. ft.	26%	4 48	1·203 cu. ft.	34·5%
" Superspeed "	2 000 W	156° F.	2 48	84 W	34·4%	4 05	136 W	47·4%

It might be argued that the obvious solution is the provision of a 1 800 W plate for rapid boiling and a 1 000 W or less for simmering, etc. This, however, is an inefficient arrangement, if one plate can suffice, since it may necessitate the heating up of both plates to complete one cooking operation. Difficulties present themselves when we attempt to introduce elements of different loadings into one boiling plate, and the best attempt at a solution so far is a subsidiary resistance mounted with a switch to form a unit which may be easily adapted to existing plates.

A patented device of this nature is now obtainable, and we may therefore look forward to further developments on these lines.

In generally surveying the position it would appear that the enclosed-type plate has definitely established itself on the score of reliability, and that extra rapid boiling will be obtained by means of low voltage transformer-operated plates ; and it is probable that a combination of these two plates in a single cooker will prove popular in the future.

ON VIEW AT THE I.M.E.A. EXHIBITION.



One of the exhibits of the Manor Electric Oven and Fire Co., in the old Torbay Hospital.

Left : The " Bijou " cooker exhibited by the Credenda Conduits Co., Ltd. An improved type grill-pan is another item of interest.

Above : A popular model to be seen on the stand of Moorwoods, Ltd. Three cookers of the " family " type are also shown.

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SWITCHGEAR DEVELOPMENTS.

Finding a Substitute for Oil—Methods of Investigation Criticised—Making Use of the Arc—Trouble Mainly Due to Gas—Importance of Mechanical Construction.

By CHARLES C. GARRARD, Ph.D., M.I.E.E., A.Am.I.E.E.

THE very considerable proportion that the cost of the switch and controlling gear bears to the total capital charge of present day power plant may justify a short discussion of recent progress in that branch of electrical engineering.

While it is unreasonable to classify expenditure under that heading as unremunerative, in that such apparatus does not directly take part in the generation of current like a turbo-alternator, nevertheless it is clear that the tendency for the ratio of cost of switchgear to total cost to increase with the extension of plant installed requires careful watching, especially to make sure that unnecessary expense is not incurred due, for example, to following precedent rather than thinking things out afresh.

Needless to say with matters as they are at present, it would be bad economy to instal inadequate plant of the character in question. But all such expenditure must be thoroughly scrutinised to make sure it is necessary, and that it has not been specified again because it has been called for in the past.

The Oil Circuit Breaker.

Some years ago the present writer had to explain to a jury the construction of an oil circuit breaker, and found it rather difficult to persuade that body of laymen that to produce the highest known artificial heat within a mass of highly inflammable material, such as oil, was a reasonable thing to do; and at the present moment we are still doing it and shall probably so continue for several years to come.

There can be no doubt that the efforts which inventors are now making to get away from oil as a constitutent of a circuit breaker will eventually lead to success, and thereby ensure a much greater safety than we have to-day. It is very open to doubt, however, whether the method of approach to the problem of the oil circuit breaker adopted by many investigators is correct. It is sought by these researchers to establish the arc energy as a criterion of operation of the circuit breaker.

Arc Energy Variation.

Unfortunately it is found that the arc energy varies tremendously, apparently without any very good reason, and we have it on high mathematical authority that, in accordance with the principle of probability, that the number of tests necessary, to make sure that one has hit the worst possible case, is so large, that practical rating tests become almost impossible.

Now, as has been pointed out recently by the mathematical physicists, the difficulty of finding the location of the electron within the atom is probably due to the fact that such a true location does not exist, so the difficulty of identifying arc energy with the rating of an oil circuit breaker is probably because the two have little or nothing to do with each other. The energy of the lighted match which explodes a room full of gas is small; yet the consequences are very serious. So it is with the oil circuit breaker. As made by reputable manufacturers, however, it is to-day a highly efficient apparatus. It very rarely gives trouble but when it does, generally it is due to a gas explosion. The oil becomes vaporised and is ignited and explodes, and this may be when the circuit is by no means overloaded. Bad contact is the origin of a large proportion of such cases. Therefore a good simple mechanical

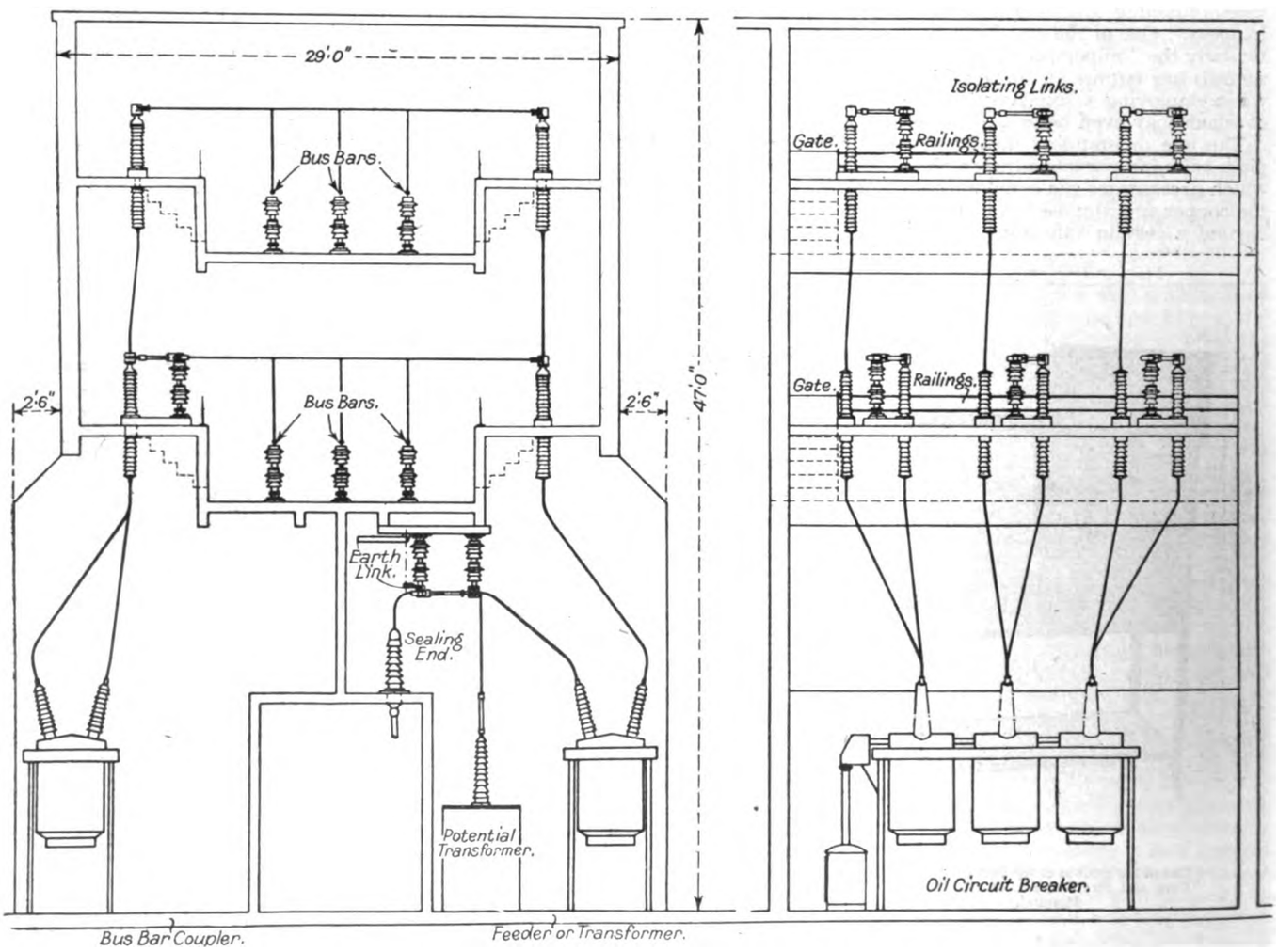

Fig. 1.—Indoor-outdoor switchgear for 66 000 volts.

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construction is the chief consideration. It also follows from this that oil switches which have to carry large currents are likely to be more difficult to design and maintain than those for high voltages. This is actually the truth.

The difficulty of dealing with large currents is particularly emphasised with metal-clad compound-filled gear. The compound hinders the dissipation of heat, and consequently current densities have to be very much lower with compound-filled gear than with the cubicle type. It would appear that 4 000 A at 50 periods is about the largest current that can be used with compound-filled gear unless the cost be increased altogether out of proportion.

Fig. 2 illustrates a design of compound-filled gear for a current of 4 000 A. Naturally non-magnetic material must be used for the enclosures, and it is found that modern silicon-aluminium alloys are excellent for this purpose. These have great mechanical strength combined with ductility, and are unaffected, beyond of course being melted, when subjected to the action of an electric arc. While in practice, naturally, such an eventuality as arcing to the metallic enclosure would only occur in case of accident, nevertheless the use of a metal which would ignite under such circumstances is undesirable. Some aluminium alloys suffer from this disadvantage but the silicon alloys in question are quite satisfactory in this respect.

In order to keep down the heating due to the passage of the alternating current through the connections, it is necessary that the same should be properly shaped and correctly disposed relatively to each other. There are two phenomena which are present with alternating current which cause the heating to vary from that which takes place due to the passage of an equal direct current. These are the eddy current, or skin effect, and the proximity effect. Rectangular strip busbars are unsatisfactory in this respect. The best result is obtained by the use of tubular busbars, and with the three phases arranged at the corners of an equilateral triangle. It will be seen that the design in Fig. 2 is in accordance with these remarks.

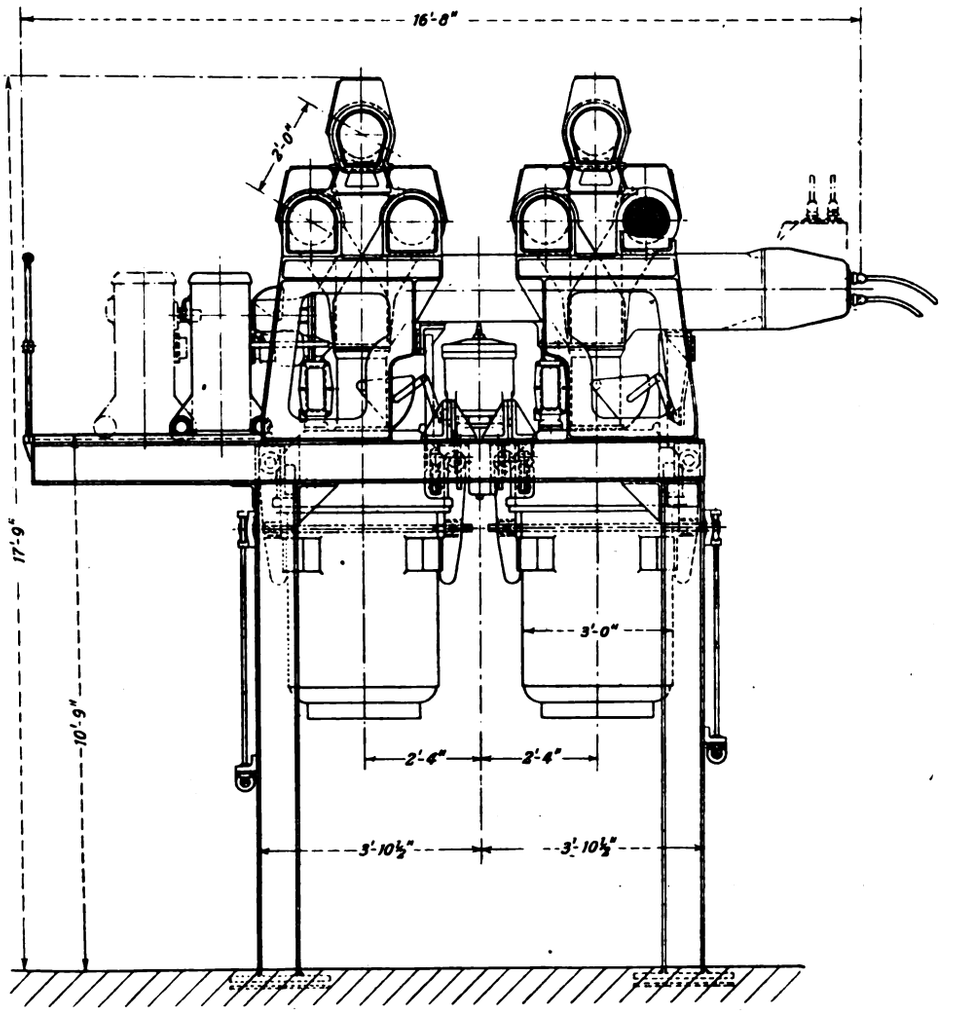

Fig. 2.—A design of compound-filled switchgear for 4 000 A at 33 000 V.

Fig. 3.—Illustrating the "sunk" type of switchgear house.

The Central Electricity Board has made the decision to use exclusively outdoor type-gear for its 132 000 V stations. The results in practice of this decision, under the atmospheric conditions of this country, are awaited with considerable interest.

Generally speaking, the locations of the Board's 132 000 V stations facilitate the use of open type apparatus. This is not the case however with situations within densely populated areas. It has been suggested to apply the metal clad principle for such cases for voltages of 66 000. The size of 66 000 V switches is, however, so large that the clearances to earth and the distance between phases are such that it is difficult to justify the metallic enclosure of the connections. Naturally such a design is quite possible, but the cost would be large.

Probably the best arrangement is the indoor-outdoor type illustrated diagrammatically in Fig. 1. The apparatus itself is similar to that used for outdoor stations but is to a great extent protected from the weather by a building. The oil circuit-breakers themselves are half exposed to the outside. Such a design is somewhat similar to that used largely on the continent for 110 000 V stations. (The Golpa Power House is an example.)

During the last few years an interesting development of this type, due to Brown Boveri, has made considerable headway. This is known as the "sunk" type. The particular point is the arrangement of the oil circuit breaker. The top of this is made very strong, much stronger relatively than the tank. The latter is sunk below the switch house floor into a fireproof chamber, which communicates with the outside atmosphere. The theory underlying this construction is that under certain circumstances it is impossible to prevent the tanks of the oil circuit breakers blowing off. Therefore the design, as described, has been adopted which allows such an accident to take place without damage to the rest of the switch house. It is claimed by the originators that practical experience has thoroughly justified the theory.

Fig. 3, in the previous column, illustrates the "sunk" type of construction.

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Fortunately the idea formerly prevalent that the efficiency of an electric contact varied inversely as the current density of the surfaces in contact is nowadays quickly dying out. Considerable progress has been made recently in the application of line contacts to many kinds of switchgear. Such contacts have been used in oil switches, contactors and drum controllers for many years; but in the case of air break circuit breakers brush contacts have been, up to the present, practically universal.

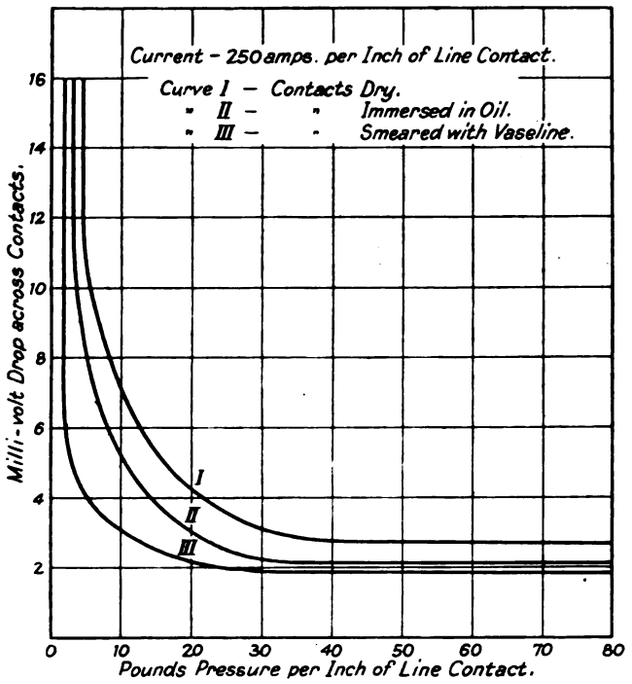

Fig. 4.—Milli-volt drop across line contacts.

Shape of Contact.

Fig. 4 gives the millivolt drop across a line contact formed by a D-shaped piece of copper pressing with its round face against a copper block, the radius of curvature of the D-shaped piece being 1 in. The curves show at once the value of lubrication of the contact. It will be seen that the contact resistance reaches a minimum with a pressure of about 27 lb. per in. length of line contact; greater pressures are not any advantage. It is found that the value of intensity of pressure which gives the best result varies somewhat with the shape of the contact, being lower with a small radius of the D-shaped piece. In other words, the sharper the shape of the contact line the better; but the difference is not great.

The values given in the curves were obtained by applying the pressure between the contacts and then subjecting them to slight vibration. If the vibration be omitted the contact resistance may be 6 to 20 times greater than the values indicated by the curves.

The same result is, however, obtained by subjecting the contacts to a mutual slight rubbing action. Of course, all properly designed switches are made so that their contacts close with a rubbing action. It is found that this principle of line contacts when applied to air break circuit breakers results in a very large reduction in the closing operating force. Needless to say, such contacts are very much more robust and less liable to damage than were the brush contacts previously used.

BOOK REVIEWS.

The Design, Construction, and Maintenance of Docks, Wharves and Piers. By F. M. du Plat Taylor, M.Inst.C.E., M.I.Mech.E., with an introduction by Sir Joseph Broadbank. (London: Ernest Benn, Ltd.) Pp. xxvii+495. 70s. net.

In this encyclopædic volume practically every detail on the engineering side of port operations is dealt with, and in spite of the very wide ground covered by dock engineering, a vast amount of practical information is brought within the range of a single volume. Among the various special lighting requirements the author points out that while for wharves and docks wide distribution of light with the absence of shadows is necessary, the lighting of jetties in navigable waters should be arranged to avoid confusion with navigation lights, the lamps being hooded to throw the light downwards only. In dock and wharf machinery, the author, while on the whole preferring electrical to hydraulic methods, considers that the practice of many ports in having both hydraulic and electric power systems is the ideal condition, each system having a field of usefulness in which it is superior to the other. A great economic advantage of electrical machinery is that the power consumed is proportional to the work done, whereas in the case of the hydraulic machine the water consumed in the operation of, say, lifting the empty crane hook is the same as that used in lifting the crane hook with the full load attached.

In the section dealing with the layout and equipment of a dock generating station the author mentions a system which he has adopted of storing all engine spare parts and all spanners and tools on boards fixed to the wall. The spare parts are clipped to the boards by sheet brass clips with wing nuts for removal, and the tools hung upon hooks. This is considered to be preferable to stowing in boxes and lockers, as deficiencies are readily detected, and as they are exposed the staff is obliged to keep them clean and polished or oiled.

There is an interesting section on electric cranes with which goods can be handled at fairly high speeds for lifts up to 50 ft., for as low a power cost as ½d. per ton, with energy at 1·75d. per kWh. A description is given of a light type of electric locomotive crane, of 11½ cwt. capacity, recently installed at Boulogne. The jib is triangular in cross-section, having three principal members connected by lattice bracing. The base of the jib is consequently also triangular in plan, with three main members, the front one of which forms the axis or hinge for luffing. At the apex of the triangle formed by the jib base is a bronze nut mounted on trunnions, and in this nut works a steel screw actuated by means of worm gear by a small electric motor mounted on the roof of the crane house. Level luffing gear, designed by Stothert and Pitt, and by Babcock and Wilcox, are described and details are given of large floating cranes electrically operated, but from the propelling machinery.

For stacking purposes in dock warehouses the electric runabout crane is finding increasing applications, and electric battery trucks are rapidly superseding hand trucks for trucking operations. The book is well produced and profusely illustrated. G. W. D.

Elementary Applications of Statistical Methods. By H. Bannister. (London: Blackie and Son.) Pp. 56. 3s. 6d. net.

This book will be found a useful laboratory manual, summarising several of the more important methods of statistical research in a very handy form. It is doubtful, however, if anyone not already possessing a working knowledge of the subject would make much of it. The author refers those wishing to understand statistical theory to Yule's "Introduction to the Theory of Statistics." Others may prefer Bowley's "Elements of Statistics."

A book of this length must omit a very great deal of important matter—for example, Poisson's distribution, the basis of many caculations in automatic telephony is not mentioned—nor are skew frequency distributions, which almost invariably occur in power supply problems.

A minor defect is that one would imagine from the treatment that a "normal" distribution usually meant a symmetrical binomial distribution. This is right in a sense, but the term is usually applied to the Gaussian Error Function (which, of course, can be obtained from the binomial).

Instead of the usual tables of probability the appendix gives a set of curves which is for many purposes preferable especially in a "practical laboratory handbook," and the graphs for $\chi 2$ (appendix 1) are particularly welcome.

To sum up—anyone using statistical methods from time to time, but not sufficiently frequently to keep all the definitions in mind, or requiring a handy guide for approximate computations, will find this book very useful. In any difficult problem, reference would, of course, be made to a standard treatise.

The ground covered is goodness of fit (of frequency distribution); meaning of mode, mean and standard deviation; measures of dispersion; precision of mean; elementary correlation.

W. Fordham Cooper.

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MARINE ELECTRICITY.*

The "Viceroy of India" Revisited—The First Big Electric Passenger Liner Under the British Flag Considered as an Experiment, a Prototype, and a Fuel Conserver—Some Further Thoughts on Electricity for Propulsion.

By A. C. HARDY, B.Sc., A.M.I.Mar.E. (Author of "Merchant Ship Types," etc.).

IF any justification were needed as to the efficiency of electric propulsion from a maintenance point of view, one need go no further than the engine-room of the 19 700-ton P. and O. liner "Viceroy of India" to seek it. I was fortunate enough to be able to make an inspection of the ship at Tilbury shortly after her return from her maiden "shake-down" round trip to Bombay, and I can very definitely assert that the machinery after some 12 000 miles' running appeared to be in very good trim. That there is a future for large electric passenger liners on certain trades has been gradually recognised as a fact. The "Viceroy of India," having established a precedent in British shipbuilding and shipowning, is unquestionably doing what the "Virginia" and "California" as large electric ships did in America—pave the way for further similar ships.

The Shipowners' View.

The far-seeing and successful shipowner seldom adopts any system of propulsion other than that which has given him satisfaction previously unless the new system is going to result in some material benefit. A net lowering in the fuel bill is sufficient justification in the majority of cases, and has incidentally been responsible for the almost phenomenal increase in motor and in motor-electric ships. The electrically propelled ship at once offers a definite saving in fuel bills as compared with a corresponding steamer. Its advantages, however, neither begin nor stop there. Psychologically, perhaps, the electric liner represents a higher expression, a more up-to-date expression, of marine engineering technique than does the corresponding steamer. It offers, too, to the passenger an undeniable freedom from vibration; a comfort and a smoothness of operation which is inevitably associated with the operation of electric motors. It eliminates almost entirely that "ringing," rising and falling with the motion of the ship, necessarily associated with the most carefully balanced of geared turbine sets. It permits of an ease of manœuvrability which is almost astonishing. It allows of a flexibility of power output which is at once gratifying and economical. The electric ship is an easy "watch keeping" ship. As far as can be judged at present from the "Viceroy of India" she should have a remarkably low repair and maintenance bill. If the potential repair and maintenance bill for ships' machinery increases proportionately with improvements in machinery technique, then obviously the skill and care of operating staffs must increase in proportion too.

The motorship, on many routes to-day, is the most all-round economical ship in the world. Unless she is well serviced and looked after she may well prove the most expensive. The electric liner is perhaps a little less economical than the motorship, but she should not require quite the same amount of skilled care and maintenance.

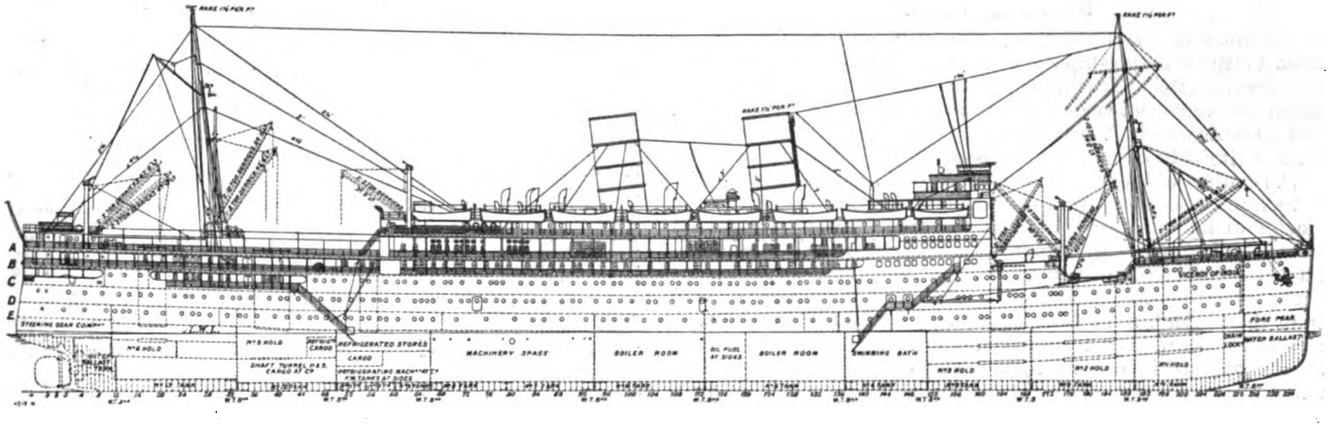
The turbine and the turbo generator, considering power output for space taken up, is probably one of the most compact forms of energy creator in the world. And this is even true if we take into consideration modern water tube boiler equipment and its auxiliaries. Probably, taking this into account, ideal economy and ideal compactness is more nearly approached in the Diesel engine-driven generator. In this case, however, there may be other disadvantages which have to be taken into consideration also. Probably a thorough relative assessment of the values of the respective systems will never be possible until a large Diesel-electric passenger liner has been built. For that reason the proposed new mammoth White Star liner as an electric ship is so significant. As a Diesel-electric ship she is even more significant, because she will be the largest ship in the world. The electric motor as a marine prime mover, however, is now definitely established, whatever the method employed to generate the current which feeds it. The electric motor, in its turn, is again most attractively compact.

We have suggested that the turbo-generator is extraordinarily compact in proportion to its power output. In no case is this more apparent than on the "Viceroy of India." One had remarked this on visiting the ship on the occasion of a demonstration run before she left her builder's hands. A second visit to the ship last week more than confirmed this. And in this compactness is seen yet one more inherent advantage of electric propulsion. The two main turbo-generators, each of some 11 600 H.P. output at 3 000 r.p.m., are on a raised flat in the main engine room on either side of and just abaft the main control station. This enables auxiliary machinery—condensers, feed pumps, circulating pumps, etc.—to be grouped conveniently below and around, at tank top level. As direct-coupled or geared turbine sets they would inevitably have to be on a level with the propeller shafts. The modern electric ship's main engine room in practice is really even more compact than was that of the theoretical electric ship of 10 or 12 years ago. But notice that whereas the original conception of marine electricity insisted for propulsion that the motors should be located right aft and thereby save, or rather give to the stevedores, much extra valuable cargo space, modern practice has determined that it is much more handy and practicable to sacrifice a problematic few hundred cubic feet of cargo space and to arrange everything under the eye of the man on watch in the engine room. The "Viceroy of India's" two main motors, each developing some 8 500 H.P., are very compact units conveniently located at the aft end of the engine room. They are also subject to great flexibility of operation as the following will make clear.

Ease of Operation.

For example, both motors can be run with only one turbo-alternator and four out of the six Yarrow water tube boilers in use. Thus with one alternator developing about 11 600 H.P. the ship can make about 16·5 knots with the two main shafts turning at about 92-93 r.p.m. Under these conditions the

* Mr. Hardy revisited the "Viceroy of India" on our behalf after that ship's maiden voyage. He here records his further impressions.



Inboard profile of the 17 000 H.P. electric passenger liner "Viceroy of India," now touring the Mediterranean.

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boilers are using fuel at the rate of about 80 to 85 tons per day for all purposes, including heating, lighting, and cooking. On the other hand, at the somewhat higher speed of 18·5 knots, both turbo-alternators are taking their steam at 375 lb. pressure and 700 deg. Fahr. super-heat from all six Yarrow boilers. The two main motors are turning at 104-105 r.p.m., and the boilers are using fuel at the rate of 110 to 113 tons per day for all purposes. At a speed of 19 knots the main motors are turning at about 109 r.p.m. Such flexibility has, in service, resulted in considerable fuel saving, and the "Viceroy of India" on her maiden round voyage from London to Bombay, including harbour consumption at each end, used, as the table shows, but 3 521 tons of oil compared with an average of 4 807 tons for two similar oil burning ships with steam reciprocating engines and oil fired boilers. Unquestionably this is partly due to the possibility of being able to develop normal service speed with one turbo-alternator only and four boilers out of six, and partly due to the economies possible with modern high steam pressures and super-heat. Her boiler plant is not only compact but it may also be regarded as very efficient.

Advantages of Electricity for Cruising.

To-day the "Viceroy of India" arrives at 9 a.m. at Palma after having covered some 1 977 miles of her first 4 221 miles Mediterranean course. She is scheduled this summer to make in all five cruises to the Western Mediterranean, Northern Africa, and the Balearic Islands. These cruises will total some 21 889, miles and as most of the "runs" in the cruises will be performed at something under 16 knots, the ship should prove very economical running on one generator only. Cruising demands infinitely much more manœuvring than normal running, and here again the advantages of electric propulsion stand out. The "Viceroy of India" has been reported as a result of the experiences of her first voyage as being almost too quick on the "throttle," or on the controls, to be more exact. A motor ship is generally acknowledged to be quicker on the telegraph than an ordinary steamer. The electric ship, it would appear, is quicker than either. The possibilities of pilot house control are worth considering in connection with a ship of this type, but it seems really questionable whether this would be desirab e in view of the compact and efficient nature of the control cabinet on the upper platform on the "Viceroy of India." The largest electric ship with pilot house control is, I think, the British-built, American-owned tanker "Brunswick," completed last year on the Clyde and fitted with B.T.-H. equipment. This vessel has a deadweight tonnage of 12 500 tons, and, as far as the bridge end of the control gear is concerned, everything is centered in the Sperry automatic steering pedestal, on each side of which is a blank engine room telegraph face. Movement of the telegraph handles forward, in an arc away from the operator, increases the speed of rotation of the main propelling motor. Similar movement in an arc towards the operator decreases the speed of the motor. This ship thus is controlled absolutely like a tram-car and is really an automatic ship, because by setting the automatic gyro compass steering device and setting the main electric motor speed handle, the ship runs without human aid. Pilot house control, of course actually is not at any particular advantage on long ocean passages. In manœuvring in and out of port, however, there are considerable advantages once the pilot and navigating officers become really accustomed to the quickness of manœuvring.

Running Tests.

Commissioned last summer, this electric ship—one of the largest electric cargo ships—covered a total of some 48 000 miles in seven months. This mileage was all accounted for on long ocean passages between California, South Africa, Australia, and New Zealand. An inspection of the Diesel-electric plant a short time after the ship had made a voyage from California to Australia and then to a British port, revealed that the propelling machinery was in excellent condition. And as a matter of fact on the "Viceroy of India" after her maiden voyage only minor adjustments have been found to be necessary to the electrical machinery. No greater testimony surely could be needed as to the reliability of the electric ship than this. And, remember, too, that the electric ship is even now going through a formative stage in much the same way as the motorship did in 1912. The electric ship, however, will never and can never compare numerically with the motorship. She will always be a special case, but in her present state does not in any way represent the final and finished electric ship. Technique will alter and even improve considerably during the next few years. The electric ship of to-day is only an experimental foundation upon which the electric ship of to-morrow will be built.

Even already signs are not wanting that newer and more powerful electric liners are contemplated by European shipping companies, and on her maiden voyage the "Viceroy of India" had the representatives of important shipping companies on board—always a significant fact. The "Viceroy of India" has a S.H.P. of about 17 000 H.P. The new Dollar liners, to which reference was made in the last article in this series, are the largest and most powerful of new electric liners. They are also among the fastest because they will have a speed of between 20 and 21 knots in service. A maximum shaft horse power of 26 500 puts them on a par with big Italian liners like the motor liner "Augustus." They will easily be the biggest and fastest ships in round the world trade, their duties taking them out to the Far East from New York via Panama and home via the Philippines, ports in the Dutch East Indies, and the Suez Canal. Alternatively they may be employed in transpacific service from San Francisco to the Orient. As an example of the money which is now being spent by shipping companies in electrical shipping, it may be mentioned that the Dollar line contract alone will involve a total expenditure of £9 000 000, split up among various shipyards.

A comparison between the leading features of the new Dollar liners and the "Viceroy of India" is interesting in contrasting the various dimensions and service requirements. It will be noticed that the boiler equipment of the former is just double that of the latter.

ELECTRIC LINERS OF RECENT TYPE COMPARED.

Ship	L.o.a. × Build × D/mld.	Power	Displacement	Speed	Boilers	Passengers
"Viceroy of India"	.. 612 × 78 × 82[1]	17 000	25 000 tons	17–18	6 W.T.[2]	415/258/—
Dollar Liner	.. 653 × 81 × 42·5	26 500	31 000 tons	20–21	12 W.T.[3]	332/—/140

[1] To topmost of nine decks. [2] Yarrow type. [3] Babcock and Wilcox type.

Refrigeration Facilities.

The new Dollar liners will have exceptionally large cargo capacity, amounting to about 650 000 cu. ft. of general cargo and as much as 70 000 cu. ft. of refrigerated space. A tendency may be noted on all modern ships which have readily available electrical power, and whose trade requirements make it advisable, to fit large refrigerated space. Electric current represents a very convenient power source for the operation of refrigerating machinery, being both compact and clean. The deadweight capacity at a 32 ft. designed load draft is 17 400 tons. Large passenger accommodation of the latest type is provided for 332 first class and 140 tourist class passengers, while oriental steerage passengers to the number of 772 can also be accommodated in 'tween-deck spaces. For the work they have to do, these ships are among the most important now on order or under construction.

Some idea of the actual operating cost of big electric ships may be gained from the fact that on her maiden voyage from London to Bombay and back the "Viceroy of India" consumed some 6 800 000 electrical units for propulsion purposes and some 728 125 units for the "hotel" load, which includes heating, lighting cooking, punkah louvres, and laundry use. The cost per unit for the propulsion load, including 17½% capital charges, wages, and victualling of engine room compliment, works out at 0·346 pence. When this is taken into account in conjunction with the attached tables, it will be realised that the electric liner is likely to be an economic factor in shipping of no mean potentiality in the near future. The saving in gross oil fuel is interesting even when the ships are at different displacements. This becomes all the more pronounced with speeds and displacements reduced to a common figure.

P. & O. ELECTRIC SHIP "VICEROY OF INDIA"—VOYAGE RESULTS COMPARED WITH THOSE OF TWO STEAM SISTER SHIPS.

Ship	S.H.P. Available	Displ. Tons	Speed Kts.	Gross Oil Fuel	Lub. Oil
"Viceroy of India"	17 000	200 026	16·3	3 521 tons	361
"R" class steamer	13 500	19 235	16·14	4 655 tons	1 320
"R" class steamer	13 500	18 540	16·03	4 958 tons	1 279
SAME RESULTS AT CONSTANT DISPLACEMENTS AND SPEEDS.					
"Viceroy of India"	17 000	20 026	16·3	3 521 tons	361
"R" class steamer	13 500	20 026	16·3	4 801 tons	1 320
"R" class steamer	13 500	20 026	16·3	5 270 tons	1 279

The high lubricating oil consumption for the "R" class steamers is particularly noticeable. These ships have steam reciprocating engines and oil fuel Scotch boilers.

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METERING BULK SUPPLY.

An Interesting Italian System with a Variety of Applications.

(By A CORRESPONDENT.)

IN the last few years generating stations have been increasing in size, and large amounts of power are sold and bought among various undertakings, with the result that methods which were considered as right years ago are not now satisfactory.

It is not to be wondered at that the use of a simple kWh meter of the induction type is only resorted to in a few unimportant cases. More elaborate systems of tariffs, dependent upon the measurement, not only of the kWh, but also of the power factor and of the maximum demand, have now been evolved.

In actual practice, however, these measurements are unfortunately all based on some sort of meter of the induction type, which is not the most accurate form of a measuring instrument. It is, therefore, interesting to hear of a new system which overcomes this handicap, in a new range of metering equipments which are just being put on the market by Messrs. Istrumenti di Misura "C.G.S.," of Monza (Italy).

This patented system is capable of a variety of arrangements and modifications so that practically any requirement can be met. For the sake of brevity I propose to deal with only one of these, the "C.G.S." Wattgraph-Integrator.

This instrument consists essentially of a standard "C.G.S." relay-operated, motor-driven, precision recording wattmeter (Fig. 1), in which the motor operates also a specially-designed planimeter. This recorder consists of two wattmeters of the electro-dynamic type mounted as a sort of Kelvin balance. By this clever disposition, and by operating it through a motor relay, the makers have reached a degree of accuracy hitherto unobtainable by other means.

The same motor is also used to operate the planimeter, as shown on Fig. 2.

Method of Working.

The displacement of the pointer is reduced and transferred through the flexible strips 4 and 5, and through the pulleys 6 and 7, to the chariot 8, upon which there is an integrating wheel 3 sliding along the surface of a clock propelled disc 2. This sliding motion is so arranged that, when the pointer is at zero, the integrating wheel lays on the centre of the disc (and therefore also at its zero), while when the pointer indicates the maximum, the integrating wheel lays near the edge of the disc (and therefore also at its maximum). A strip spring wound inside the drum 11 exerts a tension on the chariot by means of the flexible strip 10.

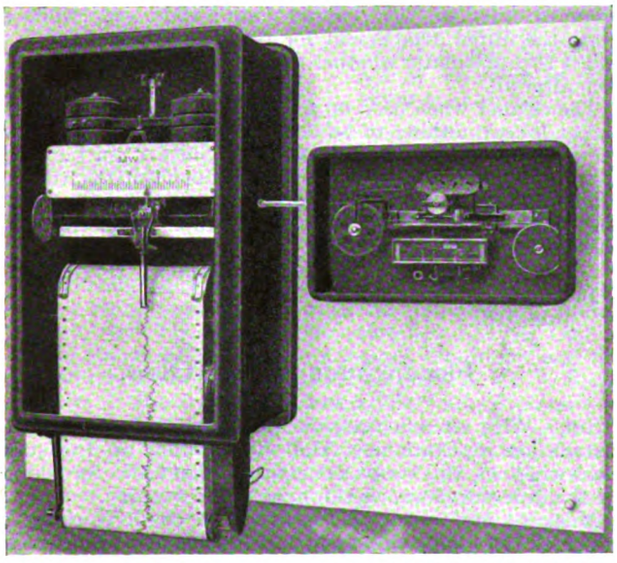

Fig. 1.—Showing a "C.G.S." meter with the specially-designed planimeter in position.

By this simple arrangement one obtains a chart with valuable information about occurrence, size and time of peaks, thus a very accurate registration in the standard Board of Trade units.

As groupings of instruments can, in a similar way, be easily arranged so as to record also the power factor, kVA, reactive component, etc., with further attachment for the automatic insertion of other instruments when the load comes under pre-determined conditions, it is obvious that this system is well suited for tariffs in cases of bulk supply and energy transfers.

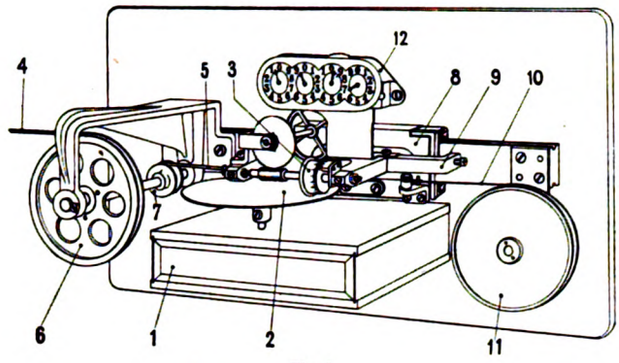

Fig. 2.

METER STANDARDS.

Reduction of Limits of Error—Performance of A.C. and D.C. Types for Measuring Electricity Supply.

AMONGST the specifications recently issued by the British Engineering Standards Association may be mentioned No. 37-1929, which is a revision of the 1919 edition and differs from its predecessor in several important respects. In the first place, the permissible limits of error have been appreciably reduced, the limits for all sizes, grades and types of meters now being within the Board of Trade limits. In the second place, differentiation has been made in several important respects between d.c. and a.c. meters, whereas in the 1919 edition there was no differentiation as regards the majority of the electrical performance requirements. Thirdly, two grades of both a.c. and d.c. types are provided for, namely, a sub-standard grade and a commercial grade. Fourthly, the registering mechanism is now restricted to the pointer type, and must consist of not less than 6 pointers. (This clause obviously does not apply to electrolytic meters, nor does it apply to sub-standard meters with special dials for testing or other purposes.)

A very useful feature of the Specification is a folding sheet containing a summary of the performance requirements. This sheet can be removed from the Specification and mounted in the test-room for ready reference.

Copies of the specification may be obtained, price 2s. 2d. each, post free, from the Publications Department, British Engineering Standards Association, 28, Victoria Street, London, S.W.1.

I.E.E. GOLF.

Result of Competition for the G.P. Dennis Trophy at Hesketh Club.

THE Golf Competition organised by the Mersey and North Wales (Liverpool) Centre of the I.E.E. in conjunction with the North Western Centre, in aid of the I.E.E. Benevolent Fund was played at the Hesketh Golf Club, Southport, on May 29th. Fine weather prevailed and some very good cards were returned. The G. P. Dennis Trophy was won by Mr. A. G. Barnard (Liverpool), with a net score of 1 down. Mr. J. O. Balshaw and Mr. F. G. Briant tied for second place with a score of 2 down. In the first division Mr. J. O. Balshaw and Mr. A. G. Barnard tied for first place with a net score of 75 and in the second division Mr. H. Gawthorne returned the best card with a score of 80. In the two-ball foursome the best card was returned by Mrs. Kessler and Mr. W. A. Phillips with a net score of 80½ and for the second best card Mr. F. E. Boot and Mr. F. G. Briant tied with Mr. R. Foster and Mr. R. Turnbull with a score of 81. The putting competition was won by Mr. G. S. King. The total entry was 75, of which 53 took out cards for the various competitions. Mr. S. E. Britton, chairman of the Liverpool Centre, presided at the dinner held at the Prince of Wales Hotel, Southport, and was supported by Mr. J. Harcourt Williams, chairman of the North Western Centre. The prizes were presented by Mrs. J. Harcourt Williams.

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CORRESPONDENCE.

The Editor welcomes the free expression in these columns of genuine opinion on matters of public interest, although he disclaims responsibility alike for the opinions themselves and the manner of their expression.

North-East Coast Exhibition.

[To the Editor.]

Sir,—As one who has a sentimental interest in the north-east coast it has struck me as somewhat surprising that so little is heard of the North-East Coast Exhibition outside the northern area of England. Here in the south few people even know that there is such an exhibition!

We were told in the little advertising that reached the south coast that the Newcastle exhibition would be "a Wembley of the North," and here we are with the exhibition started to all intents as a purely local affair.

In the case of Wembley, the large national "dailies" published pictures almost every week, gave articles on the exhibition, and so on. With the exception of a picture or two of the opening, I have seen nothing concerning the North-East Coast Exhibition outside the provincial newspaper world and the electrical press. Surely something can be done to give better support to the enterprise of those exhibitors responsible for the show?—I am, etc.,

"Cullercoats."

Bournemouth.
June 1st.

132 000 V Cables.

[To the Editor.]

Sir,—The importance of this subject, coupled with the strictures in some quarters as to the reliability of 132 000 V cables, leads me to crave some further space in your columns for further developing the subject.

1. The amount spent on the New York installation (allowing for the duplicate cables necessary to put it on a par with our ideas over here as regards standby capacity) was £1·475 per kW per mile transmitted.

(*a*) This was a fancy price (owing to the novelty of the installation), and would now be only of the order of, say, £0·22 per kW per mile (in the case of Battersea), 15 miles by 300 000 kW by £0·22 = £990,000. (The difference between American and British initiative is illustrated by the readiness with which our American friends will find eight times the sum of money for an experiment.)

2. The *initial* transmission, it is well, however, to remember, would be only some 150 000 kW, and would cost perhaps only £660 000, with a very much higher proportion of spare cables than in New York.

(*a*) It might be some three years before developments in the growth of load made the next installation necessary. During these three years it may be taken as absolutely certain that any trifling improvements found desirable will have been introduced, and will appear in the second lot of cables.

(*b*) As regards causes of weakness in the cables, those of us who have for the last five years followed with unremitting and laborious attention the developments of paper insulated cables, know quite well that, having now entirely dropped non-radial electrostatic fields, there only remained the questions of voids in the cable, due to expansion and the change of power factor, and of capacitance, due to heating. The latter has now been experimented on, and tested, till we have reached a point where nobody would dare to hint *that we do not know* all we should learn by waiting.

(*c*) The question of voids is recognised, by those best qualified to judge, as completely met by the pressure-oil-filled type of cable. The only factor not yet tested by experience "in the field" is the effect of expansion and contraction below ground—whether due to tropical heat or to arctic cold, or to superincumbent loads; perhaps also the effect of external vibration. This can be met by greater depth of laying. These difficulties could all be met by slinging cables against the embankment walls on both sides of the river, high enough to be clear of the mud, and yet low enough to be always covered by the water, and with suitable provision for lifting joints for repairs.

(*d*) The expansion due to temperature caused by the current can be met by giving the cables a conservative rating, remembering that the heating goes down as the *square* of the load, and a conservative rating is not, therefore, expensive.

3. Another point that must be borne in mind is that it is inconceivable that all the cables—if laid in different routes—should go down suddenly; and in this sense we are taking very little greater risks than with generating plant units. What trifling extra risk there is can be met by the provision of a rather greater proportion of spare plant in cables than in generators, say, double the amount. As the £660 000 mentioned includes the equivalent of four spare generator units, it surely will not be contended that this is insufficient. A small extra sum would give a still greater protection; but is not considered necessary. In any case, a cable unit is replaceable in very much less time than a generator unit.

4. Have I not made it clear that, from the engineer's point of view, there is no risk of interruption of the supply.

5. From the financier's point of view, the £660 000 will always be worth £330 000 if the cables are used at 66 000 V, and the financial risk is, therefore, *in the limit* £330,000; and this is extremely remote. What is £300 000 to a scheme of the size of Battersea, compared with Britain losing the pre-eminent position in the world for cables and the world's markets for 132 000 V cables? It would pay the C.M.A. to take this risk and to offer to put in British 132 000 V cables *on a 10 year guarantee*, rather than lose the world's market, for tens of millions of pounds, for super-tension cables in the near future.—I am, etc.,

A. M. Taylor.

Erdington,
Birmingham.
May 27th.

Vacuum Cleaner Attachments.

[To the Editor.]

Sir,—A point which appears to be worthy of the attention of manufacturers of electric vacuum cleaners, is the unsuitability of the present design of cleaner attachments. The tool with which one is required to clean upholstery for instance, is usually of aluminium, and if used without the brush is very inclined to scratch furniture, paint work, etc. Further, the shape of the device renders the cleaning of stairs extremely difficult. It might, of course, be suggested that one should use the rubber attachment for the purpose, but here, again, one can spend so much time changing from one device to the other in order to "get behind" stair rods, etc., while still using the fluted attachment for the stair treads, that in the end it is problematic whether a hand broom is not the easiest way after all.

The cleaner when used on a "straight" job such as a floor carpet leaves nothing to be desired, but my experience with the attachments is not encouraging. Since I am but one of many users of vacuum cleaners it is possible that there are other equally critical "converts," in which case the sooner the cause of this mild grouse is remedied the better for all concerned.—I am, etc.,

An Electrical Housewife.

Brighton.
June 3rd.

Floodlighting Stained Glass.

[To the Editor.]

Sir,—With reference to your description of a floodlighting installation at Stationers' Hall for lighting up the stained glass windows, this seems to me an excellent idea for adoption by the different churches throughout the country.

Many of my week-ends are spent in country walks, and many of the churches which I visit have windows which, if treated with floodlight, would create an interest in stained glass which is, for the most part, confined to a few.

If it were possible to gain the interest of the congregations of these churches, I feel that many of them would be willing to bear the comparatively small cost of installation, particularly when they were made to realise that its erection would in no way spoil the beauties of the exterior of the buildings.—I am, etc.,

Wanderer.

Carshalton,
Surrey.
June 5th.

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NEWS IN BRIEF.

Hull's Prosperous Telephone Department—Electrical Association for Women—Ex-Siemens Men's Association—World Engineering Congress.

MAIDSTONE T.C. has received sanction to a loan of £3 000 for domestic electrical apparatus for letting out on hire.

Hull municipal telephones department made a profit of £15 000 in the past financial year, after paying the Government £11 000 in royalties.

Guildford Electricity Committee has again considered the question of establishing an electricity showroom at 199-200, High Street, but the matter is deferred for the time being.

On May 25th members of the Electrical Association for Women visited the new power station at Longford, near Coventry. After inspecting the machinery, the visitors enjoyed the novelty of a journey up the inside of one of the four cooling towers.

An electro-technical assistant to the City Electrical Engineer of Salford is required.

The summer meeting of the North Midland Centre of the I.E.E. will be held at Buxton on June 29th and 30th.

The Crown Agents for the Colonies invite applications for the post of assistant telegraph engineer in the Public Works Department of the Government of Hong Kong.

The results, just published, of the working of the Paris-Berlin trunk telephone in 1928 show that, in the first three months after the laying down of a larger supply of through lines, the number of calls increased by more than 300%.

At a meeting of the Electrical Association for Women, on May 29th, Mr. H. L. Dover delivered a lecture demonstration with a thermal storage electric cooker sent from Sweden by arrangement with Dr. Ekström and Mr. R. Borlase Matthews.

Mr. John McCallum seeks leave to amend the specification of the application for letters patent No. 308 413 for "An improvement relating to lead-sheathed electric cables." Particulars of the proposed amendment appeared in the "Illustrated Official Journal" (Patents) of May 23rd, and notices of opposition must be lodged at the Patent Office within a month from that date.

At a meeting on April 26th an association of Ex-Siemens' Men was formed, and on May 29th the first re-union dinner took place, with Mr. Frank Willis (English Electric Co.) in the chair. Some fifty members attended the dinner and the concert which followed. The hon. secretary is Mr. J. Snow Huddleston, Dagenham Dock, Essex, who will be pleased to give full particulars of the Association.

The papers to be read at the World Engineering Congress and World Power Conference to be held in Tokio in September and October include "Synthetic Fuels and Lubricating Oil," by Prof. A. W. Lash; "Pulverised Fuel for the Small Unit," by Messrs. H. W. Holland and E. C. Lowndes; "The Volumetric Measurement of Coke and Coal" by J. E. Lea; "The Storage of Steam," by Dr. E. G. Ritchie; and "Coal Cleaning, with Special Reference to Japanese Coal," by Dr. R. Lessing.

At a meeting of Manchester Education Committee on May 27th, Ald. Woollam referred to a request which had been made by the managers of a non-provided school that the Committee should authorise and pay for an electric lighting installation in the school, so as to make its teaching as efficient as that of provided schools. Mr. Woollam said it had, unfortunately, been decided to ask for a report on the matter from the Sites and Buildings Sub-Committee, which did not, in his opinion, affect the matter of principle involved.

Representatives of more than 40 countries are attending the biennial International Congress of Telegraph Agencies which opened on May 25th at Therapia, Turkey.

The annual autumn meeting of the Institute of Metals will be held in Dusseldorf from September 9th to 12th. This will be the first meeting of the institute to be held in Germany.

The laying of the new submarine telephone cable from Norbreck, near Blackpool, to Port Grenaugh, Isle of Man, was begun by Siemens Bros. and Co.'s c.s. "Faraday" on June 1st.

In the Blackpool Municipal Cricket League, Electricity beat Police, scoring 170 for two wickets, to which the Police replied with a total score of 104.

A £6 000 000 project to harness the Osage River, in Missouri, as part of a new hydro-electric scheme, is announced. Transmission lines will convey power to Crystal City, where one consumer has contracted for 150 000 000 kWh per annum.

In order to conform to the proposed scheme of decorative lighting along the front during the forthcoming season, Portsmouth Electricity Committee proposes to arrange for additional decorative lighting on the pier deck and at the pier entrance, at a cost of about £300.

The British Empire Steel Corporation has completed plans for the erection at Glace Bay, Nova Scotia, of a power plant costing approximately $2 000 000 and equipped to supply the industrial district of Cape Breton, including the corporation's fifteen collieries and surface plants.

According to an Iowa report 13 817 farms are served electrically from central-station companies and about 14 000 from individual farm-lighting plants. Only 24 towns in Iowa out of the total of 922 do not have electric service. The average population of these towns is 133.

Smethwick Corporation has decided "to express grave concern at the proposed transfer, to a company controlled by a foreign undertaking and supported by foreign capital, of the whole of the ordinary shareholding in the Shropshire, Worcestershire and Staffordshire Electric Power Co.," and "to call upon the Government speedily to take steps to inhibit this and other transactions of the like nature."

Students from Brighton Technical College recently visited the all-electric farm of Mr. R. Borlase Matthews, near East Grinstead. Power from Wiremill Lake is being utilised for all the farm purposes to which electricity can be applied, including chaff cutting, grinding, milk separating and churning, cable heating of the soil, intensive illumination, etc., etc. The supports for the cable are of the X-pole type, about which Mr. R. Borlase Matthews is shortly reading a paper before the International Extra-High Tension Conference in Paris.

The Portuguese Minister of Commerce has nominated a commission of engineers to examine the whole question of the exploitation of the water power of the Douro, from the mouth of the River Huebra to Oporto. At the same time the General Administration of Water Services will examine the proposals already submitted for the exploitation of the hydro-electric power of the Douro, in order that the Government may take whatever steps it considers necessary to develop the zone reserved to Portugal under the terms of the convention concluded with Spain in 1927.

LOOKING BACKWARD.

FIFTY years ago it was recorded in THE ELECTRICIAN' *of June 7th, 1879, that :—*

Rock drilling was a new application of electricity.

The introduction of electric light had preceded that of gas in Persia, and several Jablochkoff candles were consumed every night by the Shah in his palace at Teheran.

* * *

TWENTY-FIVE years ago, according to THE ELECTRICIAN *dated June 10th, 1904 :—*

A "free" wiring scheme was contemplated at Dover.

The coming of the steam turbine was received with mixed feelings.

At a run of the Ladies' Automobile Club there were six electric cars out of a total of 50.

There was discussion at the I.E.E. annual meeting of a revision in the articles of association affecting the Associate class.

* * *

TEN years ago THE ELECTRICIAN *on June 6th, 1919, announced that :—*

The Birthday Honours included a Knighthood for Mr. Charles Bright.

The E.L.M.A. was to take over the work of the Tungsten Lamp Association.

A joint meeting of the I.E.E., the E.C.A., and the N.A.S.E. was held to find the best way to advance the use of electricity in the many small houses that were about to be erected.

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ELECTRICAL M.P.'s.

Electrical Industry Well Represented, Although by Fewer Members.

OUT of the fourteen candidates associated with the electrical industry who took part in the Parliamentary elections last week, only six were elected. These were Mr. P. J. Pybus, Lt.-Col. Sir Frederick Hall, Mr. George Balfour, Sir Philip Dawson, Mr. P. J. H. Hannon and Major-General Sir Newton Moore, the last five being re-elected.

Mr. P. J. PYBUS (Lib.), elected for the Harwich Division of Essex, gained a seat for the Liberal Party, and had a majority of 2 700 votes in excess of the poll for the Unionist candidate. In 1924 the Unionist majority was 2 315. Mr. Pybus is chairman of the Power and Traction Finance Co., and a director of Willans and Robinson, the English Electric Co., and other electrical companies.

*Lt.-Col. Sir FREDERICK HALL (U.), re-elected for the Dulwich Division of Camberwell, had a majority of 5 700, compared with 15 611 in 1924. He also is a director of electrical companies, including the County of London Electric Supply Co. and the South London Electric Supply Corporation.

*Sir PHILIP DAWSON (U.), again re-elected for Lewisham (West), did not suffer as great a reduction of majority as most other Unionist Members as a result of Labour activities. He secured a preponderance of 9 872 over the poll for the Labour candidate, compared with a majority of 12 942 in 1924. As most of our readers are aware, Sir Philip is a notable figure in the electrical world. He is a partner in the firm of Kincaid, Waller, Manville and Dawson, consulting electrical engineers, and a director of Johnson and Phillips, the Reading Electric Supply Co., Wessex Power Producers, and other companies. He was a member of the Ministry of Transport Railway Advisory Committee and of the Board of Trade Water Power Resources Committee.

*Mr. GEORGE BALFOUR (U.) re-elected for Hampstead with a majority of 14 897, compared with 15 770 in 1924, is also a notable case of failure of the Labour attack. Mr. Balfour is chairman of Balfour, Beatty and Co., the Scottish Central Electric Power Co., and a director of other companies connected with electricity supply and traction work.

*Mr. P. J. H. Hannon (U.), re-elected for the Moseley Division of Birmingham, is a director of the Westminster Electric Supply Corporation, Ltd.

*Major-Gen. Sir Newton Moore (U), who retains his seat for Richmond, is a director of the General Electric Co., Ltd.

Those who have been defeated include Mr. J. W. McKAY, secretary of the Electrical Wholesalers' Federation (Lib). who stood for Coventry; Mr. R. S. CHATFIELD, chairman of Eastbourne Electricity Committee (Lab.), for Eastbourne Division of East Sussex; Mr. R. R. FAIRBAIRN, formerly manager of Worcester tramway undertaking (Lib.), for Worcester; *Mr. W. PRESTON, head of William Sanders and Co., electrical engineers, Wednesbury (U.), for Walsall; *Mr. R. G. ELLIS, a director of the Yorkshire Electric Power Co. (U.) for Wakefield; *Ald. J. P. BURMAN, a member and formerly chairman of Birmingham Electricity Committee (U.), for Duddleston Division of Birmingham; Mr. SIDNEY E. GARCKE, a director of the British Electrical Traction Co. and other companies (U.), for Kingswinford Div. of Staffordshire; Mr. E. KILBURN SCOTT, consulting engineer and author of books on electrical subjects (Lib.), for Leeds (South).

BIRTHDAY HONOURS.

Few Awards to Persons Connected with Electrical Industry.

AMONGST the Honours conferred by the King on the occasion of his 64th birthday are the following:—

KNIGHTS.—The Honour of Knighthood has been conferred upon Mr. William Smith Jarratt, Comptroller-General of the Patent Office; Mr. Roland Thos. Nugent, Director of the Federation of British Industries; Mr. Chandrasekhara Venkata Raman, Professor of Physics, Calcutta University.

OFFICER OF THE ORDER OF THE BRITISH EMPIRE. Captain Richard Alston Hale Lewin, Instructor, School of Electric Lighting, Gosport.

MEMBER OF THE ORDER OF THE BRITISH EMPIRE.—Mr. Augustus Charles Hayes Statham, Assistant Engineer, Wireless, Indian Imperial Posts and Telegraphs Service.

COMPANION OF IMPERIAL SERVICE ORDER.—Mr. A. L. De Lattre, Assistant Engineer-in-Chief, General Post Office.

* Members of the late Parliament.

PERSONAL.

MR. C. O. Brettelle has been appointed technical editor of the "Electrical Review" in succession to the late Mr. A. H. Allen.

Mr. H. A. Blackburn, of Huddersfield, has been appointed tramways manager to Keighley Corporation at a salary of £500 per annum.

Mr. R. Alan S. Thwaites, of the Yorkshire Electric Power Co., has been elected vice-chairman of the Yorkshire Association of the Institution of Civil Engineers.

Mr. J. G. Statter, of J. G. Statter and Co., is due to arrive at Liverpool on June 10th, by the "Walmer Castle," after a successful business trip to South Africa.

Mr. Allan Grant, previously assistant district engineer with the Clyde Valley Electric Power Co., has been appointed district engineer to the Grampian Electricity Scheme.

The directors of the British Electric Traction Co. announce with regret that Mr. E. Garcke, the founder of the company and its moving spirit since its inception, is retiring from the board.

Wigan Tramways Committee has recommended the appointment of Mr. J. Brierley, as general manager of the tramways, in succession to Mr. C. Hopkins, who has accepted a similar appointment at Sunderland.

Sheffield Electricity Committee recommends the appointment of Mr. Ernest Morgan, chief engineer and general manager of the electricity department, Wolverhampton, as general manager and engineer, at a commencing salary of £1 250 per annum.

Many of our readers will be interested in the announcement of the approaching marriage of Mr. R. B. Renwick, son of Sir Harry Renwick, to Miss Dorothy Mary Parkes, elder daughter of Mr. and Mrs. Harold Parkes, of Alveston, Stratford-on-Avon. The wedding will take place at St. Margaret's, Westminster, London, on June 11th.

Golfing readers will be interested to learn the latest feat of Mr. P. N. Rand, the general sales manager of the English Electric Co. Playing at Bramley, Surrey, last week, his shot from the fifteenth tee struck the pin squarely about 4 in. from the ground and the ball dropped into the hole. The fifteenth is a 120 yards blind hole with a bogey of 3.

Following the resignation of Mr. J. D. Peattie, distribution development engineer, in the Manchester Electricity Department, Mr. H. Hawkins, high-tension mains engineer, has been appointed distribution development engineer. Mr. A. W. Crompton, technical assistant, has been appointed assistant distribution development engineer, and Mr. P. T. Fowler, assistant high-tension mains engineer, has been promoted to the position of high-tension mains engineer.

Sir Ernest Benn recently complied with a request, by the organisers of the Electrical Convention, now being held in Atlantic City, that he should make an address for the "Movietone," on the subject of private ownership. On Wednesday morning the following cablegram was received at Bouverie House: "The National Electric Light Association extends to you grateful acknowledgement and thanks for movietone record shown the assembled thousands in attendance at the Convention to-day. The record is excellent, and so carried away was the assemblage with your concise and convincing argument on the superiority of private over government ownership that, then and there, it was unanimously moved that this message of appreciation be cabled to you at once. We wish it were possible to transmit as easily some comprehension of the enthusiasm with which the movie record was received.—Preston S. Arkwright. President."

Obituary.

MR. F. PERCY BALLARD, on May 24th, after an operation. He was for many years on the staff of Marconi's Wireless Telegraph Co.

MR. HERBERT GLEAVE, aged 30 years, chief electrician to the Chemical and Metallurgical Corporation, Ltd. He was previously with the St. Helens Cable and Rubber Co.

MR. JOSEPH JENKINSON, on May 22nd, aged 71 years. He was for about 20 years on the staff of the Urban Electric Light Co., at Grantham, and retired about six years ago. He was formerly a member of Grantham U.D.C.

MR. JOSEPH SHEPHERD, electrical engineer, Bexley, Kent, on May 28th, at the age of 61 years. He was formerly assistant electrical engineer to London County Council. Afterwards he went to Russia as an electrical expert for the British Government. He was at one time chairman of Bexley U.D.C.

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BUSINESS ITEMS.

MR. H. MCCALLUM, electrician, of Prestwick, Ayr, has removed his business to 2, Boyd Street.

As from June 10th, the address of the Cardiff branch office of PHILIPS' LAMPS, LTD., will be 11, Womanby Street.

HOSKEN, TREVITHICK, POLKINHORN AND CO., LTD., of Truro, have opened new electrical showroom premises.

The GENERAL ELECTRIC CO., LTD., announce price reduction of automobile lamps. Of the thirteen types affected the majority are " BAS " lamps.

Mr. CECIL VEITCH, electrician, of Prestwick, Ayr, has removed his business from 113, Main Street, to Royal Bank Buildings, Gardiner Street.

B.E.N. PATENTS, LTD., 92, Tottenham Court Road, London, W.1, announce that they have received an order for " B.E.N.—Myers " high pressure washers from the L.M. and S. Railway.

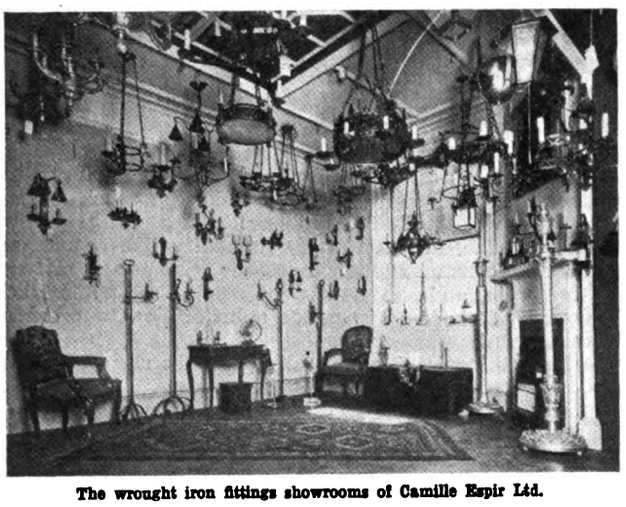
J. G. WHITE AND CO., of 9, Cloak Lane, London, E.C.4, have opened offices in the Equitable Trust Company Building, 39, Rue Cambon, Paris, under the management of Mr. R. L. McClure.

The new Gecophone adjustable reed-cone movement, made by the GENERAL ELECTRIC CO., LTD., is now fitted with a cone anchoring attachment. This small addition simplifies the attachment of the cone diaphragm to the armature reed, and will thus be greatly appreciated by constructors.

The Plaza Cinema, Liverpool, has installed floodlighting units similar to those at the Tivoli Theatre, London, and consist of twelve type I.E.2/86 G.E.C. projectors, equipped with gasfilled lamps. The BERKELEY ELECTRICAL ENGINEERING CO., LTD., of 29, Buckingham Gate, London, S.W.1, were the contractors responsible for the scheme.

The lighting installation at the Grosvenor Dancing Academy, Chester, in which approximately one thousand 60 W. type " Osram " colour sprayed lamps are installed, form the basis of a scheme, by Messrs. H. MORGAN, Broughton, Manchester. There are seven circuits operated by a small motor and many colour changes and rainbow effects are obtainable.

At the Tenth Brussels Commercial Fair, held from April 10th to 24th, there were 2 894 exhibitors representing 28 countries, including 1 885 Belgian, 141 Japanese, 144 German, 438 French and 60 British. The chief groups included machinery, etc. (550 firms), electricity, wireless, etc. (221). It is stated that good business was done in the electricity section. The next Fair will be held April 2nd to 16th, 1930.



The wrought iron fittings showrooms of Camille Espir Ltd.

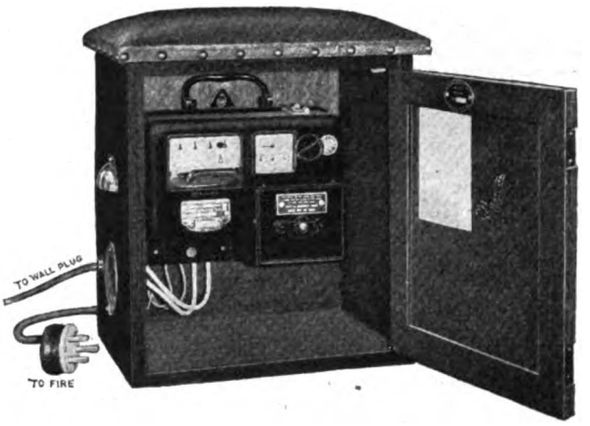
At John Barker's of Kensington, PHILIPS' LAMPS, LTD., were responsible for the whole of the arrangements for the announcing of results to the crowd which had congregated both in the Restaurant and Display Hall in order to hear the election results. A special control room was established on the fourth floor, from which were controlled the loud-speakers in the restaurant and display hall. Results were received ov r a special wire, and were transmitted to the control room, where they were announced, thence passing through a eries of amplifiers, finally emerging from the speakers. Between the results, the audiences were entertained by gramophone music relayed by the same means. The apparatus comprised two 50 W amplifiers which were driven from the a.c. mains together with a microphone, and " A " amplifier.

See page 706.

PORTABLE METER BOXES.

Interesting Device of the Brompton and Kensington Electricity Supply Co.

THE Brompton and Kensington Electricity Supply Co., Ltd., has sent us particulars of a portable meter box (Patent No. 25 866), which is designed to assist in increasing the general uses of electricity for heating, etc., in such places as hotels, boarding houses, and so on.



The portable meter box showing the construction.

The apparatus consists of a readily portable box or box-sea fitted with an electric meter, usually upholstered and placed by the fireplace. The ingeniousness of the device lies in the method adopted for connecting it with the circuit supplying the electric fire or other apparatus, the consumption of which it is desired to check or record. The box-seat is fitted with a plug base of a certain size and gauge, into which the plug attached to the flexible cord of the electric fire fits. A flexible cord is taken from the meter box with a plug top attached, which fits into the plug base on the skirting of the room in which the fire is used. This latter base is of a different pattern or gauge to that on the box-seat, so that it cannot be plugged direct into the wall plug base, but must be connected through the medium of the meter box. The box being fitted with a prepayment meter, energy can only be obtained by inserting the requisite coin. The meter box-seat is usually supplied in the form of an upholstered seat, but can be made up in any convenient size, shape or material, to match furnishings of room, and is thus as unobtrusive as possible. Another design is that of a curb fender with one end fitted as the meter box, and the other end can be used for the reception of kettle and utensils for heating water, milk, etc., used on boiling ring of the hotel pattern radiator. This curb can be arranged for the pins of plug to protrude and go straight into the flush plug base on wall, and flexible cord dispensed with. The insertion of coin is through a small aperture in the door, which is kept locked until the coin receptacle is emptied by the proprietor.

The advantage of the device is that, in hotels and boarding houses, when a guest desires to have an electric fire, it is sent to the room (with prepayment meter) all ready for use. In addition, when the fire is not required, it can be removed complete with the meter box. In this way the proprietor need only provide as many meters as the fires actually required, with a consequent saving in cost. The cabling for the fires can also be simplified and " looping " into adjoining rooms easily practicable.

Meters may be calibrated to give a predetermined benefit on the price charged, which not only covers the rental of the apparatus, but gives a satisfactory return to the proprietor. A resetting device is fixed to the meter, so that when the guest leaves, the meter is reset at zero.

York Electricity Committee has received the sanction of the Minister of Transport to the placing of overhead lines in the parishes of Nether Poppleton, Skelton, in the villages of Acaster Malbis, Towthorpe, and at Strensall, Hob Moor and Fulford.—The Committee recommends that rectifying plant be installed in the Groves sub-station at an estimated cost of £1 460.—Sanction has been received to loans of £3 422 for sub-station buildings; £16 390 for mains; £9 935 for plant; £5 000 for transformers; and £30 000 for mains and services.

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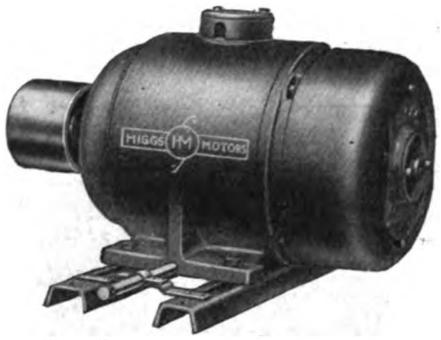
NEW INDUCTION MOTOR.

WE are advised by HIGGS MOTORS (Mr. Walter F. Higgs), of Witton, Birmingham, that they have recently commenced production of a new range of repulsion induction motors of the single-phase type. The machines are suitable for driving line shafting, or for incorporation in air compressors, pumps, washing machines and domestic appliances of all descriptions. They are commercially silent in operation, but the makers point out that they are not recommended for use in household refrigerators or organ blowing. The machines are constructed with a double wound rotor. On the periphery there is a winding somewhat similar to a d.c. armature, connected to a commutator in the usual manner, below this there is a squirrel cage winding. These working in conjunction with one another, develop a high starting torque with a reasonably low starting current. The brushes are permanently on the commutator. The specification of the company's standard a.c. and d.c. motors applies generally to these machines as they are a combination of the two.



Illustrating a new repulsion induction machine, by Higgs Motors.

There are eight different types available, giving powers of between 0·1 and 1 H.P. and speeds between 775 and 1 170 r.p.m., 40, 50 and 60 cycles being catered for. The type MK series is provided with drilled cast phosphor bronze bearings and lubricated by the wool yarn system. The remainder of the series is provided with ball bearings. The type 14k frames are arranged to run in the horizontal position, but should they be required to operate on a wall or ceiling the end cover can be correctly fitted. The types other than 14k can be run on the floor, wall, or ceiling, without alteration, as they are fitted with ball bearings. The standard rotation is clockwise when viewed from the pulley end, but the rotation can be reversed by a movement of the brush rocker. Instructions are sent with each machine. The limits of variation with respect to supply voltage are plus and minus 5%. The makers state that the machines can be thrown direct on to the line by means of a switch. When a starter is used the motors will develop 35/40% of full load torque with full load current. The starters are designed to pass full load current on the first stud, but this torque will increase as the starter handle is moved over, which, the manufacturers point out, is not the case with squirrel cage single-phase motors.

JOHN BENN HOSTEL.

Distinguished Company to Attend Banquet on June 25th.

LORD MELCHETT has consented to take the chair at the banquet which will be held on June 25th, at the Savoy Hotel, London, on behalf of the John Benn Hostel. This is the second public banquet which the East End Hostels Association has arranged, the first being held two years ago when the Lord Mayor of London presided and the headmaster of Harrow was the principal speaker. On the present occasion there is a brilliant toast list, for the headmaster of Eton, the Dean of St. Paul's, Mr. A. P. Herbert, the Mayor of Stepney, Sir J. Tudor Walters, Sir Ernest Benn and Captain Wedgwood Benn are all on the list of speakers.

Acceptances so far to hand make it certain that a very distinguished company will assemble on this interesting occasion, and the Hon. Sec., Miss F. Robinson, Bouverie House, Fleet Street, will be glad to hear from members of the trade who would like to have seats reserved for them.

The work of the Hostel is well-known to our readers, and it is therefore of interest to record the fact that the Queen has sent a miniature edition of Shakespeare and one or two other special gifts to be sold by auction at the Old English Fair, Chislehurst, on June 13th, on behalf of the John Benn Hostel.

BATTI-WALLAHS' LUNCH.

A Layman's Views on the Electrical Industry.

AT a luncheon of the Batti-Wallahs' Society, held at the Hotel Cecil, London, on May 30th, Mr. H. L. Howard in the chair, Mr. Henry S. Horne gave "A Layman's Views on the Electrical Industry."

One of the first things that struck him was that buildings were rarely given their electrical equipment until after the builder had finished his work. This necessitated a good deal of cutting away and delayed completing the job.

He was also surprised at the variety of voltages at which electricity was supplied. This was an age of standardisation, and the electrical industry needed standardisation as much as, if not more than, any other industry.

Speaking of the recent American investments in British electricity supply undertakings, he said he had asked one of the people concerned in a recent deal if he was not paying a very high price for something yielding only a modest return. "On paper we are," he replied, "but I am confident that the management we put in will in a short time double or treble what has been done in the past." That this was not empty boasting he knew from personal observation, which enabled him to say that many similar enterprises in various parts of the world had so been taken over during the last five years, and that this had generally given rise to a great increase in earning power.

In his view the electrical industry was run too much by technical men with little or no knowledge of commerce. The technical man was naturally important, but that importance seemed to have been exaggerated.

The trouble was that we were not sufficiently adventurous. We looked with complacence on estimates of probable future consumption which were ludicrously small compared with the real possibilities if we only went out for the business.

The consumption of electricity could be enormously increased, but it was desirable to let the consumer know what was being done, how, and why. As a farmer on a large scale he had tried numerous ways to obtain information as to how he could use electricity in farming. If his own difficulty in getting information was general it was not difficult to see why progress was slow.

After visiting several electrical trade exhibitions he thought they were exactly like a Woolworth demonstration.

Propaganda, Mr. Horne continued, was a subject on which he was qualified to speak. When he went out to educate the consumer and the builder about cement he was laughed at by the people in the cement industry; already the propaganda had justified itself.

Yet he had been told that the great electrical industry spent only £30 000 a year on industrial propaganda. A sum of that size was a piffling amount when there were 46 million possible users of the product wanting to know about it. He was not talking as a "layman" when he said that such a small expenditure was like putting money down a sink. If it was possible to take an interesting commodity like cement and spend on advertising it four times the cost of the electrical industry propaganda and reap good results, the potentialities of electricity from the propaganda point of view were tremendous.

He had noticed that practically the only users of electric signs were people who lived by advertising. The electrical advertising field was not even scratched as yet.

The electrical industry had a wonderful future, but like many others it ought to do a little gambling with personality. He believed that if the industry would only take a chance and make more use of the commercial mind it would cover not only Great Britain but the world, and would easily eclipse all existing estimates of consumption.

BRASS ARMOURING WIRE ELECTRIC CABLES.

The British Engineering Standards Association has recently issued a Specification relating to brass armouring wire for electric cables. The wire dealt with is intended primarily for use in the automobile and similar industries. The Specification provides for three sizes of wire and specifies the chemical composition of the material, the tolerances permitted on the dimensions, and the finish; mechanical tests are included, and the procedure of selecting samples for these tests is laid down. Copies of the new Specification, No. 356–1929, may be obtained from the Publications Department, British Engineering Standards Association, 28, Victoria Street, London, S.W.1, price 2s. 2d. post free.

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GRAMOPHONE DEVICE.

An Electrically-Operated Self-Winding Mechanism.

WE have received from AUTO-ELECTRIC DEVICES, LTD., of Diamond Works, Brighton, particulars of a device for gramophones which, it is claimed, combines the advantages of both the spring motor and the electric motor. The device is known as the A.E.D. self-winding gramophone (Patent No. 299 645), and consists of an electric motor connected to a spring motor of standard type, by means of a gearbox containing a reduction gear. This gearbox is connected to the winding shaft of the spring motor by means of a coupling consisting of one member fixed to the winding shaft and one sliding member, which is held in engagement by an adjustable coil spring, the actual coupling being effected by two steel balls and sockets. When the spring motor is wound to such pre-determined point that the tension of the main spring exceeds the tension of the spring which keeps the coupling in engagement, the loose member of the coupling is forced back out of engagement with the fixed member, thus freeing the winding shaft of the spring motor from the electric motor. Attached to this winding shaft at its opposite end is a sprocket wheel, the teeth of which engage with a pivot trigger attached to a steel bar which carries the moving member of the electrical switch. Upon the disconnection between the electric motor and the spring motor taking place, the winding shaft of the latter is naturally forced back in a reverse direction by the action of the wound spring. When this occurs, one of the teeth of the sprocket wheel engages with the pivot trigger and moves the switch bar, thus opening the electrical circuit. The pivot trigger is so arranged that in moving, it forces a steel pawl into the path of the teeth of the sprocket wheel, thus checking any further backward movement.

Driven from the gear-wheel of the gramophone spring, via a worm and worm wheel, is a shaft carrying two slotted circular discs, in the slots of which is a yielding pin. According to the time desired between windings, the gear ratio of this member is arranged for the discs to make one complete revolution. In the standard machine this time is approximately three and a half minutes. On the completion of one revolution the floating pin strikes against a projection on the switch bar, is forced to the other end of the slot, and then drives the switch bar forward, thus closing the circuit and re-starting the winding operation. The lay-shaft of the gearbox which connects the two motors is drilled and tapped to take a standard winding handle.

REDUCTION OF CHARGES.

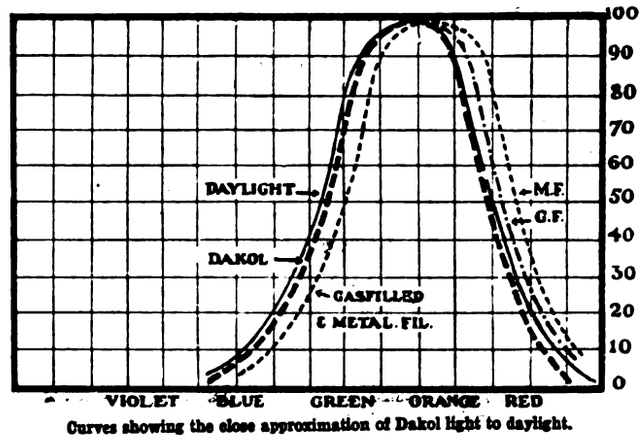
Alterations in Rates to Industrial and Domestic Consumers.

THE following reduced charges for electricity are announced. Figures in parentheses are the former rates:—

Wallingford (*Wallingford and District Electric Supply Co.*), lighting, 10d. (1s.) per kWh; *Rugby U.D.C.* commercial tariff, power, l.t. supply, 1½d. per kWh, with minimum charge of 72 kWh per quarter per H.P. installed; h.t. supply (by agreement), below 50 000 kWh per annum, 1·375d. per kWh; between 50 000 and 250 000 kWh, 1·25d. per kWh; beyond, 1·2d.; business premises lighting, 4½d.; cooking, 1d.; heating, controlled by time switch to keep off peak load, 1d. *Tonbridge U.D.C.*, lighting and power, fixed charge 20% p.a. of rateable value, with minimum charge of £2, to be collected quarterly in advance, plus 1d. per kWh. *Shropshire, Worcestershire and Staffordshire Electric Power Co.*, unit charge under residential tariff reduced by 33⅓% *Bromley* (*Kent*) *Corporation*, "all-in" tariff, private residences 10% of rateable value, plus 1d. per kWh (12½% and 1¼d.); business and non-domestic premises, £12 10s. per annum per kW of lighting installed, plus 1d. per kWh (£12 10s. and 1¼d.). *Llandrindod Wells U.D.C.*, lighting, 7½d. (8d.) per kWh; power, 4d. (5d.); heating and cooking, 1¾d. (2d.) *Blyth* (Northern Counties Electric Supply Co., Ltd.), shop lighting, 6d. per kW (6½d.) with secondary rate of 2½d. per kWh, number of kWh at primary rate to be consumed before secondary rate has effect depends upon floor area of shop; domestic supplies, 6d. (6½d.) per kWh, with sliding scale extending from 6d. to ¾d. per kWh, based on number of rooms. *Fulham* (*London*) *B.C.*, discount allowed on unit charge to large power consumers under kilowatt system, increased from 10% to 12½% on all consumption registered where total account is not less than £2 000 per quarter.

ARTIFICIAL DAYLIGHT.

ALL interested in "daylight lamps" whether for matching fabrics or lighting drawing offices, laboratories or workshops, will do well to examine the productions of DAKOL ELECTRIC, LTD., of 39, Victoria Street, London, S.W.1.



Curves showing the close approximation of Dakol light to daylight.

There is, for instance, a large hexagonal model recommended for art galleries and large showrooms. It is 14 in. wide, and is recommended for use with 300 or 500 W gasfilled lamps.

The accompanying diagram, which is derived from reproductions of spectra, expresses the relative values of the colours in the spectra of North Sky daylight, the Dakol lamp and an unshielded metal filament lamp. The vertical differences between these luminosity curves show the relative values. Thus, in the green, daylight is seen to be about 30% better than a metal filament lamp. It may be remarked that the sensitiveness of the eye to colours depends on the intensity of the source of light. When this is low, as in twilight, the eye becomes more sensitive to the blue end of the spectrum. The curves have the same shape, but are moved bodily to the left, so that the maximum sensitivity, which in strong light would be near the orange part, in weak light is in the blue green.

The method of filtering used in these lamps is quite simple. The light rays pass through two glasses, which are placed one over the other. One glass is blue; the other has been treated with an acid. When ordinary electric lamps are switched off, and Dakol lamps are substituted, at first the light seems to have a bluish tinge. This is, we understand, a momentary optical effect due to comparison with the yellow light.

ELECTRIC TRACTION.

Scottish Tramway Officials Discuss Omnibus and Railways Opposition.

AT the annual conference of Scottish Tramways and Transport Association at Pitlochry on May 24th and 25th, Mr. L. Mackinnon, manager of the Glasgow tramways, read a paper on "Additional Powers," in the course of which he supported the granting to any statutory body, whether municipal or private, the right of transport monopoly or protection within its own area. He also referred to the necessity for the relief of tramway undertakings from their present unfair obligations, and suggested that the tramway speed limit should be increased to 30 miles. Mr. J. Beckett, secretary of the Municipal Tramways and Transport Association, in the course of a paper on "Past and Present Road Passenger Carrying Business," said the conflict of interests seemed to be inevitable so long as we had independent ownership of transport facilities without either the will or the urge to co-ordination or the means of enforcing it. Such an important social service as transport must become a monopoly if it were to be effective and economical, operated out of its own resources without profit. Referring to the omnibus problem, he said local authorities were thrown into an unequal contest. They had antiquated weapons and harsh limitations. Regarding the position as between road and railway transport, he said all the portents pointed to an immense merger of all railway and road transport services. At the annual business meeting, Mr. J. H. Shepherd, of Dunfermline, was elected chairman, and Mr. L. Mackinnon vice-chairman. Mr. Robt. Watson, of Edinburgh, is secretary and treasurer.

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BUSINESS OPENINGS.

Latest Particulars of Electrical Engineering and Wiring Installation Contracts for which Tenders are being Invited at Home and Abroad.

WE give below the latest particulars of contracts for which tenders are invited. The closing date is given, where available.

HALIFAX TOWN COUNCIL, June 7th.—Electrician's work in connection with extension of Shelf Sanatorium. Forms of tender, etc., from the Borough Engineer, Halifax; deposit £1 1s.

ANNOUNCING results with "Philips'" public address equipment at Barker's, London, on election night.

HULL CORPORATION, June 7th.—Electric light installation at Central Public Library. Specification from Mr. D. Harvey, city architect, Guildhall, Hull.

SHEFFIELD CORPORATION, June 7th.—Electric wiring and fitting at Carfield, Firshill, Hunter's Bar, Intake, Lowfield, Woodbourn, Woodseats, and Woodside Council Schools. Specifications, etc., from Mr. W. G. Davies, city architect, Town Hall, Sheffield; deposit £1.

SUTTON AND CHEAM URBAN DISTRICT COUNCIL, June 7th.—Installation of fire alarm system, connected with the fire station. Plans showing positions of fire alarm boxes, etc., from the Engineer and Surveyor.

BRADFORD CORPORATION, June 8th.—Upholstering of fifty sets of tramcar seats. Specification, etc., from Mr. R. H. Wilkinson, 7, Hall Ings, Bradford.

CENTRAL LONDON SCHOOL DISTRICT, June 8th.—Supply of four electric motors, switchgear, shafting, belting, etc. Specification from Mr. G. P. Morrell, clerk to the Managers, Greenford Avenue, Hanwell, London, W.7.

CLYDE NAVIGATION TRUST, June 8th.—Six or 12 months' supply of electrical stores, etc. Form of tender (No. 8) from the Superintendent of Stores, 1, Graving Dock, Govan.

COUNTY OF LANARK, MIDDLE WARD DISTRICT COMMITTEE, June 10th.—Electric lighting works in connection with erection of fifty-two additional houses at Overton Road, Cambuslang. Schedules from Mr. P. C. Smith, Housing and Town Planning Dept., District Offices, Hamilton, until June 10th.

Supply of Lamps.

GLASGOW EDUCATION AUTHORITY, June 10th.—Supply of electric lamps. Specifications, etc., from the Education Offices (Supplies Dept.), 129, Bath Street, Glasgow, C.2; deposit 10s.

CHEADLE AND GATLEY URBAN DISTRICT COUNCIL, June 11th.—Overhead distribution scheme (contract 47) and two e.h.t. truck cubicles (contract 50). Specifications from Mr. R. W. Willis, 37, High Street, Cheadle; deposit £1 1s. for each.

STOCKTON-ON-TEES CORPORATION, June 11th.—Supply of two 1 250 kVA, three-phase transformers and l.t. three-phase switch-gear. Specification, etc., from Mr. S. G. Marston, Electricity Works, Thompson Street, Stockton-on-Tees.

EAST HAM EDUCATION COMMITTEE, June 12th.—Electric lighting installation at the Salisbury School. Specification, etc., from the Secretary, Education Office, Town Hall, East Ham, London, E.6; deposit 10s. 6d.

METROPOLITAN ASYLUMS BOARD, June 12th.—Two electric passenger lifts at Colindale Hospital; fire alarm system at High Wood Hospital for Children, Brentwood; and electric bell system at Casual Ward, Swaffield Road, Wandsworth. Specifications from the Board's Office, Victoria Embankment, London, E.C.4; £1 deposit in respect of each work.

STOKE-ON-TRENT CORPORATION, June 12th.—Supply of 33 000 V overhead transmission lines. Specification, etc., from the City Electrical Engineer, St. George's Chambers, Kingsway, Stoke-on-Trent; deposit £2.

WALTHAMSTOW URBAN DISTRICT COUNCIL, June 12th.—Two natural draught cooling towers and ferro-concrete tank at the Electricity Works. Specification, etc., from Mr. G. R Spurr, Electricity Works, Exeter Road, Walthamstow deposit £1.

E.H.T. Cables.

COLWYN BAY URBAN DISTRICT COUNCIL, June 14th.—Supply, laying and jointing of e.h.t. and l.t. cables. Specification, etc., from the Engineer, Electricity Offices, Colwyn Bay.

LEICESTER CORPORATION, June 14th.—Steam engine, electric power wiring, etc., at Lero Public Wash-house. Specification, etc., from City Surveyor; deposit £2.

FARNWORTH URBAN DISTRICT COUNCIL, June 15th.—Supply of l.t. cables. Specifications, etc., from Mr. A. J. Hutchinson, engineer and manager, Electricity Department, Albert Road, Farnworth, Lancs.

BELFAST CORPORATION, June 17th.—Manufacture and supply of (a) h.t. combined cubicle and truck-type switchgear (Specification W. 85); and (b) transformer kiosks (W. 88); and manufacture, supply, and erection of (c) 1 000 kW rotary convertor (W. 86); (d) 500 kW rotary convertor (W. 87); (e) c.c. switchgear for sub-stations (W. 89); (f) h.t. armour-clad switchgear for sub-stations (W. 90); and (g) h.t. truck-type switchgear for sub-stations (W. 91). Specifications from Mr. F. H. Whysall, city electrical engineer and manager, East Bridge Street, Belfast; deposit £2 2s. for each.

EAST GRINSTEAD URBAN DISTRICT COUNCIL, June 17th.—Supply, laying and jointing of l.t. cables. Specification, etc., from the Clerk, Council Offices, London Road, East Grinstead; deposit £1 1s.

EDINBURGH EDUCATION AUTHORITY, June 17th.—Electrical installation at Colinton, Davidson's Mains, Gilmerton, Granton, Juniper Green, Willowbrae, and Milton House Schools. Specifications from Executive Officer, Education Offices, Castle Terrace, Edinburgh.

SWANSEA CORPORATION, June 17th.—Electrical requirements of Municipal Secondary Schools, Dyevor Place, and De la Beche Street, Swansea. Schedule, etc., from the Borough Architect, 3, Prospect Place, Swansea.

WEST HAM EDUCATION COMMITTEE, June 17th.—Electric light installation at Fyfield Open Air School Extension, near Ongar, Essex.

STOKE-ON-TRENT CORPORATION AND STAFFORD COUNTY COUNCIL, June 22nd.—Electric light and power installation in new buildings at North Staffordshire Technical College, Stoke-on-Trent. Further particulars from the Clerk to the Governors, Town Hall, Hanley; deposit £5 5s.

ACTON EDUCATION COMMITTEE, June 27th.—Electric lighting installations in schools. Specifications from the Borough Engineer, Municipal Offices, Acton, London, W.3; deposit £1 1s.

STAFFORDSHIRE EDUCATION COMMITTEE, July 2nd.—Electric light installation in Kingswinford Brockmoor Council School and in new buildings on the adjoining site. Specification, etc., from Messrs. Moffett, Rosher and Mann, consulting engineers, Union Chambers, Temple Row, Birmingham; deposit £5 5s. Only registered electrical contractors are invited to tender.

LONDON COUNTY COUNCIL, July 8th.—Manufacture, supply and maintenance of (*a*) 150 electric tramcar bodies; (*b*) 150 sets of swing bolster bogie trucks; (*c*) 150 sets of electrical equipment for tramcars, with assembly of bodies, trucks, electrical equipment, etc., into complete tramcars; and (*d*) 150 sets of magnetic track and wheel brake equipments.

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Specifications, etc., from the Clerk, County Hall, Westminster Bridge, S.E.1 ; deposit £2 for each section or £7 for the four.

SUNDERLAND CORPORATION, July 8th.—Manufacture and supply of 12 months' requirements of (*a*) paper insulated, lead sheathed cable, (*b*) rubber insulated wire, (*c*) consumers, meters, and (*d*) gasfilled and vacuum lamps. Specifications from the General Manager, Electricity Offices, Dunning Street, Sunderland ; 10s. deposit for each section. Applications must state the classes of goods for which specifications are desired.

WEST MIDLANDS JOINT ELECTRICITY AUTHORITY, July 10th. —Supply and erection at Ironbridge power station of three boilers, each having normal rating of 225 000 lb. of steam per hour, with economisers, air heaters, fans, ironwork, pipework, coal pulverising plant, ash handling plant, etc. Specification (No. 3), etc., from Mr. E. F. Hetherington, chief engineer and manager, Phœnix Buildings, Dudley Road, Wolverhampton ; deposit £2 2s.

Overseas.

UNLESS otherwise stated, particulars of overseas contracts are to be had from the Department of Overseas Trade (Room 52), 35, Old Queen Street, Westminster, London, S.W.1. *Note.—An asterisk denotes that local representation is, in practice, essential.*

VICTORIAN RAILWAY COMMISSIONERS, June 12th.—Supply and delivery of track reactors for power signalling. (Reference B.X. 5 302.)

ANTWERP MUNICIPALITY, June 17th.—Supply of 32 electric travelling cranes for new dock. (Reference A.X. 7 924.)

NEW ZEALAND POSTS AND TELEGRAPHS, June 18th.—Supply of telephone cords (No. P. and T. 151/1425.) (Reference B.X. 5 251.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, June 18th.—Supply of switchboard cable (contract C. 427). (Reference B.X. 5 228.)

JOHANNESBURG MUNICIPALITY, June 20th.—Supply of h.t. and l.t. cables (contract 188). (Reference B.X. 5 342.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, June 20th.—Two 5-ton electrically driven hoist blocks, with overhead conductors, runway girders and switches (tender No. 1 446). (Reference T/A.X. 7 867.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, June 20th.—Supply of one 10-ton and three 4-ton electric level luffing cranes (tender No. 1 437). (Reference A.X. 7 828.)

NEW SOUTH WALES PUBLIC WORKS DEPARTMENT, June 22nd.—Supply and erection of transformers, with certain spares, for Burrinjuck hydro-electric development (contract No. 29/29). (Reference B.X. 5 230.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, June 25th.—Supply of protected type telephone cable terminal boxes (schedule C. 430). (Reference B.X. 5 231.)

POSTMASTER-GENERAL'S DEPARTMENT MELBOURNE, June 25th.—Supply of underground and aerial telephone cable (Schedule C. 443). (Reference B.X. 5 346.)

NEW ZEALAND GOVERNMENT RAILWAYS DEPARTMENT, June 26th.—Supply and delivery of trailing cables for portable electric machines. (Reference B.X. 5 277.)

VICTORIAN RAILWAY COMMISSION, June 26th.—Alternating current power point mechanisms (contract 42 669). (Reference B.X. 5 334.)

VICTORIAN RAILWAY COMMISSION, June 26th (extended from May 15th).—Supply of geared three-phase, electric winding engine. (Reference A. 7 650.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, June 27th.—Supply of 2 200 and 660 V cables and accessories (tender No. 1 466). (Reference B.X. 5 343.)

SOUTH AFRICAN POSTS AND TELEGRAPHS, June 27th.—Automatic wall and table pattern telephones (tender No. 158). (Reference B.X. 5 273.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, June 30th.—Supply of two 5-ton electrically driven hoist blocks, complete with overhead conductors, and switches. (Reference A.X. 7 867.)

VICTORIA STATE ELECTRICITY COMMISSION, July 1st.—Supply and delivery of 44 000 V transformers. (Reference B.X. 5 293.)

LOURENCO MARQUES PORT AND RAILWAYS BOARD, July 8th. —Supply of two 5-ton electric portal cranes (Circular No. 60). (Reference A.X. 7 994.)

STATE ELECTRICITY WORKS, MONTEVIDEO, July 8th.—Construction and equipment of 50 000 kW power station.

POSTMASTER - GENERAL'S DEPARTMENT, MELBOURNE, July 9th.—Resistances and reactances. (Reference B.X. 5 281.)

NEW SOUTH WALES GOVERNMENT RAILWAYS, July 10th.—One 750 kW turbo-alternator ; 2 200 V ironclad switchgear ; two switch operating batteries ; and two motor generator sets. Specifications from the Chief Electrical Engineer, 61, Hunter Street, Sydney.

EGYPTIAN MINISTRY OF THE INTERIOR, July 15th.—Supply and erection at Minia power station of one Diesel engine driven a.c. generating set of 250 kVA. (Reference B.X. 5 331.)

VICTORIAN ELECTRICITY COMMISSION, July 15th.—Two 750 kVA transformers and spares (No. 29/42). (Reference B.X. 5 325.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, July 16th.—Supply of 250 galvanised steel transmission line towers to carry copper conductors, or 190 towers to carry steel-core aluminium conductors. (Reference A.X. 7 735.)

MONTEVIDEO PORT AUTHORITY, July 22nd.—Supply of 300 kilo. electro-pneumatic hammer. (Reference A.X. 7 974.)

Telegraph Instruments.

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, July 23rd.—Telegraph instruments (schedule C. 436). (Reference B.X. 5 323.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, August 6th.—Supply of 120-ton, four-motor, overhead travelling crane and runway (specification No. S.M. 358). (Reference A.X. 7 810.)

NEW ZEALAND POSTS AND TELEGRAPHS, August 7th.—Enamelled and silk covered resistance wire (No. P. and T. 151/1497). (Reference B.X. 5 322.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, August 13th. —Water turbine driven generating sets and switchgear, for Waitaki power development (section 2). (Reference B.X. 5 278.)

EGYPTIAN MINISTRY OF THE INTERIOR, August 13th.—Supply of electric power plant, with underground and overhead network, for the town of Maghagha, Minieh Province. (Reference B.X. 5 318.)

PIETERSBURG (TRANSVAAL) MUNICIPALITY, August 13th.—Supply of h.t. and l.t. cable, lamps and sundries, in connection

TWO views of the stand of A. Reyrolle and Co., Ltd., at the North-East Coast Exhibition, Newcastle-on-Tyne. A description of some of the exhibits was given last week.

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with extensions of the electricity undertaking. (Reference B.X. 5 312.)

PIETERSBURG (TRANSVAAL) MUNICIPALITY, August 13th.—Supply and erection of steam raising plant, engine, alternators, and switchgear (contract A). (Reference A.X. 7 983.)

AUCKLAND ELECTRIC POWER BOARD, August 19th.—Single-phase transformers. (Reference B.X. 5 324.)

NEW ZEALAND GOVERNMENT RAILWAYS, September 4th.—Supply of motor generator (specification 287). (Reference B.X. 5 308.)

Tenders Accepted.

EMPRESS WORKS, ST. THOMAS ROAD, HUDDERSFIELD.—A. Parker, electrician's work, £89.

BROMLEY EDUCATION COMMITTEE.—G. E. Wallis and Sons, Ltd., electric lighting of school.

WOODSTOCK CORPORATION.—Woodstock Power Syndicate, electric lighting for 1929-30 period.

BARNSLEY GUARDIANS.—Brown and Roberts, electrician's work at the Institution for one year.

EAST HAM CORPORATION.—Bertram Thomas, supply of feeder panel, £416. (Recommended.)

ASHFORD (KENT) URBAN DISTRICT COUNCIL.—Dowling, electric light wiring of 60 houses, £372.

HOLBEACH GUARDIANS.—Bratley and Sons, electrical installation at the Institution, £137 15s.

PLYMOUTH CORPORATION.—Tudor Accumulator Co., Ltd., repairs to storage battery at the mental hospital, £107 5s.

BEDFORD CORPORATION.—Pirelli-General Cable Works, Ltd., main line to Wootton Pillinge, £1 329 (recommended).

BRIGHTON CORPORATION.—Vickers-Armstrong, Ltd., provision of de-aerating plant, for the electricity department, £976.

HASTINGS CORPORATION.—Mirrlees Watson Co., Ltd., electrically driven pumping plant for Kent Street water well, £2 000.

PORTSMOUTH CORPORATION.—Johnson and Phillips, Ltd., supply of h.t. cable, £3 168, and l.t. cable, £6 552. (Recommended.)

WEST RIDING EDUCATION COMMITTEE.—F. Porter, electric light installation in Ardsley (E. and W.) Westerton Council School, £52.

DUNFERMLINE CORPORATION.—A. Rolland and Co., electric light installation in 18 houses on a site east of Townhill Road, Dunfermline, £516.

ESSEX COUNTY COUNCIL.—Christy Bros., Ltd., Chelmsford, laying underground electric cables at Harold Court Sanatorium, £509 12s.

WEYMOUTH CORPORATION.—British Thomson-Houston Co., Ltd., motor generator, £112; Alfa-Laval Co., oil purifier. (Both recommended.)

ALDERSHOT CORPORATION.—Bruce Peebles and Co., Ltd., motor convertor, £3 036; Metropolitan-Vickers Electrical Co., Ltd., switchgear, £524.

YORK EDUCATION COMMITTEE.—H. Mandefield, electric lighting installations at Fulford Road special and open-air schools. (Recommended.)

MAYO COUNTY BOARD OF HEALTH.—G. Delahunty, electric lighting installation in connection with structural alterations at Creagh House, near Ballinrobe.

GENERAL POST OFFICE.—G. E. Wallis and Sons, Ltd., electric lighting at Farnborough, Herne Bay, Pembury, and Southborough Telephone Exchanges.

EAST HAM CORPORATION.—Enfield Cable Works, Ltd., supply of cable, £5 635; Bertram Thomas, supply of h.t. and l.t. switchgear and remote control gear, £3 938.

GILLINGHAM (KENT) CORPORATION.—Callender's Cable and Construction Co., Ltd., cable and transformers, in connection with extensions to Rainham, Wigmore and Hempstead.

CARLISLE CORPORATION.—Supply of cables for 12 months: Metropolitan Electric Cable and Construction Co.; British Insulated and Helsby Cables Ltd., and Macintosh Cable Co.

STEPNEY (LONDON) BOROUGH COUNCIL.—Universal Electrical Mfg. Co., supply of 12 sub-feeder boxes, and 35 two-way and 36 single-way disconnecting boxes, £285. (Recommended.)

WALTON-ON-THAMES URBAN DISTRICT COUNCIL.—Hopkinson, changing-over apparatus, £388 7s. 6d; Blandford, special apparatus for wireless installations affected by the change-over.

BOLSOVER URBAN DISTRICT COUNCIL.—J. Collier and Co., supply and erection of about 50 wooden poles, cables, etc., in connection with the lighting of Whaley Village. (Recommended.)

CHESTERFIELD CORPORATION.—Macintosh Cable Co., Ltd., overhead feeders for New Whittington trolley 'bus extension, £660 16s.; Greenwich Cable Works, Ltd., miscellaneous cables, £683.

BOMBAY CORPORATION.—Balmer, Lawrie and Co., Ltd., supply of electric lamps for 12 months, Rs. 5 392; Greaves, Cotton and Co., Ltd. (Rs. 4 729) and Sharma Trading Co. (Rs. 432) supply of electrical goods.

MANCHESTER CORPORATION.—Etchells, Congdon and Muir, supply of electric bed lift at Abergele Sanatorium; Ferguson, Pailin, Ltd., 33 000 V switchgear, for High Street, Oldham Road, Denton (West) and Droylsden (Ellen Street) sub-stations.

BIRMINGHAM CORPORATION.—Baxter and Impey, electric lighting installation at Edgbaston pumping station. General Electric Co., Ltd., supply of rotary convertor equipment at two sub-stations; Electric Construction Co., Ltd., rotary convertors for Summer Lane generating station and three sub-stations.

MARYLEBONE (LONDON) BOROUGH COUNCIL.—Tudor Accumulator Co., Ltd., renewal of positive plates of battery at Blandford Street sub-station, £2 000; General Electric Co., Ltd., enclosing convertor set at Blandford Street sub-station, £585. (Both recommended.)

WEYMOUTH CORPORATION.—Johnson and Phillips, Ltd., erection of e.h.t. and l.t. equipment for the supply to Weymouth Bay estate, £1 643 8s. 6d.; English Electric Co., Ltd., earthing equipment for two turbo alternators, £325; Ferranti, Ltd., supply of one 50 A rotating standard meter-testing set, £90.

BEXHILL CORPORATION.—Enfield Cable Works, Ltd., supply of cable, six months' renewal of contract; Bertram Thomas, feeder panel for Little Common sub-station, £76, and balancer panel for Ashdown Road works, £68; Crompton Parkinson, Ltd., balancer for Ashdown Road works, £275 4s., regulator £7 7s., and mechanical starter, £9 15s. (All recommended.)

STOKE-ON-TRENT CORPORATION.—Overhead wiring and services to new houses on various estates: Sutton estate, £183 18s. 2d., and Eaton Street, £43 11s. 9d., Barnett and Soans; Cornhill estate, £302 10s., H. Parker, and £359 17s. 6d., E. Holloway; Hanford estate, £176, H. Parker, and £229 12s. 6d., Tomlins, Ltd. Metropolitan-Vickers Electrical Co., Ltd., supply of 1 000 kVA transformers, £570 each.

LONDON COUNTY COUNCIL.—Cox-Walkers, electric light wiring and fitting at Bevington Road School, Kensington, £450. Also tendered: Stegman and Co., £487; Alpha Mfg. and Electrical Co., Ltd., £495; A. Dean and Co., Ltd., £509; J. Briggs, Ltd., £539; Grierson, Ltd., £557; A. Hawkins and Sons, £569; H. J. Cash and Co., Ltd., £569; Electrical Installations, Ltd., £595; L. G. Tate and Co., Ltd., £608; Barlow Brothers and Co., £755; Heath-Pritchard, Ltd., £758.

Supply of Cable.

SHOREDITCH (LONDON) BOROUGH COUNCIL.—Hackbridge Cable Co., Ltd., supply of cable, £4 525 10s. 4d. (recommended). Also tendered: W. T. Glover and Co., Ltd., £4 610 10s. 10d.; British Insulated Cables Ltd., £4 666 3s. 1d.; Pirelli General Cable Works, Ltd., £4 675 8s. 9d.; Siemens Bros. and Co., Ltd., £4 725 10s. 8d.; Union Cable Co., Ltd., £4 745 0s. 2d.; Macintosh Cable Co., Ltd., £4 752 9s.; Standard Telephones and Cables, Ltd., £4 759 17s. 1d.; W. T. Henley's Telegraph Works Co., Ltd., £4 796 15s. 5d.; Greenwich Cable Works, Ltd., £4 828 16s. 8d. Each tenderer stated current market prices for copper and lead on which tender is based, and variation in price per mile for each £1 per ton rise or fall.

GLASGOW CORPORATION.—Annual supplies: Cables, single, Enfield Cable Works, Ltd.; telephone, Callender's Cable and Construction Co., Ltd.; l.t., W. T. Glover and Co., Ltd., Enfield Cable Works, Ltd., and Callender's Cable and Construction Co., Ltd.; e.h.t., Callender's Cable and Construction Co., Ltd., and W. T. Glover and Co., Ltd.; rubber insulated, Craigpark Electric Cable Co., Ltd., and Edison-Swan Electric Co., Ltd. flexibles, Craigpark Electric Cable Co., Ltd.; meters; d.c., Chamberlain and Hookham, Ltd., and Ferranti, Ltd.; a.c. Metropolitan-Vickers Electrical Co., Ltd., Edison Swan Electric Co., Ltd., Ferranti, Ltd., Electrical Apparatus Co., Ltd., and Chamberlain and Hookham, Ltd.; arc lamp carbons, General Electric Co., Ltd.; electric cookers, Siemens Electric Lamps and Supplies, Ltd., and Falkirk Iron Co., Ltd.; electric kettles, Bulpitt and Sons, Ltd.; cast iron boxes, section pillars, etc., James Allan, Senr., and Son, Ltd., Carron Company, Falkirk Iron Co., Ltd., David King and Sons, Ltd., Lane and Girvan, John Needham and Sons, M'Dowall, Steven and Co., and Robert Taylor and Co. (All recommended.)

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WORK IN PROSPECT.

ALTRINCHAM.—Extensions, Public Offices, for the Urban Council. Particulars, Mr. F. H. Brazier, 7, Market Street.

ASHBOURNE.—Houses (22). Particulars, E. Morley and Sons, Ltd., Derby.

BILLINGE AND WINSTANLEY.—Houses (20). Particulars, the Surveyor.

BOGNOR.—Masonic Hall, to cost £5 000. Particulars, the architect, Mr. J. Draper.

BOURTON-ON-THE-WATER.—Clinic. Particulars, Mr. R. S. Phillips, Shire Hall, Gloucester.

BROMSGROVE.—Houses (14). Particulars, the Surveyor.

BUCKHURST HILL (ESSEX).—Houses (54), Hurst Road Estate, for Mr. Stokes.

CARSHALTON.—Houses (32), Banstead Road, for Mr. W. Shire.—Houses (14), Waverley Way, for Hill and Seaby.

CHESTERFIELD.—School (240 places). Particulars, Mr. C. A. Edeson, Berryhill Lane, Mansfield.

CIPPENHAM.—School, for Bucks Education Committee. Particulars, the Director of Education, Aylesbury.

CRICKLADE AND WOOTTON BASSETT.—Housing scheme (32), for Rural Council. Particulars, the clerk, Mr. R. C. Hawkes, High Street, Wootton Bassett.

CUMNOCK.—Extensions, including hall, to the Baptist Church. Particulars, the Secretary.

DIDCOT.—School (250 places), for Berks Education Committee. Particulars, the Director of Education, Reading.

EDINBURGH.—School. Particulars, the Director of Education.—Extensions, George Heriot's School, to cost £34 750. Particulars, the Clerk.—Child welfare clinic and nursery school, Prestonfield. Particulars, the Clerk.—Hospital. Particulars, the hon. sec., Mr. R. W. Martin, 5, Hill Street.

HALIFAX.—High school, for the Borough Education Committee. Particulars, the Director of Education.

HEMSWORTH.—Infirmary block, for Board of Guardians. Particulars, the Clerk.

HODDESDON.—Houses (12). Particulars, Mr. William Plumpton.

LEEK.—Church schools, to cost £10 000. Particulars, the Rev. J. G. Halford.

LINCOLN.—Extensions, St. Giles' School (300 places), for the Borough Education Committee. Particulars, Mr. R. C. Minton.

LINCS.—Conversion of Nocton Hall into Mental Institution. Particulars, the Clerk.

MANSFIELD.—Cinema theatre. Particulars from the contractor, Mr. C. H. Hill.

MELTON MOWBRAY.—Extensions, War Memorial Hospital, to cost £18 000. Particulars, Messrs. Herbert, Leicester.

MERTHYR TYDFIL.—Extensions, General Hospital. Particulars, the architects, Johnson, Richards and Rees.

MOSSLEY (LANCS).—Housing scheme (30), for the Town Council. Particulars, the housing surveyor, Mr. G. G. Forster.

NORTHWICH.—Housing scheme (28). Particulars, Mr. J. Birtwistle, Winnington Street.

READING.—Post Office extensions, for H.M. Office of Works, King Charles Street, London, S.W.

STOURBRIDGE.—Church. Particulars, the contractors, T. W. Edwards and Sons, Audnam.

TRADE PUBLICATIONS.

KENRICK AND JEFFERSON, LTD., of West Bromwich, have sent us a folder dealing with business equipment and furniture.

Sheet No. 42F, describing and illustrating mining specialities has been published by GENT AND CO., LTD., Faraday Works, Leicester.

Folder No. 4150/5, describing the "Cadillac" blower is now available from METRO-VICK SUPPLIES, of Trafford Park, Manchester.

PHILIPS LAMPS, LTD., 145, Charing Cross Road, London, W.C.2, have published list No. 404 dealing with industrial lighting fittings.

BIRMINGHAM ELECTRIC FURNACES, LTD., 55, George Street Parade, Birmingham, have published a new folder relative to "Birlec" furnaces.

Gate-end circuit breakers are dealt with in list No. 49/1, issued by MAVOR AND COULSON, LTD., 47, Broad Street, Mile End, Glasgow.

List No. W.233 dealing with radio receivers has been issued by the WHOLESALE FITTINGS CO., LTD., of 23/37, Commercial Street, London, E.1.

The DRAYTON REGULATOR AND INSTRUMENT CO., LTD., West Drayton, Middlesex, has issued a provisional list relative to dial thermometers.

The JAMES KEITH AND BLACKMAN CO., LTD., 27, Farringdon Avenue, London, E.C.4, has issued a new folder relating to fans of the ventilating type.

The ELECTRIC HEATING CO., George Street, Croydon, has issued two pamphlets dealing with the "Elect" boiling ring and "Junior" iron, respectively.

We have received from the Z ELECTRIC LAMPS AND SUPPLIES CO., LTD., 73, Newman Street, London, W.1, a newly issued electrical accessories catalogue.

The electrical control of printing machinery is the subject of booklet No. 245, published by BROOKHIRST SWITCHGEAR, LTD., Northgate Works, Chester.

ELECTRIC ART SHADES (1928) LTD., Feering Factory, Kelvedon, Essex, have published a new wholesale price list of lampshades in imitation vellum.

Leaflet No. 287 descriptive of multi-speed squirrel cage motors has been received from BROOKHIRST SWITCHGEAR, LTD., of Northgate Works, Chester.

H. O. SWOBODA, INC., 3 400 Forbes Street, Pittsburgh, Pa., has sent us bulletin No. 160 describing the "Falcon" electrically-heated asphaltum coating tanks.

A.T.M. fire alarm equipment is dealt with in publication No. 84, issued by the AUTOMATIC TELEPHONE MANUFACTURING CO., LTD., of Strowger Works, Liverpool.

Details of a new "Celestion" loud speaker for incorporation in self-contained portable sets are given in a leaflet just issued by CELESTION, LTD., of Kingston-on-Thames.

List X/329, dealing with direction finding equipment type RA76, for marine use, has been published by the RADIO COMMUNICATION CO., LTD., 34/35, Norfolk Street, London, W.C.2.

The BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, London, W.C.2, has issued leaflet No. A.G. 281, describing the company's electric gramophone pick-up and tone arm.

ILLUSTRATING a special train prior to its departure from Willesden for Bonnybridge with the oil tanks and component parts for the last three B.T.-H. 132 000 V outdoor oil-immersed circuit breakers for the first sub-station of the eastern ring of the Central Scotland Electricity Scheme.

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ELECTRICITY SUPPLY.

Village Lighting—Croydon and Kingston Extensions—Coventry Assisted Wiring Scheme—Expansion of Warrington Area—Congleton's Supply Scheme—Developments at Hastings—Carlisle's Rural Supply Project.

THE village of Friockheim, in the Arbroath district, is to be lighted electrically.

Bideford Electric Light Co. has decided to supply electricity to the parish of Instow.

Leyton T.C. has received sanction to a loan of £24 590 in connection with the change over from d.c. to a.c.

Eastbourne Electricity Committee seeks sanction to borrow £9 496 for main extensions to Willingdon and Wannock.

Lytham St. Annes extension to Warton and Freckleton is expected to be inaugurated by the Mayor on June 18th.

Barking Electricity Committee is to lay additional mains from Axe Street sub-station to the sewage works, at a cost of £3 200.

Accrington Corporation has agreed to supply electricity for the Royal Agricultural Show, at Blackburn boundary, at 2d. per kWh.

Wrexham T.C. has applied for a loan of £800 for constructing and equipping a sub-station at the Abbot leather works and a transformer kiosk at Old Acton smithy.

It has been reported to Malpas R.D.C. that the North Wales Power Co. will have a supply of electricity available for the district towards the end of the present year.

Croydon T.C. has decided to extend the generating station, including new cooling towers, coal handling plant, and switch-rooms, at an estimated cost, including plant, of £300 500.

Coventry Corporation has adopted a scheme for assisted wiring of residences, shops and business premises. Installations will be carried out by members of the Electrical Contractors' Association.

Kingston-on-Thames T.C. proposes to instal further plant at the electricity works, including a 3 000 kW generating set, at a cost of about £43 000, to meet the demand in the borough, and the estimated requirements of Walton-on-Thames and Weybridge.

Barnstaple R.D.C. has requested Bideford and District Electric Light Co. to proceed at once with provision of a supply of electricity for the parish of Instow. Underground cables are to be used along the front, and overhead lines in the back and side roads.

Warrington Corporation contemplates extending its area of supply to Agden, High Legh, and Warburton. Mr. F. V. L. Mathias, the borough electrical engineer, reports that it is likely that the requirements of these areas in three years will amount to 161 000 kWh.

Sanction has been obtained by East Ham Electricity Committee to borrow £3 500 for buildings, £5 526 for mains, and £15 000 for plant.—The Committee has accepted a tender amounting to £3 986 18s. for the erection of a sub-station at Manor Park.

In anticipation of the Commissioners granting an Order, Mr. A. Ellis has been authorised to prepare the specifications and estimates of the cost of an electricity scheme for Congleton. Energy will be taken from the main transmission line to be established by the Joint Authority.

Hastings T.C. has informed Battle R.D.C. of its intention to provide a supply of electricity to Crowhurst, and a committee has been appointed to meet Corporation representatives, for the purpose of making suggestions to preserve the amenities of the district in the erection of overhead lines.

Bournemouth Housing Committee has received from the Bournemouth Branch of the Electrical Contractors' Association an expression of regret that electric lighting is not provided in the Council houses, and a request that the advantages of electricity should be more fully considered on future occasions.

Mr. R. H. Hamilton, managing director of the Northern Light and Power Co., Warrenpoint, intends to apply to the Northern Ireland Electricity Commissioners for an Order authorising the use of land at Ringmacilroy for a generating station. It is proposed to erect overhead lines in Warrenpoint.

Southwark (London) B.C. has authorised capital expenditure of £7 500 on mains and £3 850 on reconditioning of cooling tower, economiser replacements, repair of flues, ducts and fans, retubing, etc., of boilers, steam pipes, repair of condenser electrical replacements, circuit breakers, etc. and battery replacements.

Guildford Corporation has decided to extend mains in the Worplesdon Road district at a cost of £1 658. The Borough Electrical Engineer has received an application from Mr. Hiscock for a supply of electricity to a new estate at Blackheath. In order to give the supply, the mains are to be extended at a cost of £507 10s.

Birkenhead Electricity Committee has received sanction to borrow £2 200 for an e.h.t. main from Upton to Greasby, and £1 360 for extensions of h.t. mains, and switchgear at the Singleton Avenue sub-station.—The Committee is seeking a loan of £1 754 for h.t. main extensions to the Leighton Hall Estate and the Pensby kiosks.

Driffield R.D.C. has decided to oppose the grant of the Buckrose and District Electricity Order to the Holderness Trust, Ltd., on the ground that, while the original proposal was to provide for the whole of the rural district, the compulsory works laid down in the Order only cover the parishes of Bainton, Hutton Cranswick, and Nafferton.

Hull Parks Committee has instructed the City Electrical Engineer to lay cable at a cost not exceeding £180 for the purpose of lighting East Park bandstand electrically.—The Tilworth Grange Institution is to be lighted by electricity and the new pavilion is also to be wired for electric light. The City Architect has been authorised to obtain tenders.

Glasgow Electricity Committee is to extend the 20 000 V switch-house at Port Dundas sub-station at a cost of £2 400. A sub-station is to be erected in Garngad Road, and additional switchgear is to be installed at Byres Road and Cadogan Street sub-stations, at a cost of £2 094. Extensions of distributing mains, at a cost of £16 000, have been authorised.

Hastings Corporation is to extend mains and provide street lamps at a cost of £1 500.—The Electricity Committee is to provide additional supply to Ore Brickfields, Ltd., at a cost of £750.—A supply to Crowhurst is to be provided at a cost of £7 500.—Terms for a bulk supply to the works and mines at Mountfield, Robertsbridge, have been arranged with Gypsum Mines, Ltd.

The Exe Valley Electricity Co. has informed the Dulverton R.D.C. of its application to the Ministry of Transport for consent to use 6 600 V overhead lines for carrying out the Bampton and Dulverton Special Orders. With a view to ultimate linking up with bigger centres of electricity supply, the central section of the line has been designed for a working pressure of 33 000 V.

Carlisle Corporation has applied for loans of £5 000 for meters, £15 000 for mains and services, and £3 500 for mains work and switchgear for an additional supply to the works of Ferguson Bros., Ltd., which necessitates the laying of a new feeder. Application is to be made for an Order to supply to the whole of Carlisle rural district and certain parishes in Brampton rural district.

Battersea (London) Electricity Committee seeks sanction for loans of £10 208 for additional plant for Lavender Hill and Chatham Road sub-station, etc., and £12 665 for changing over from d.c. to a.c. in Albert Bridge Road and Prince of Wales Road.—The Committee has voted £20 000 for laying additional mains and installing further sub-station plant to cope with the increasing demand.

Brighton Electricity Committee has obtained sanction to borrow £17 590 for works in connection with the extension of the North Road sub-station. The Engineer has been asked to report upon a suggestion that the Committee should put into operation a two-part tariff.—The Lighting Committee is seeking consent to the alteration of the system and pressure of the supply to properties in Patcham from 460-230 V d.c. to a.c. 400 V between phases, and 230 V between each phase and neutral; 50 periods.

The Shropshire, Worcestershire, and Staffordshire Electric Power Co. is about to make an interconnection at Oddington with the Wessex Co. At Moreton-in-Marsh and Stow-on-the-Wold underground systems are being laid. An overhead line will be carried from these villages to Banbury, a distance of 20 miles, and intervening villages will be connected, and wayleaves for a line from Redditch to Banbury are being sought. An overhead line is being erected from Stourport to Church Stretton, and work has been commenced on a high power pressure line between Cheltenham and Gloucester.

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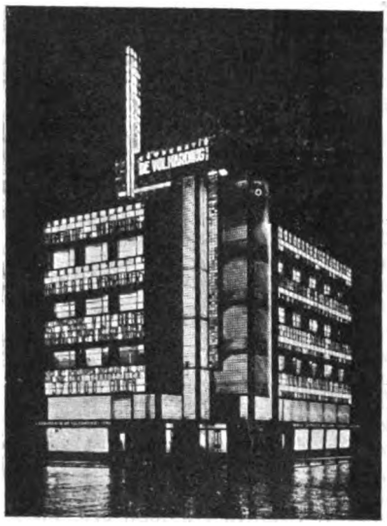
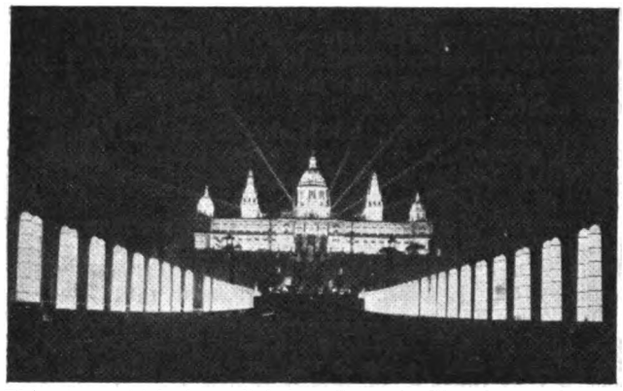
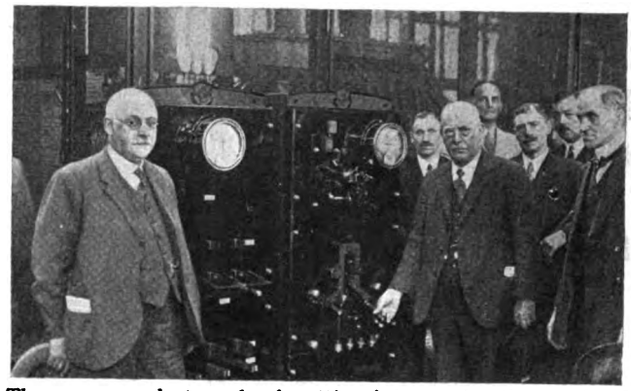
ELECTRICAL NEWS OF THE WEEK IN PICTURES.



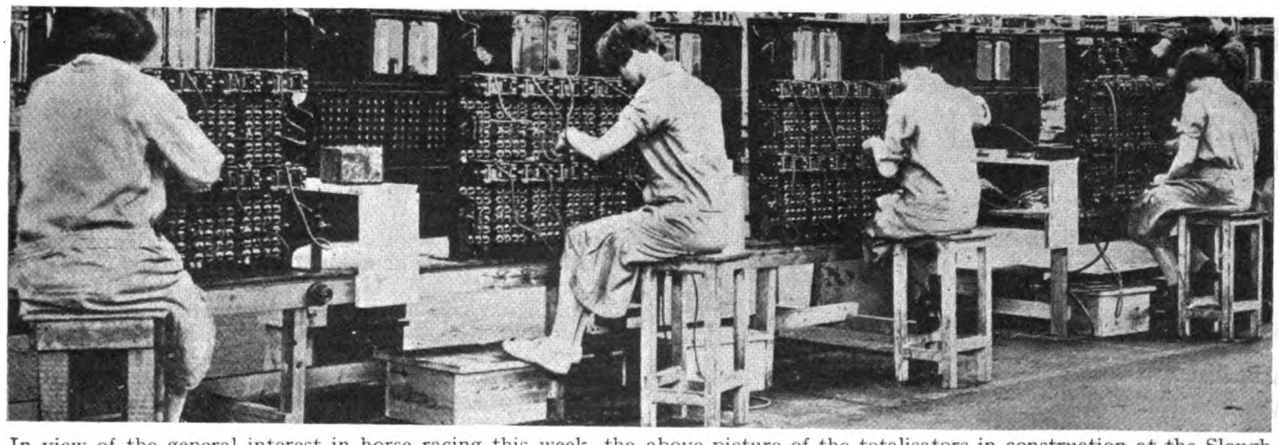
The Vol-Harding Building (left) recently erected in the Hague, is an interesting example of exterior lighting where advertising plays a primary part in the night design of the building. The horizontal bands, built up of glass separated by glazing bars, form the advertising space on the façade. The lettering is only visible when the bands are illuminated from the back. Colour has been introduced in the vertical pylons and also above the shop windows. The total electrical installation is 85 kW, of which 60 kW are used for lighting. The interior uses 700 lamps and the façade lighting 1 400. The day view (right) presents a pleasing and restful building, and there is due variation in the tones of the different materials.



This view, which shows lighting effects rivalling those to be seen at the North-East Coast Exhibition, is of the National Palace at the Barcelona Exhibition. A number of British firms occupy stands at the exhibition, and we understand that quite an appreciable amount of business is being done.



The ceremony last week of putting into service the overhead supply from Stoke-on-Trent to Leek. Amongst those to be seen in the picture are the chairman of Leek Lighting Committee and the chairman of Stoke-on-Trent Electricity Committee. The latter gentleman is at Torquay.



In view of the general interest in horse racing this week, the above picture of the totalisators in construction at the Slough works of the Graham Amplion Co. are of interest. The machines are being built to the specification of the Race Course Betting Control Board, and it is expected that the first one will be installed during the autumn. The wiring up of the lamps and the automatic switches for lighting them, is here seen in progress.

A supply of electricity is to be given by Maidstone T.C. to Teston and Wateringbury, at an estimated cost of £6 500, and, during the summer, mains in the town are to be relaid and other work carried out at an estimated cost of £8 173. The size of the main to the sewerage works is to be increased at an estimated cost of £2 125.

Croydon Electricity Committee has been in negotiation with the Central Electricity Board with regard to extensions for supplying the further needs of the Corporation and for giving additional supplies to neighbouring undertakings, and the committee recommends that it be authorised to obtain tenders for one 20/25 000 kW turbo-alternator, with auxiliaries, foundations, etc., £71 200; one 1 400 000 gall. p.h. circulating water pump, piping and valves, £5 700; boiler house extensions, with two 100 000 lb. p.h. boilers, coal conveyor, coal handling plant, piping, etc., £121 400; engine room extension, switch house, bridges, etc., £23 500; switches, reactors, cables, transformers, etc., £45 000; cooling tower and circulating water culvert, and piping, £26 000; pipe line to cooling towers, pumps, starters, foundations, etc., £5 300; land and fencing for cooling towers, £1 500, for switch house, £400; and for siding extension and coal handling plant, £500. The total estimated cost is £300 500, based on the ultimate development of the site to include a further two 25 000 kW sets.

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COMPANY NEWS.

Franco-American Manufacturing Enterprise—International General Electric Co's Agreement with Russian Government—The Marconi £1 Shares — Steady Progress of Lancashire Power Co.—New Companies.

COMPARATIVELY few changes have to be recorded this week in price quotations of electrical shares. In the manufacturing section, English Electrics have risen from 8s. 1½d. to 8s. 9d, but other movements are downward; British Insulateds at 72s. 6d. losing half-a-crown, and Brush Electrical, General Electrics, and W. T. Henley's 1s. 2d. each. Ever Readies have also eased a trifle. Metropolitan Electric Supply ordinary shares have risen 1s. 3d., to 47s. 6d., and Yorkshire Electric Power shares have improved 6d. Eastern Telegraph Stock is a shade easier at 270, but Marconi's are unchanged.

Last Annl. Divd.	Description.	This Week.	Last Week.	1926 to 1928. Highest.	Lowest
%	**Electricity Supply.**				
(d)	Brompton & Kensington Ord. ..	26/-	26/-	35/6	23/9
4	Central Elec. Sup. 4% Deb. ..	93*	94	95½	88½
(a)	Charing Cross Elec. Ord. (£1) ..	26/-	26/-	51/-	24/3
4½	,, ,, ,, 4½% C.P. (£1)	17/6	17/6	18/3	16/6
(b)	Chelsea Elec. Sup. Ord.	26/6	26/6	45/3	24/-
10	City of Lond. Elec. L'ting Ord. ..	33/1½	33/1½	52/10½	26/-
6	,, ,, ,, ,, ,, 6% C.P.	23/-	23/-	24/3	21/6
10	County Lon. Elec. Sup. Ord. ..	55/-	55/-	68/6	25/9
6	,, ,, ,, ,, 6% C.P.	23/-	23/-	24/-	21/3
(e)	Kensington & K'bridge Ord. (£1)	26/6	26/6	27/6	23/9
1/9⅜	Lon. Elec. Sup. Ord. (£1) ..	27/6	27/6	37/6	23/-
1/9⅜	Metro. Elec. Sup. Ord.	47/6	46/3	53/-	24/9
4½	,, ,, ,, 4½% C.P. ..	17/6	17/6	18/3	16/3
7½	N'castle & Dis. Elec. Ltg. Ord. ..	28/9	28/9	31/9	17/6
1/2⅜	N'castle-upon-Tyne Elec. Sup.Ord.	26/3	26/3	30/3	19/3
6	N Metro. Elec. 6% C.P.	23/-	23/-	23/9	20/10
6	Notting Hill 6% C.P. (£10) ..	11	11	11½	9½
(c)	St. James & P.M. Ord (£1) ..	27/6	27/6	28/6	23/6
1/6	Shrops.Worcs.&Staffs.PowerB.Ord.	48/9	48/9	37/6	21/4
1/9 1/2	W'minster Elec. Sup. Ord. (£1) ..	26/-	26/-	52/9	24/-
4½	,, ,, ,, 4½% C.P.(£1)	17/6	17/6	17/10½	16/7½
8	Yorks. Elec. Power Ord.	35/6	35/-	38/9	24/6
6	,, ,, ,, 6% C.P. ..	24/-	24/-	26/9	20/7
	Railways and Tramways.				
8	Brit. Elec. Trac. Pfd. Ord. Stk. ..	130½	130½	152	117
6	,, ,, ,, 6% Pf. Stk.	127½	127½	133	103½
4	Cent. Lon. Ry. Ord. Stk. (asstd.)	72	72	72	54
4	,, ,, ,, 4% Deb.	80	80	83	77½
4	City & S. Lon. 4% Perp. Deb. ..	78½	78½	81	76½
5	Lon. Elec. Rly. Cons. Ord. Stk. ..	73½	73½	75½	42½
4	,, ,, ,, ,, 4% Pf. Stk.	73	73	77	68
4	,, ,, ,, ,, 4% Deb. ..	80	80	83	76½
5	Lon. & Sub. Trac. A. Deb. ..	95½	95½	97½	74
4	Lon. Un. Trams. 1st Deb... ..	64	64	63	39
4½	Met. Elec. Trams, 4½% Deb. ..	72	72	73½	62
5	,, ,, ,, 5% Deb. ..	67½	67½	70½	65½
3½	Met. Rly. Cons. Ord. Stk... ..	61	61	81	54½
3½	,, ,, ,, 3½% Pf. Stk. ..	63	63	67	60½
3½	,, ,, ,, 3½% Deb. ..	70	70	73½	67½
5	Met. Dis. Rly. Ord. Stk.	76½	76½	77½	52½
4½	,, ,, ,, 4½% 1st Pref. ..	81½	81½	84	74½
6	,, ,, ,, 6% Perp. Deb. ..	116½	116½	118½	110
4	S. Met. Elec. Trams, 4% Deb. ..	70	70	70	64½
7	Underground Electric Rlys. Ord.	23/6	23/6	28/2	11/-
—	Yorks. (W.R.) Trams, Ord. ..	5/-	5/-	16/-	3/-
4½	,, ,, ,, 1st Deb. ..	59	59	78	60
	Electrical Manufacturing.				
7	Brit. Elec. Transformer 7% C.P...	13/9	13/9	19/10	4/6
‡5	Brit. Insulated Cables Ord. ..	72/6	75/-	86/3	56/-
6	,, ,, ,, 6% C.P. ..	22/6	22/6	23/10	21/-
7	British Thomson-Houston Pref. ..	23/9	23/9	24/9	19/7
7	,, ,, ,, 7% Deb.	103½	103½	109½	102½
10	Brush Electrical Ord.	27/6*	28/9	30/9	24/-
‡5	Callender's Cable Ord.	87/6	87/6	91/3	66/-
6½	,, ,, 6½% C.P.	25/-	25/-	25/9	22/-
7½	,, ,, 7½% B. Pref. ..	27/6	27/6	28/3	25/-
8	Crompton-Parkinson 8% Cum. Pf.	25/-	25/-	27/-	14/-
6	,, ,, 6% Cum. 2nd Pf.	17/6	17/6	19/6	9/7
7½	Edison Swan Elec. 1st Pref. ..	25/7½	25/7½	13/-	7/4½
5	,, ,, ,, 1st Deb. Stk.	86½	86½	92	81½
7½	Elec. Construction Ord.	18/9	18/9	32/6	23/6
7	,, ,, 7% C.P. ..	22/6	22/6	22/9	21/-
—	English Elec. Ord.	6/3	6/3	15/9	5/-
—	,, ,, 6% C.P. ..	8/9	8/1½	18/9	7/-
7	Ericsson Telephones 7% Pref. ..	20/-	20/-	22/7½	17/6
35	Ever Ready (Gt. Britain) Ord. ..	23/6	23/9	92/3	18/1
6	Ferranti 6% Pref.	18/-	18/-	19/4½	16/9
7	,, 7% 2nd Pref.	21/3	21/3	19/3	13/9
10	General Elec. Ord.	52/6	53/9	46/6	26/6
‡25	W. T. Henley's Ord.	122/6	123/9	120/-	69/3
10	Johnson & Phillips Ord.	36/3*	36/3	67/11	31/-
7½	Lon. Elec. Wire. & Smith's Pref...	23/9	23/9	25/-	22/3
7½	Siemens Bros. & Co. Ord. ..	27/6*	27/6	30/6	24/9
10	Telegraph Const. Ord. (£12) ..	24½	24½	30½	20
	Telegraph.				
3½	Anglo-Am. Tele. Ord. Stk. ..	61½	61½	63½	56½
10	Eastern Ord. Stk.	270	272½	273	‡35
3½	,, 3½% Pref. Stk.	67½	67½	70½	59
4	,, 4% Deb.	78½	78½	81½	74
10	Eastern Extension Ord. (£10) ..	27	27½	27½	14
22	Gt. Northern Telegraph (£10) ..	33	33	43½	26
10	Indo-European (£25)	50½	50½	48½	30
20	Marconi's Wireless T. Ord. ..	78/9	78/9	84/4	12/-
15	,, Int. Mar.	62/6	62/6	90/-	16/6
10	Western Tel. Ord. (£1)	27	27½	27½	12½

(a) 19$^{9}/_{10}$d. per share. (b) 1s. 9·3d. per share. (c) 1s. 6·949d. per share.
(d) 1s. 8·706d. per share. (e) 1s. 7·181d. per share. ‡ Including 1s. bonus.
* Ex dividend.

HOLSWORTHY GAS AND ELECTRIC SUPPLY CO., LTD.—Div. of 4% has been declared.

BURMA ELECTRIC SUPPLY CO., LTD.—Intm. div. 2½%, less tax, is payable on ord. shs.

INTERNATIONAL COMBUSTION, LTD.—Dividend of 6% on pref. shs. has been declared.

ADELAIDE ELECTRIC SUPPLY CO., LTD.—Intm. div. of 6% on ord. shs (same as last year).

MELBOURNE ELECTRIC SUPPLY CO., LTD.—Intm. div. of 5% on ord. shs. Same as last year.

NATIONAL ELECTRIC CONSTRUCTION CO., LTD.—Net pft. for past year, £17 949. Div. 10%, less tax.

CITY OF BUENOS AYRES TRAMWAYS CO. (1904), LTD.—Div. of 1s. 3d. p. sh. (at rate of 5% p.a.), less tax, for three months ended March 31, 1929, is announced.

INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION.—Directors have authorised issue of common stk. priced at $50 a sh., permitting stkhldrs. to subscribe in the ratio of one sh. for each ten shs. held.

WESTINGHOUSE ELECTRIC AND MANUFACTURING CO.—An agreemt. has been concluded with the French firm of Schneider et Cie for the formation of a joint electrical mfg. co. in France, with a cap. of $4 000 000.

BRAZILIAN TRACTION, LIGHT AND POWER CO., LTD.—Qrtrly. div. of 50 cents. p. sh. on ord. shs. of no par value has been declared. London agents: Canadian and General Finance Co., Ltd., 3, London Wall Bdgs., E.C.2.

COMPANIA HISPANO-AMERICANA DE ELECTRICIDAD.—Net pft. for 1928, 50 884 559 pesetas, agst. 43 196 875 pesetas. Fin. div. of 9% proposed on "A," "B," "C," and "D" shs. and 4½% on "E" shs., making 15%, agst. 14%.

RANGOON ELECTRIC TRAMWAY AND SUPPLY CO., LTD.—Net pft. 1928, £58 058, agst. £60 326, after placg. £58 500 to res. for renewals and £4 000 to res. for cables. Div. on £1 ord. shs. R.1 12 annas p. sh. free of Indian tax. Fwd. £20 624, agst. £24 994.

ENGLISH ELECTRIC CO. OF CANADA.—Pfts. for 1928, $243 104, increase $24 527. To depreciatn., $40 000. After allowing for full year's divs. on class "A" stk., pfts. available for class "B" shs. were equal to $2.08 p. sh. Blce. to surplus acct. $143 104.

WESTERN UNION TELEGRAPH CO.—Gross revs., includg. divs. and int., for first three months of 1929, $35 228 385, agst. $32 210 169; total exes. $30 739 675, agst. $28 330 986; int. on bonded debt $902 516, agst. $899 151; net income $3 586 194, agst. $2 980 032.

BOMBAY ELECTRIC SUPPLY AND TRAMWAYS CO., LTD.—Net pft. for 1928, Rs. 4 927 794, plus Rs. 222 838 brt. in. Div. 14%. To reserves, Rs. 251 666; written off rights and concessions, Rs. 40 710; written off exes. of re-extensn. of debs., Rs. 2 000 000; fwd. Rs. 248 256.

INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION.—Earngs. for 1928, $81 234 824, agst. $37 228 946, major portn. of increase being due to association with the Mackay properties. Net income, after provision for all charges, £14 596 337, equal to $10.26 p. sh., agst. $11.7 p. sh. last year.

ELECTRIC CONSTRUCTION CO., LTD.—Net pft. for year ended March 31, 1929, £8 738, to which are added £8 043 brt. in and £10 000 transferred from div. equalisatn. fund. Fin. div. at rate of 7% p.a. on pref. shs. and fin. div. at rate of 5% p.a. on ord. shs., both subject to tax. Intm. paymt. on ord. was 3% actual.

AKTIEBOLAGET ELEKTROLUX.—Gross pft. for 1928, 7 993 161 kronor, or 10 933 803 kronor includg. int. received and divs. from subsidiaries. Net pft., 9 123 751 kronor. Provided for taxes, 1 200 000 kronor; to res. 1 000 000 kronor; amortisatn. of patents, 848 577 kronor. Div., 9%. Fwd. 700 968 kronor, agst. 629 319 kronor brt. in.

KALGOORIE ELECTRIC LIGHT AND POWER CORPORATION.—Pft. for 1928 £16 544, agst. £26 841. After addg. £780 bt. fwd. and £446 net repaymt. of inc. tax claimed, and allocatg. £7 000 to deprctn. res., £10 771 available, directors recmd. paymt. of 6%, less tax, on income deb. stk., div. of 6%, less tax at 2s. in £, on ord. shs (same), placg. to res. £1 000, fwd. £622.

MANITOBA POWER CO.—Earngs. for 1928 were equal to $2.65 p. sh., agst. $2.56 p. sh. Gross earngs. $1 218 266, agst. $1 002 290. Deductg. operatg. exes. and adding miscellaneous

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income makes gross income $1 120 125, agst. $876 784. Deductg. int., taxes, divs., etc., left surplus $23 971, agst. $31 109, makg. with amt. brt. fwd., total surplus of $72 960.

INTERNATIONAL GENERAL ELECTRIC CO.—An agreement betwn. co. and the Soviet Government for exchange of patents and designing, engineering and manufacturing information for ten years is announced. American engineers will be sent to Russia to assist the Soviet Electrotechnical Trust in carrying out plans for the expansn. of the electrical industry in that country.

BRAZILIAN TRACTION, LIGHT AND POWER CO., LTD.—Gross earngs. of co. and its subsidiaries for 1928, $42 774 813, agst. $38 319 989; net earngs. $24 869 330, agst. $22 054 624, plus miscellaneous income $145 933, agst. $50 876. Net blce. to accts. of parent co., $14 762 619, agst. $11 947 669; net pft. $14 121 605, agst. $11 947 669. After paying pref. divs. (four qrtrly. at 1½% ea.) and ord. divs. (two of 1¾% ea. on $100 shs. and two of 44 cts. ea. on shs. of no par value), surplus on year was $6 053 459, agst. $5 001 813; making total surplus $14 947 366, out of which $5 000 000 is placed to res. and $9 947 366 carried fwd.

BAHIA TRAMWAY, LIGHT AND POWER CO.—The trustee (Sir Wm. Plender and Mr. G. Kitchin) and the receiver (Mr. B. H. Binder) on behalf of deb. hldrs. of Bahia Tramway, Light and Power Co. announce that negotiatns. for a settlemt. of the claim of the co. agst. the municipality of Bahia have now been concluded. Arrangemt. provides for cash paymts. spread over three years, and, it is estimated, shd. result in total distributn. to deb. hldrs. of about 30% of nom. amt. of their debs. In 1914 co. agreed to accept paymt. for the business, which was sold to municipality, in the form of 6% bonds, which are held by the trustees for the deb. hldrs. The municipality has defaulted and attempted to repudiate the bonds.

BRITISH ELECTRIC TRACTION CO., LTD.—Gross pft. for yr. ended March 31, 1929, £330 822, agst. £311 908). Deductg. gen. exes. and loan int., £54 348, and deb. stk. int., £79 479, blce. is £196 995. Directors recommend fin. div. of 3% on pref. stk., making 6% for yr., and divs. of 8% on pfd. ord. stk., and 5% on defd. ord. stk., leaving surplus £40 735. Directors recommend that of this blce, £14 788 be capitalised and distributed to def. ord. stkhldrs. in fully paid def. ord. shs. of £1 each, to be converted subsequently into def. ord. stk. Subject to this being approved, pref. stkhldrs. are entitled to further div. of 1·67%, making 7·67% for year, leavg. £14 025 to be added to undivided pfts. acct., makg. that acct. £186 251. Res. remains at £520 000. Investmts. stand at £4 371 392.

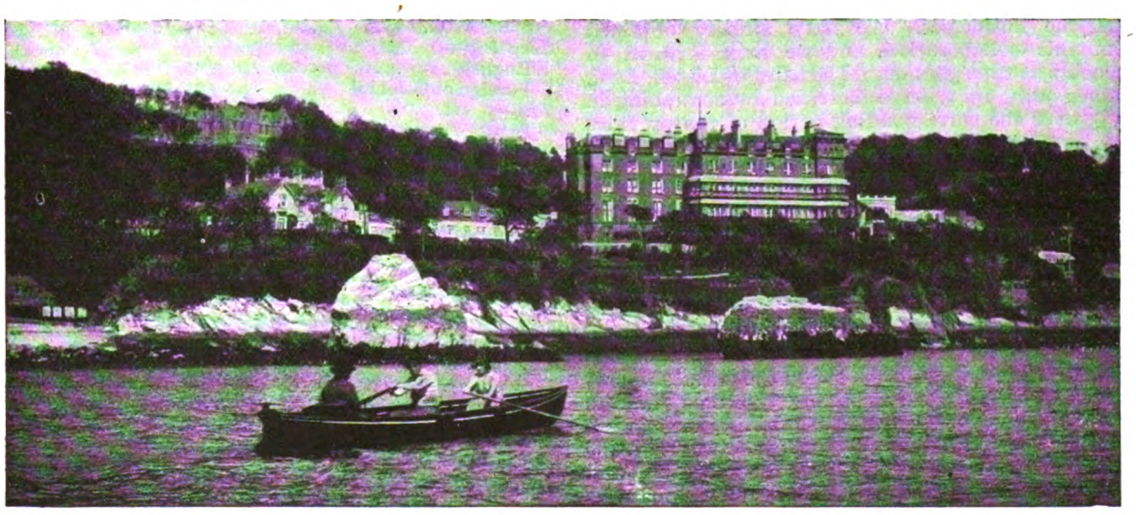
UTILITIES POWER AND LIGHT CORPORATION.—This American Corporation, in its report for 1928, announces its ownership of the Greater London and Counties Trust, which owns the entire capital stock, except directors' qualifying shs. of a number of electricity supply companies in Great Britain. The subsidiaries include the Bedfordshire, Cambridgeshire and Huntingdonshire, the Cookham and District, the East Anglian, the Oxford, Wessex and Western, electric supply companies and Edmundson's Electricity Corporation. The income report of the Utilities Power and Light Corporation shows gross earngs. $43 240 584, agst. $29 180 145; net income of the Corporation and its subsidiaries, $4 496 850, equal to $27·67 p. sh. on pfd. stk. After paying $7 p. sh. on pfd. stk., blce. amtd. to $4.95 p. sh. on class "A" stk., and after paying $2 p. sh. on "A" stk., blce. amtd. to $2·42 p. sh. on "B" stk.

MARCONI ONE POUND SHARES.—The two committees representg. the £1 shhldrs. of Marconi's Wireless Telegraph Co. announce abandonmt. of their plan to issue units against the deposit of £1 shs., in consequence of an intimatn. from the Inland Revenue authorities that the full *ad val.* duty wd. have bn. claimed—i.e., 1% on the market value of the shs. transferred. The committees suggest the substitutn. of a holdg. co. for the proposed deposit with a trustee. Under this scheme an investmt. co. wd. be formed with an authorised cap. sufficient to enable it to exchange its own shs. at par for the shs. of such holdrs. of £1 ord. or £1 pref. shs. of the Marconi co. as might signify their intentn. of supportg. the scheme. The shs. of the investmt. co. wd. be of 5s. ea., and four shs. would be issued in respect of every £1 ord. or £1 pref. sh. of the Marconi Co. Pendg. proceeds. in the High Court for an injunctn. wh. have bn. commenced by a hldr. of £1 shs., the committees will defer such actn. in connectn. with the scheme they now propose as would involve expense.

Company Meetings.

KOLSTER-BRANDES, LTD.—Lt.-Comm. Ellery W. Stone, presiding at the statutory meeting on May 24th, said: We shall be sorry if you go away without making a tour of our works while they are in operation and inspecting the additional facilities now nearing completion. You can confidently lay claim to what is, I believe, one of the best—if not the best—laid-out and equipped radio factories in Great Britain. Our associated company, Kolster Radio Corporation, of America, is enjoying an excellent market for its products and securing an increasing share of the American radio business. Present indications are that the American company's volume of sales will be from 60 per cent. to 70 per cent. greater than last year. In view of the close working arrangements between the two companies, the success of the American company must be reflected in expanded activities for Kolster-Brandes, Ltd. As to Kolster-Brandes, Ltd., the indications are that your directors' prospectus estimates as to turnover and net profits should safely be reached.

LANCASHIRE ELECTRIC LIGHT AND POWER CO., LTD.—Mr. Alfred Shepherd, presiding at the meeting on June 3rd, said the profit of the operating company was £238 514, against £203 734. The maximum load at the Radcliffe station had risen from 48 200 to 51 400 kW and that at Padiham from 13 000 to 16 500 kW. During the year the Parliamentary company had spent £385 069, of which £186 686 was expended on the new Kearsley station. Electricity sold was 206 608 807 kWh, an increase of 17%. The reduction of the average price per kWh on the l.t. system was due to a greater use of electricity for domestic heating and cooking, for which the charge was



A picturesque view of the Imperial Hotel, Torquay, the Headquarters of the I.M.E.A. Council during the period of the Convention.

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1d. per kWh where the combined lighting and domestic power tariff was adopted. It was anticipated that the first two of the four 42 000 H.P. units at the Kearsley station would be in operation in the autumn of this year. The price at which the issue of shares was made last April, namely, 27s. per share, would show a substantial sum available for reserves. The report and accounts were adopted, and the fixed dividends on the preference shares and a dividend of 7½% on the ordinary shares, with a further dividend of ½% on the 7% participating preference shares were approved.

TELEFONAKTIEBOLAGET L. M. ERICSSON.—At the recent annual meeting the managing director, Herr. K. F. Wincrantz, announced that the total gross annual income exceeded 100 000 000 kronor and that deliveries made during the past year from Swedish telephone and cable works and from the radio co. amounted to about 75 000 000 kronor, an increase since the preceding year of about 25%, in spite of the fact that prices in general during the year decreased somewhat, owing to keen international competition. The foreign works belonging to the co. increased their turnover by 28%. The number of telephone subscribers of the affiliated concession co.s by Jan. 1, 1929, was 141 000, in comparison with 120 000 at the end of 1927, which was equivalent to a net increase of 16%, and the total revenues of the L.M. Ericsson Co., derived from telephone subscription fees now amounted to about 20 000 000 kronor.

Expansion of Business Abroad.

Of the affiliated concession companies, the Mexican one paid a dividend of 10%, and that of Entreriana in South America and the Polish Co., both 10%, while the company in Southern Italy paid 7%. The company had taken over the telephone works in Dorpat, and the Norwegian telephone works Elektrisk Bureau had also been acquired. The L.M. Ericsson concern now had offices,and affiliations in 18 different countries.

EVER READY CO. (GREAT BRITAIN), LTD.—The annual general meeting was held on Friday, May 31st. Mr. M. Goodfellow chairman and managing director, said: We come before you at the end of a year in which the sales and profits of the year constitute a record, and in which the general development of the business has made great progress. Were our industry protected by an import duty, it is true that our development would have been greater still, for our calculations show that portable lamps and dry batteries of all descriptions imported into this country from abroad would, if manufactured in our own factories in this country, employ some 5 000 additional workpeople. We believe that we observe signs among the manufacturers on the Continent of a more rational outlook regarding their exports to this country, which, during the past few years, have been made at unremunerative prices. The share capital issued has been increased from £570 000 to £742 800. The reserves are now £470 000, compared with £225 000 a year ago. We have increased the general reserve from £200 000 to £350 000. The balance on profit and loss account, after the payment of the final dividend, will be £30 696, or a few hundred pounds higher than the sum brought forward from last year. The Lissen acquisition, in the view of your directors, is one of great importance, not only to this company but to Lissen, Ltd. Steps have already been taken to bring about a close collaboration between the businesses. We have already obtained benefits from this collaboration, and we look forward to increasing benefits as time goes on. The sales of Lissen, Ltd., since September 30th, 1928, have increased by something in excess of 25% over the corresponding period of the previous year. The sales of our business for April and May of this year are 25% above the sales of April and May, 1928. The report was adopted and the dividends approved.

MARCONI'S WIRELESS TELEGRAPH CO., LTD.—At the meeting on May 29th, Lord Inverforth, chairman, said the profit for 1927 amounted to £412 971, the estimated comparable figure for 1928 being approximately £408 500. An interim dividend of 20 per cent. had been paid on the ordinary shares in respect of 1927, and a similar dividend for 1928, which dividends would be final. The decision to dispose of the company's interest in what might be called the entertainment side of wireless had been arrived at because the directors were of opinion that the company's principal interest consisted in its wireless traffic services, and in the manufacture and sale of transmitting and receiving stations both for telegraphy and telephony, of broadcasting stations and of wireless apparatus for ships. The report set out in some detail the history of the negotiations which had resulted in the formation of Cables and Wireless, Ltd., and since the issue of the report shareholders had received from the Bank of England, on behalf of Cables and Wireless, Ltd., an offer to exchange their shares for shares in that great new company. The directors might be asked on what ground they justified their action in agreeing to a merger of interest with the cable companies. They had followed the course they did because the Government of this country had decided that the exploitation of the Beam system of wireless telegraphy for Imperial communications was to be taken out of the hands of the company which had invented and developed the system, and was to be made a monopoly of the Post Office. The directors decided that, provided the Government was prepared to agree to the establishment of one comprehensive system of Imperial communication, and to hand over to the company responsible for operating that system the Imperial Beam stations which had been acquired from Marconi's Co. the directors were prepared to enter into negotiations for the merging of the company's interests with the Eastern and Associated Telegraph companies. The terms which had been offered to the shareholders on behalf of Cables and Wireless, Ltd., were such that he felt sure the overwhelming majority of shareholders of all classes would decide to accept. That the directors' action had met with the approval of shareholders was shown by the fact that the board held proxies for over 1 200 000 shares. The allocation of shares in Cables and Wireless, Ltd., amongst the different classes of shareholders of this company had been criticised by certain holders of £1 shares, as to which he would say that the board were satisfied that the allocation was fair having regard to the history of the company and to the equities of the situation. The Marconi Co. would continue to carry on its sales and manufacturing business, and the research incidental and essential to the success of that business. The shares of Imperial and International Communications, Ltd., would be held by the Marconi Co. and by the cable companies, whose shares in turn would be owned by Cables and Wireless, Ltd. The boards of all the companies were to be identical. The directors were confident that shareholders would best be serving their own interests by exchanging their shares for shares in Cables and Wireless, Ltd. The report and accounts were adopted, and resolutions, altering the articles of association with a view to carrying out the plan of the wireless and cable merger were approved.

METAL AND CHEMICAL PRICES.

TUESDAY, June 4th.

		Price.	Inc.	Dec.
Copper—				
Best Selected ..	per ton	£74 10 0	—	—
Electro Wirebars	,,	£84 10 0	—	—
H.C. Wires, basis	per lb.	11¼d.	—	—
Sheet	,,	1s. 0d.	—	—
Phosphor Bronze—				
Wire (Telephone) basis	per lb.	1s. 2¼d.	—	—
Brass 60/40—				
Rod, basis ..	per lb.	9d.	—	—
Sheet ,, ..	,,	10¾d.	—	—
Wire ,, ..	,,	11¾d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£3 12 6	—	—
Galvanised Steel Wire, basis 8.S.W.G. ..	,,	£14 15 0	—	—
Lead Pig—				
English	per ton	£25 0 0	—	—
Foreign or Colonial	,,	£23 10 0	—	5s. 0d.
Tin—				
Ingot	per ton	£197 15 0	£1 10 0	—
Wire, basis ..	per lb.	2s. 7½d.	—	—
Aluminium Ingots	per ton	£95 0 0	—	—
Spelter	,,	£26 10 0	—	7s. 6d.
Mercury	per bottle	£22 5 0	—	—

Sulphur—Flowers, Ton £12 0 0 *Sulphuric Acid*—
,, Roll ,, £10 10 0 (Pyrites, 168°) Ton £6 15 0
Copper Sulphate ,, £25 to £25 10 0 *Sodium Chlorate* per lb. 2¾d.
Boric Acid (Crystals),, £30 0 0 *Sodium Bichromate* per lb. 3¼d.
Rubber—Para fine, 11¼d.; plantation, 1st latex, 10¾d.

∴ The metal prices are supplied by British Insulated Cables Ltd., and the rubber prices by W. T. Henley's Telegraph Works Co., Ltd.

THE LEAD MARKET.

Quiet conditions have, according to James Forster and Co., prevailed throughout the week pending the result of the General Election. Owing to the pressure of arrivals, the backwardation has contracted from 5s. to 1s. 3d. per ton.

Closing prices on May 21st were £23 11s. 3d. for May, June and July, and £23 10s. for August, 1s. 3d. down to 2s. 6d. higher on the week according to position.

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NEW COMPANIES.

LAING ELECTRICITY SUPPLY CO., LTD.—Cap., £10 000. To carry on business indicated by title. Reg. Office: 4, Duke Street, Golspie, Sutherland.

E-KON-O-ME ENGINEERING CO., LTD.—Cap., £300. Manufacturers of and dealers in mechanical and electrical hammers, etc. Reg. Office: 126, Oldbury Road, Smethwick.

PEAK SIGNS, LTD.—Cap., £100. Manufacturers of and dealers in daylight, illuminated (electric or other) signs, etc. Secretary: J. J. G. Sowerby, Weir Cottage, Chertsey, Surrey.

C. H. STAVE LTD.—Cap., £1 500. Electrical, wireless, scientific and general engineers, manufacturers of and dealers in electrical apparatus, etc. Reg. Office: 182, Church Street, London, W.8.

SUPRA ELECTRA MOTORS, LTD.—Cap., £10 000. Manufacturers and distributors of and dealers in electric motors, etc. A first director: J. Sinclair-Ross, 1, Morpeth Terrace, Westminster, S.W.1.

PANDONA, LTD.—Cap., £500. Manufacturers of and dealers in wireless receivers and instruments, electric or other advertising signs, etc. Reg. Office: Empire House, 159, Great Charles Street, Birmingham.

DISTRIBUTORS (BRITISH ELECTRICAL), LTD.—Cap., £1 000. To acquire business of a ventilating and general electrical engineer as formerly carried on by E. E. Lee as "Distributors," at 25, Victoria Street, London, S.W.1.

MAJOR, NEWMAN AND SONS, LTD.—Cap., £500. Electrical engineers, manufacturers of and dealers in wireless, telegraphic, telephonic, and electrical instruments, etc. Reg. Office: 34, College Road, Harrow, Middlesex.

BROWN'S HEAT STORAGE AND DRYERS (FOREIGN), LTD.—Cap., £5 000. Manufacturers of and dealers in machinery, plant and tools, electrical engineers, etc. Solicitors: Edwards and Childs, 17, Billiter Street, London, E.C.3.

C. HADDON POUPARD AND CO., LTD. Cap., £1 000. Electrical engineers, manufacturers of and dealers in accumulators and primary batteries, wireless receivers, loud speakers and components. etc. Reg. office: Thermion Works, 50a, Cranbrook Road, Ilford.

H. AND H. DAVIES AND CO., LTD.—Cap., £5 000. To acquire business of H. and H. Davies and Co., and carry on business of electricial and general engineers and contractors, etc. Solicitors: Walter Martin and Co., 8, New Court, Lincoln's Inn, London, W.C.

DISPLAY-MAKERS, LTD.—Cap., £1 000. To acquire business of H. T. Widgery, and to carry on business of designers and manufacturers of and dealers in pictorial window displays, electrical engineers, etc. Solicitor: F. P. Woodcock, 5, Holborn, London, E.C.1.

BUSHING CO., LTD.—Cap., £60 000. Manufacturers of and dealers in insulating materials and articles and products composed of or made from insulating materials of all kinds, electrical engineers, etc. Solicitors: Watson, Burton, Booth and Robinson, Pilgrim House, Newcastle-on-Tyne.

BELCO LONDON, LTD.—Cap., £2 000. To adopt agreement between Belco, Ltd. (by its liquidator), and E. May, and to carry on business of electrical merchants and wholesale dealers, dealers in electric lamps, electric fittings, etc. Reg. Office: 2, Castle Street, London, W.C.2.

PAINTER BROTHERS, LTD.—Cap., £30 000. To adopt agreement with L. E. Painter and R. A. Painter, and to carry on the business of electrical and general engineers, etc., formerly carried on by them as "Painter Brothers" at Hereford. Solicitors: Durrant, Cooper and Hambling, 70/71, Gracechurch Street, London, E.C.

MECHANICAL AND ELECTRICAL ENGINEERING CO. (BIRMINGHAM), LTD.—Cap., £1 000. Manufacturers, importers and exporters of and dealers in electrical and mechanical equipment, wireless, electrical, magnetic, telegraphic, telephonic and other appliances, etc. Reg. office: 18/20, Stafford Street, Birmingham.

YOUNG ACCUMULATOR CO. (1929), LTD.—Cap., £225 000. To acquire undertaking of Young Accumulator Co., Ltd., in a process used in connection with the manufacture of electrical accumulators, to carry on business of electricians, electrical engineers, etc. Reg. Office: 4, Drapers Gardens, London, E.C.2. (Public co.)

HYDRO THERMAL POWER, LTD.—Cap., £50 000. To acquire patents, licences, secret processes or inventions relating to a system of hydro-electric practice of generating power and a combined boiler and accumulator, to erect hydro-electric power stations and machinery, to carry on business of hydro-electric and general engineers, etc. Solicitors: Cohn, Seligman and Bax, 52, New Broad Street, London, E.C.2. (Public co.)

WYNSOR ELECTRIC RANGE CO., LTD.—Cap., £1 000. To acquire undertaking of Windsor Electric Range Co., to adopt agreement with L. Burn, carrying on business as Windsor Range Co., and W. D. Stevens, and to carry on business of manufacturers of and dealers in electrical cookers, radiators, stoves, lamps, service, advertising and flashing signs, electrical and mechanical engineers, etc. Reg. Office: 1, Broad Street Place, London, E.C.2.

HARDYSON RADIO, LTD.—Cap., £5 000. To acquire any patents relating to manufacture of wireless sets, combined wireless and gramophone sets, television apparatus, combined television and sound producing apparatus and instruments, aerials, transmitters, receivers, coils and transformers, and to carry on the business of designers and manufacturers of and dealers in wireless sets, combined wireless and gramophone sets, etc. Solicitors: Cartwright and Fieldhouse, Huddersfield.

ELECTRICAL TRADE MARKS.

LION.—493 863. Class 8: Telephonic loud speakers. Graham Amplion, Ltd., 37, Walbrook, London, E.C.4; manufacturers of wireless apparatus and electrical engineers. August 4th, 1928. (By consent.)

NATURAL TONE (SIGN).—499 816. Class 8. Sound reproducing apparatus. Orchorsol Gramophones, Ltd., 126, New Bond Street, London, W.1.; manufacturers. February 7th, 1929. To be associated with No. 499 986 (2 666) ix. Registration of this trade mark shall give no right to the exclusive use of the words "Natural Tone."

TRANSONIC.—500 040. Class 8. Instruments and apparatus and parts thereof for use in wireless telephony and telegraphy. Frederick George Woodall, trading as F. G. Woodhall, 20, Union Street, St. Helier, Jersey, Channel Islands; dealer in wireless goods. February 14th, 1929.

Opposition to the registration of the following trade marks can be lodged up to June 8th.

"SYMPHONISTA."—499 635. Class 8. Wireless telephonic apparatus and parts thereof, and sound reproducing apparatus and parts thereof. Dulcetto-Polyphon, Ltd., 2 and 3, Newman Street, Oxford Street, London, W.1; manufacturers. February 2nd, 1929. To be associated with No. 344 023 (1 800) and others.

ELODEN.—499 542. Class 8. Fitted electric switchboards, measuring telephonic and telegraphic apparatus and parts threeof. Elodén Muller and Co., Gesellschaft Mit Beschrankter Haftung, Urbanstrasse 67, Berlin, S.59; manufacturers. January 30th, 1929.

499 962. Class 8. Primary and secondary electric batteries and parts thereof. A.F.A. Accumulators, Ltd., 9A, Diana Place, Euston Road, London, N.W.1; manufacturers. February 12th, 1929. To be associated with No. 483 886 (2 587).

SYMPHONION.—499 636. Class 8. Wireless telephonic apparatus and parts thereof, and sound reproducing apparatus and parts thereof. Dulcetto-Polyphon, Ltd, 2 and 3, Newman Street, Oxford Street, London, W.1; manufacturers. February 2nd, 1929. To be associated with No. 344 023 (1 800) and others.

PROCELL.—500 896. Class 8. Electric cables. Mersey Cable Works, Ltd., Linacre Lane, Bootle, Liverpool; manufacturers. March 13th, 1929.

"SYMPHONETTA."—499 831. Class 8. Wireless telegraphic and telephonic apparatus and parts thereof, and sound reproducing apparatus and parts thereof. Dulcetto-Polyphon, Ltd., 2 and 3, Newman Street, Oxford Street, London, W.1; manufacturers. February 7th, 1929. To be associated with No. 344 023 (1 800) and others.

TUNGANITE.—501 329. Class 8. Electric accumulators (not for medical purposes). Walter Haddon, 132, Salisbury Square, Fleet Street, London, E.C.4; type founder. March 27th, 1929. To be associated with No. 501 330 (2 667), xi, and others.

TUNGANITE.—501 330. Class 11. Electric accumulators (for medical purposes). Walter Haddon, 132, Salisbury Square, Fleet Street, London, E.C.4; type founder. March 27th, 1929. To be associated with No. 501 329 (2 667), viii, and others.

Opposition to the registration of the following trade marks can be lodged up to June 15th.

SKARON.—498 975. Class 8. Philosophical and scientific instruments. Timber Goods, Ltd., 164 and 166, Kennington Road, London, S.E.11; manufacturers. January 14th, 1929.

AMPLION LION.—498 850. Class 8. Telephonic loud speakers. Graham Amplion, Ltd., St. Andrew's Works, Slough; manufacturers of wireless apparatus and electrical engineers. January 9th, 1929. To be associated with Nos. 408 176 (2 236), 493 863 (2 666), and others.

LION SPEAKER.—498 851. Class 8. Telephonic loud speakers. Graham Amplion, Ltd., St. Andrew's Works, Slough; manufacturers of wireless apparatus and electrical engineers. January 9th, 1929. To be associated with No. 493 863 (2 666) and others. (By consent.)

RABCO.—501 084. Class 8. Wireless telephonic apparatus and parts. William Vennard, 227, Pentonville Road, King's Cross, London, N.1; manufacturer. March 19th, 1929.

PASSPORT.—501 135. Class 8. Wireless telephonic and telegraphic apparatus and parts. Hart Collins, Ltd., 38A, Bessborough Street, Westminster, London, S.W.1; manufacturers. March 20th, 1929.

THE FORUM (sign).—501 291. Class 8. Wireless telephonic apparatus, and parts. The British Homophone Co., Ltd., 67 to 69, City Road, London, E.C.1; manufacturers. March 20th, 1929

Opposition to the registration of the following trade marks can be lodged up to June 22nd.

AQUAVISOR.—501 201. Class 8. Philosophical and scientific instruments. Radiovisor Parent, Ltd., 26, Coventry Street, London, W.1; manufacturers. March 23rd, 1929.

ELM.—501 223. Class 13. Electric light fittings, reflectors, shades and parts, all being metal goods. Elm Works, Ltd., Elm Works, Summerstown Road, Tooting, London, S.W.17; manufacturers. March 25th, 1929.

TELELECTOR.—501 382. Class 8. Apparatus for use in transmitting sounds and for transmitting and displaying views, scenes, images or messages to a distance by telegraphy or telephony. Baird Television Development Co., Ltd., 133, Long Acre, London, W.C.2; manufacturers. March 28th, 1929.

Opposition to the registration of the following trade marks can be lodged up to June 29th.

DAVCO.—500 684. Class 8. Instruments and apparatus for use in wireless telephony and telegraphy. Daventry and Co., Ltd., Mellings Yard, Friargate, Preston, Lancashire; wireless factors. March 6th, 1929.

THE WARRIOR (sign).—501 032. Class 8. Philosophical and scientific instruments. J. Bridge and Sons, 31, West Warrior Square, Southend-on-Sea; manufacturers. March 16th, 1929.

F. L. BEST.—501 032. Class 8. Philosophical and scientific instruments. Frederic Lafargue Best, 21, Muswell Hill, London, N.10; engineer. March 26th, 1929.

PANATONE.—501 584. Class 8. Philosophical and scientific instruments. British Brunswick, Ltd., 15, 17 and 19, Cavendish Place, London, W.1; manufacturers. April 8th, 1929. To be associated with No. 491 050 (2 623) and others.

PANACHORD.—501 585. Class 8. Philosophical and scientific instruments. British Brunswick, Ltd., 15, 17 and 19, Cavendish Place, London, W.1; manufacturers. April 8th, 1929. To be associated with No. 491 050 (2 623) and others.

MUSIVOX.—501 986. Class 8. Philosophical and scientific instruments. G. F. Billing and Co., Ltd., 41, Cheapside, London, E.C.2; general merchants. April 20th, 1929.

EMBOB.—497 468. Class 13. Electric irons, soldering irons, electric terminals, electric adapters and electric switches, all being goods of ordinary metal for domestic use. Maurice Bobin, 15, Farringdon Avenue, London, E.C.4; merchant. November 27th, 1928.

SONGSTER.—498 706.—6 726 S. Class 8. Sound reproducing and recording instruments. J. Stead and Co., Ltd., Manor Works, Cricket Inn Road, Sheffield; manufacturers. January 4th, 1929. To be associated with No. 392 332—5 730 S. (2 215) and others.

EVOHLION.—499 426—6 731 S. Class 8. Sound reproducing instruments and apparatus and parts thereof. The Standard Export Co., Ltd., 25, Fargate, Sheffield; exporters and importers. January 25th, 1929.

BOGOTA TELEPHONE CO., LTD.—Directors have recd. offer from Cable, Telephone and General Trust to purchase whole of issued ord. shs. at 35s. p. sh.; offer not to be binding unless accepted by May 21 by 75% of the issued ord. shs.

LIMA LIGHT, POWER AND TRACTION CO.—Gross pfts. for 1928, £P.164 910, plus £P.269 brt. in. After paying pref. divs., makg. contributns. to amortisatn. funds and res. fund and providing for directors' remuneratn., a div. of 75 centavos on ord. shs. is recommended. Fwd. £P.1 063.

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COMMERCIAL INFORMATION.

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debt. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

BEASLEY, LTD., 95, High Street, Whitstable, electricians. £21 18s. 2d. April 24th.

BERRY AND HAYWARD, LTD., Granby Street, Nottingham, electrical engineers. £13 12s. 8d. April 24th.

BRITANNIA COMPONENT CO., 296, Oxford Street, Stepney, wireless dealers. £29 4s. 4d. March 20th.

DOMINION SUPPLIES AGENCY, 33, Albert Terrace, Middlesbrough, wireless suppliers. £14 14s. April 23rd.

EAST END ACCUMULATORS DEPOT, 15A, Holborn Street, Plymouth, electrical engineers. £14 6s. 2d. April 26th.

HAMBLING, CLAPP AND CO., LTD., 21, Garrick Street, W.C., electrical engineers. £17 3s. 10d. April 29th.

JOHNSTONE, William H., Wireless Supplies Co., 2, Lichfield Street, Charing Cross Road, W.C., wireless dealer. £22 7s. 2d. April 16.

MASON AND BROWN, Melton Road, Leicester, electrical engineers. £14 2s. April 24th.

METCALFE, Mr. J. E., 55, Fishergate, York, wireless engineer. £16 9s. 4d. April 19th.

TOPPING AND SON, 51, Linden Avenue, Thornton Heath, electricians. £14 9s. April 26th.

Deeds of Arrangement.

TICKLE, Edgar Alex., trading as the WIRELESS DOCTOR, 1, Chatterton Road, Bromley, Kent, wireless dealer. Dated May 27th, filed May 28th. Trustee, W. G. Milton, 329, High Holborn, W.C., accountant. Secured creditors, £18; liabilities unsecured, £901; assets, less secured claims, £269.

GALPIN, Sidney Bernard, 147, High Street, and 9, Gervase Street, Scunthorpe, electrical engineer. Dated May 24th, filed May 31st. Trustee, B. Spooner, 118, High Street, Scunthorpe, C.A. Liabilities unsecured, £1 811; assets, less secured claims, £1 088.

Receiverships.

P. KAY, LTD.—G. C. Jarvis, C.A., of 115-117, Cannon Street, E.C.4, was appointed Receiver by Order of Court dated May 16th, 1929.

C. J. THURSFIELD AND CO., LTD.—W. E. Alldrith, of Sun Buildings, Bennetts Hill, Birmingham, was appointed Receiver and Manager on May 18th, 1929, under powers contained in debentures dated January 8th, May 13th, 1929, and October 10th, 1927.

Mortgages.

[NOTE.—*The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—allowed by the date of the Summary, but such total may have been reduced.*]

L. P. S. ELECTRICAL CO., LTD., London, W.C.—Registered May 15th, debenture, to Bank; general charge. *Nil. December 31st, 1928.

MAXWELL (WILLIAM) AND CO., London, W., electrical engineers.—Registered April 30th, £2 000 charge, to S. T. Hurley, Briar Lodge, Askew Road, Shepherds Bush; charged on Tudor Lodge, 204, Goldhawk Road, Shepherds Bush. *——. March 4th, 1929.

SYMPER AND EVERSHED, LTD., Harrow-on-the-Hill, electrical engineers.—Registered May 14th, £500 debentures; general charge.

VIOZONE, LTD., London, E.C., electrical engineers.—Registered May 13th, £148 4s. 5d., 2nd debenture, to Export Marketing Co., Ltd., 19, Cursitor Street, E.C.; general charge.

Satisfactions.

ELECTRICAL CONTRACTS AND MAINTENANCE CO. (1925), LTD., London, S.W.—Satisfaction registered May 17th. £250, registered March 4th, 1925.

J. J. R., LTD., Wallington, wireless manufacturers.—Satisfaction registered May 13th, £250, registered February 6th, 1928.

Private Meetings, etc.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

ELECTRIC FACTORS (BLACKPOOL), LTD., wireless and electrical factors, 2, St. John's Walk, Blackpool. The statement of affairs presented at the statutory meeting of creditors in this voluntary liquidation showed ranking liabilities of £3 287, all due to unsecured creditors. The assets comprised fixtures and fittings £20; stock of electrical goods, £606, estimated to realise £522; stock of wireless goods, £833, expected to produce £625; book debts, £1 325, valued at £800; and cash in hand, £16; making a total of £1 983. After allowing £12 for preferential claims, the net assets were £1 971, or a deficiency of £1 316. At the date of the liquidation, there were fourteen suing creditors. The deficiency was accounted for by loss on trading, bad debts, and goods loaned out on hire purchase, in respect of which records were not available. The voluntary liquidation of the company, with Mr. James Todd as liquidator, was unanimously confirmed.

JONES (E. O.) AND SONS, LTD., timber merchants and electricity suppliers, Welshpool. At the statutory meeting of creditors in this voluntary liquidation, a statement of affairs was submitted which showed ranking liabilities of £9 218, and net assets expected to produce £4 412, or a deficiency of £4 806. The company was registered in August, 1925, to take over the business of E. O. Jones and Sons, which was established in 1865. In 1927, when the company moved into new premises, the directors thought it would be a sound business proposition to instal electrical plant for working its sawmill machinery, and the company also entered into a contract to provide a bulk supply of electrical energy to Welshpool. The installation of the necessary electrical plant and machinery was expensive; engines were obtained on the hire purchase system, and an overdraft obtained at the bank. The electrical receipts during the thirteen months to January 31st, 1929, were approximately £440. It was hoped that arrangements could be made for the sale of the electrical side of the business. A resolution was passed confirming the voluntary liquidation of the company.

London Gazette, etc.

Companies Winding-up Voluntarily.

PRESTEIGN ELECTRIC CO., LTD.—J. Stephenson, of Stephenson, Smart and Co., Victoria Hall, Llandrindod Wells, appointed as Liquidator.

RADIO ELECTRIC CO. (BOURNEMOUTH), LTD. By special resolution April 23rd, confirmed April 30th.

VERDON CUTTS AND CO., LTD. By reason of its liabilities, May 27th. C. L. Widlake, 9, Paradise Square, Sheffield, appointed as liquidator. Meeting of creditors at the Institute of Chartered Accountants, Moorgate Place, London, E.C.2, on Thursday, June 13th, at 2.30 p.m.

WORMIT ELECTRIC LIGHT CO., LTD.—W. Anderson and J. F. Fleming appointed as joint liquidators.

Bankruptcy Information.

BLOOD, Ralph, late 20, St. John's Road, Padiham, and now 44 and 46, Station Road, Padiham, Lancs, wireless dealer and electrician. Receiving order, May 27th. Debtor's petition. First meeting, June 10th, 3 p.m., Official Receiver's Office, District Bank Chambers, Blackburn. Public examination, June 18th, 11 a.m., County Court House, Bankhouse Street, Burnley.

HENDERSON, John Arthur (trading as HENDERSONS), of Walton-on-Naze, Essex, electrical contractor, carrying on business at 28A, Basinghall Street, London, E.C. Receiving Order, May 30th Debtor's petition. First meeting, June 12th, 11 a.m., and public examination July 5th, 11 a.m., Bankruptcy Buildings, Carey Street, London, W.C.2.

HUNT, Sydney Everest, Bryanston, St. George's Road, Babbacombe, Torquay, electrical engineer and contractor. First meeting, June 7th, 11.30 a.m., Official Receiver's Offices, Exeter Bank Chambers, Broadgate, Exeter. Public examination, June 27th, 11 a.m., The Castle, Exeter.

SKIPPER, Sydney Harold, trading as S. H. SKIPPER AND CO., 35, Broad Bridge Street, Peterborough, electrical engineer. First meeting, June 11th, 12 noon, Official Receiver's Office, 41, Sidney Street, Cambridge. Public examination, July 12th, 10.45 a.m., Law Courts, Peterborough.

Notices of Dividends.

HYDE, Hubert Algernon, 148, Weston Park, Crouch End, North London, lately at 2, East Street, Bromley, Kent, wireless dealer. First and final dividend, 4s. 1¾d. per £, payable June 14th, Official Receiver's Office, 29, Russell Square, W.C.1.

LAY, Oliver Cecil, accumulator specialist, carrying on business as THE HOME WIRELESS INSTALLATION CO., 2C and 2D, High Street, Wandsworth. First and final dividend 3s. 1d. per £, payable June 19th, Official Receiver's Office, 29, Russell Square, W.C.1.

WISHAW, Bernard Henry, Bakewell Road, Matlock, electrical wireless engineer. First and final dividend 1s. 3d. per £, payable June 18th, Official Receiver's Offices, 22, Regent Street, Park Row, Nottingham.

YEEND, Reginald, 19, Victoria Avenue, Lynn Road, Wisbech electrician, trading as the CENTRAL ELECTRICAL WORKS, lately carrying on business at 57, West Street, Wisbech, and at Red Lion Street, Spalding, Lincs. First and final dividend, 7d. per £, payable June 11th, Official Receiver's Office, 41, Sidney Street, Cambridge.

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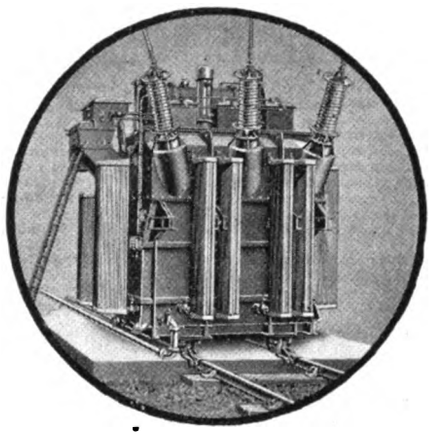

Two Million horsepower extra of Berry Transformers is now in hand for the "National Grid."

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PATENT RECORD.

The following information is prepared from the Illustrated Official Journal (Patents) by permission of the Controller of H.M. Stationery Office. Printed copies of full Patent Specifications, when accepted, may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at 1s. each.

Specifications Accepted.

309 635 W. S. Smith and N. W. McLachlan, Thermionic and the like amplifiers. (12/1/28.)
309 965 J. L. Baird and Television, Ltd. Television apparatus. (19/10/27.)
310 066 R. W. James (Manhattan Electrical Supply Co., Inc.). Luminous electrical discharge tube. (22/10/27.)
280 919 Siemens und Halske Akt.-Ges. Signalling installations. (16/11/26.)
310 070 W. Fennell. Methods of guarding for overhead electric lines. (19/12/27.)
310 096 Sykes and Dyson, Ltd., P. Sykes, and W. Cooper. Means for distributing electric current. (11/8/28.)
288 236 Electrical Research Products, Inc. Synchronous motors. (6/4/27.)
309 846 A. F. Pollock and D. A. Pollock. Thermionic valve circuits. (16/1/28.)
309 847 Automatic Telephone Manufacturing Co., Ltd., and W. J. Brown. Multi-contact switches for telegraph or like systems. (16/1/28.)
309 884 J. E. Pollak (Hermsdorf-Schomburg-Isolatoren Ges.). Lead-through insulators. (16/1/28.)
288 237 Electrical Research Products, Inc. Systems for converting light energy in electrical energy, and vice-versa. (6/4/27.)
309 890 F. D. Berners and L. Burns. Electrical connectors or adaptors. (17/1/28.)
283 957 Siemens-Schuckertwerke Akt.-Ges. Arrangements for exciting commutator machines cascaded with asynchronous machines. (22/1/27.)
309 897 T. W. Ross, C. Ryder and Associated Electrical Industries, Ltd. Electrical synchronising apparatus. (17/1/28.)
309 898 T. W. Ross, C. Ryder, and Associated Electrical Industries, Ltd. Electrical synchronizing apparatus. (17/1/28.)
310 078 R. Nettl. Electric lampholders. (18/1/28.)
309 936 J. E. Pollak (Hermsdorf-Schomburg-Isolatoren Ges.). Lead-through insulators. (18/1/28.)
309 939 A. J. Haswell and Waygood-Otis, Ltd. Controlling or preventing electrical interference with wireless installations due to the operation of electric motors. (18/1/28.)
283 961 Siemens-Schuckertwerke Akt.-Ges. Means for generating alternating electric current with reciprocating engines as the driving power. (22/1/27.)
288 238 Electrical Research Products, Inc. Television systems. (6/4/27.)
310 081 Soc. Anon. Hasler Ci-Devant L'Atelier des Telegraphes de G. Hasler, and M. Neu. Switching arrangement for zone time-metering in inter-urban telephonic connections chargeable at different rates. (19/1/28.)
283 935 Siemens und Halske Akt.-Ges. Indicating means for electric remote-control installations. (20/1/27.)
288 239 Electrical Research Products, Inc. Television and like systems. (6/4/27.)
283 966 G. Maurer. Electric selective distant-control systems. (21/1/27.)
310 083 R. B. North and A. Massey-Allen. Magneto-electric machines. (20/1/28.)
283 967 Radiotechnique. Thermionic valves and their method of application. (21/1/27.)
310 087 J. E. Pollak (Hermsdorf-Schomburg-Isolatoren Ges.). Electrical insulators. (20/1/28.)
286 638 Associated Telephone and Telegraph Co. Rotary stepping-switches. (7/3/27.)
286 262 Electrical Research Products, Inc. Television and like systems. (2/3/27.)
310 102 General Electric Co., Ltd., A. Kinnes, and J. L. Rycroft. Electric heating resistance elements. (30/1/28.)
310 107 G. Barnard and E. L. Cotterell. Protective covers for underground electric cables. (31/1/28.)
284 626 C. Gaiser. Galvanic cell. (31/1/28.)
310 111 N. Coe and A. Lithman. Electro-therapeutic appliances. (1/2/28.)
301 855 Etablissements Gaiffe-Gallot et Pilon. Electronic discharge bulbs. (7/12/27.)
301 120 Telefonaktiebolaget L. M. Ericsson and E. A. Ericsson. Systems for metering telephone calls. (14/2/28.)
310 127 R. O. Bridger. Sound-reproducers for use in wireless telephony. (20/2/28.)
285 884 Westinghouse Lamp Co. Manufacture of electron-emitting bodies. (24/2/27.)
290 651 Associated Electrical Industries, Ltd. High-voltage insulators. (19/5/27.)
287 136 British Thomson-Houston Co., Ltd. Electric control apparatus. (16/3/27.)
287 454 British Thomson-Houston Co., Ltd. Electric protective devices. (19/3/27.)
310 154. S. G. S. Dicker. (N. V. Philips' Gloeilampenfabrieken). Lighting installations comprising one or more discharge tubes having a high starting voltage. (19/3/28.)
291 083 Siemens und Halske Akt.-Ges. Arrangement for the automatic regulation of the degree of transmission of transmission systems, particularly of high-frequency transmission systems. (28/5/27.)
310 183 S. Haskins and Bros., Ltd., and E. R. Watts. Electrically operated steel roller shutters and the like. (19/4/28.)
305 009 E. Wolff. Galvanic batteries. (28/1/28.)
290 974 J. M. Roig. Portable electric power unit for use in dental surgery. (19/5/27.)
289 860 Dr. S. Loewe. Indirectly heated incandescent cathode for a vacuum tube. (4/5/27.)
310 198 M.-L. Magneto Syndicate, Ltd., and R. H. Woodall. Electrical transformers and the like. (5/5/28.)
310 201 C. H. Thompson. Manufacture of electrical porcelain insulators. (8/5/28.)
310 222 Porzellanfabrik P. Rosenthal und Co. Akt.-Ges. and W. Schmidt. Electric insulators. (5/6/28.)
293 853 E. N. Lightfoot. Electric heaters. (15/7/27.)
310 229 C. Coppock. Voltage regulating systems. (19/6/28.)

Applications for Patents.

March 19th.

8 861 O. Muck. Superimposed control currents upon d.c. networks.
8 902 National Malleable and Steel Castings Co. Electric cable couplings for railway vehicles. (20/3/28, Germany.)
8 893 J. C. Pole. Metallic vapour lamps. (20/3/28, Austria.)
8 795 P. Saunders. Clockwork for actuating electric switch.

March 20th.

9 058 Allgemeine Elektricitats Ges. Fusible cut-out. (8/12/28, Germany.)
9 057 Associated Electrical Industries, Ltd., and A. B. Field. Dynamo-electric machines.
9 039 Automatic Telephone Manufacturing Co., Ltd., and T. B. Blashill. Circuit arrangements employing gas discharge tubes.
9 031 British Thomson-Houston Co., Ltd. Electric protective arrangements. (20/3/28, U.S.)
9 032 British Thomson-Houston Co., Ltd. Electric transmission of pictures. (20/3/28, U.S.)
9 012 O. E. Buckley. Submarine signalling cables.
9 016 H. J. Coates and General Electric Co., Ltd. Electric protective systems.
8 985 A. S. Cubitt. Electric lamp blocks.
9 015 Electrodrives, Ltd., and S. F. Woodell. Mounting electric motors.
8 950 Garnett, Whiteley and Co., Ltd., and E. Whiteley. Electric inductances.
9 017 General Electric Co., Ltd., and R. Orsettich. Ventilation of dynamo-electric machines.
8 965 T. Gladdy and Trevelyans (Birmingham), Ltd. Electric tumbler switches.
9 015 J. J. Gracie and M. O. Valve Co., Ltd. Thermionic valves, etc.
8 989 F. Graetz. Electric flat-irons.
9 069 E. S. Guest. Electrical connectors.
8 971 E. Jones. Electrical resistances.
9 009 Kolster-Brandes, Ltd. Radio-transmitting apparatus. (20/3/28, U.S.)
9 056 London Electric Wire Co. and Smiths, Ltd., and E. L. Wildy. Distinguishing electric cables.
9 044 R. J. Rawlings and Sun Vi-Lite, Ltd. Arc lamps.
9 022 Siemens-Schuckertwerks A. G. Production of ring current transformers. (28/3/28, Germany.)
8 949. P. G. A. H. Voigt. Electric amplifiers.
9 067. W. Weekes. Control of transformers.
9 005. L. W. Wild and Wild-Barfield Electric Furnaces, Ltd. Electric furnaces.
9 053. G. G. de Andia-Yrarrazaval. Wireless receivers.

March 21st.

9 100. F. M. Allom. Apparatus for production of surging electric currents by mechanical motion.
2 120. C. Andrews and F. Chambers. Electric fuses.
9 168. A. E. Angold. Variable impedence devices.
9 083. M. von Ardenne Loewe-Radio Ges. Device for elimination of interference in wireless telegraphy. (21/3/28, Germany.)
9 186. Associated Electrical Industries, Ltd., and F. E. Bancroft. Electrical connectors, etc.
9 156 English Electric Co., Ltd., and J. C. Wilson. Synchronising motor-convertors.
9 169 General Electric Co., Ltd. Luminous electric discharge tubes.
9 151 A. Graham and Co., Ltd., W. J. Ricketts and W. Stott. Telephone exchange systems.
9 163 L. H. H. Holdsworth and F. F. Pyle. Electric heating apparatus.
9 177 International General Electric Co., Inc. Manufacture of insulating material. (21/3/28, Germany.)
9 093 W. H. Isherwood and W. H. Turner. Fusible cut-outs.
9 082 S. Loewe. Electric power rectifier. (21/3/28, Germany.)
9 138 H. J. Lucas. Production of electric oscillations.
9 134 W. Manchett. Electrical system of signalling on railways.
9 195, 9 196 Marconi's Wireless Telegraph Co., Ltd. Acoustic devices. (21/3/28, U.S.)
9 131 R. E. Schnorf. Production of unidirectional high voltages from alternating current.
9 199 Siemens and Halske A. G. Thermionic rectifiers and holders. (21/3/28, Germany.)

March 22nd.

9 224 E. Adamson. Electrohydraulic machines.
9 317 Associated Telephone and Telegraph Co. Telephone systems. (8/10/27, Belgium.)
9 236 G. Barker (Firm of) and G. P. Barker. Electric water heater.
9 380 F. L. Best. Magnetic systems for relays, etc.
9 381, 9 382 F. L. Best. Diaphragms from sound reproducing devices, etc.
9 350 British Thomson-Houston Co., Ltd. Vacuum switches. (23/3/28, U.S.)
9 351 British Thomson-Houston Co., Ltd. Electric circuit-making devices. (23/3/28, U.S.)
9 352 British Thomson-Houston Co., Ltd., L. Griffiths and C. J. Morton. Electric switches.
9 278 W. C. Close and P. G. Palmer. Electrically operated driving mechanisms.
9 226 A. Davies. Apparatus for electro-magnetic separation of metals.
9 315 S. G. S. Dicker (N. V. Philips' Gloeilampenfabrieken). X-ray installations.
9 293 Electrolux, Ltd. Evaporator elements of refrigerators. (4/4/28, Sweden.)
9 312 E. Hockheimer. Electric disengaging device for warping machines. (28/3/28, Germany.)
9 341 E. Pohl. Röntgen tube. (31/3/28, Germany.)
9 258 J. H. Reyner. Inductances.
9 361 E. Schmidt. Apparatus for capping carbon rods of dry batteries.
9 296 A. W. Sharman. Electric signalling.
9 298 Siemens and Halske A. G. Recording telegraphic signals. (24/3/28, Germany.)
9 255 Standard Telephones and Cables, Ltd. Metering mechanisms.
9 300 Telefonaktiebolaget L. M. Ericsson. Selector testing circuits. (24/3/28, Sweden.)
9 352 T. H. Woodfield. Electric switches.

March 23rd.

9 420 J. L. Baird and Television, Ltd. Television apparatus, etc. (31/5/28.)
9 430 British Thomson-Houston Co., Ltd. Electric circuit-controlling apparatus. (23/3/28, U.S.)
9 432 Celebritone, Ltd., and H. Green. Radio signal receiving apparatus.
9 434 Celebritone, Ltd., and H. Green. Electrical sound-reproducing means.
9 468 S. G. S. Dicker (N. V. Philips' Gloeilampenfabrieken). Winding coils.
9 469 S. G. S. Dicker (N. V. Philips' Gloeilampenfabrieken). Picture transmission systems.

COMING EVENTS.

Friday, June 7th.

Incorporated Municipal Electrical Association.—Torquay. Annual General Meeting. 10.30 a.m.

Monday, June 10th.

Electrical Contractors' Association (Hastings Sub-Branch).—Lewcock's Restaurant. Ordinary meeting.

Electrical Contractors' Association (Liverpool Branch).—Ordinary meeting, 3 p.m.

Tuesday, June 11th.

Electrical Contractors' Association (Swansea Branch).—Ordinary meeting.

Electrical Contractors' Association (Leicester Branch).—Ordinary meeting.

Wednesday, June 12th.

Electrical Contractors' Association (Eastbourne Sub-Branch).—South. Street. Ordinary meeting.

Electrical Contractors' Association (Sheffield Branch).—Ordinary meeting. 5.30 p.m.

Electrical Association for Women.—Summer outing to Ashford (Kent), by invitation of the Ashford District Branch. 10 a.m.

Polytechnic School of Electrical Engineering.—307, Regent Street, London. Lecture IV (Course of six lectures) on "Thermionic Valves," by Mr. W. H. Date. 6.30 p.m.

Thursday, June 13th.

Optical Society.—Imperial College of Science and Technology, Imperial Institute Road, South Kensington. Experiments, demonstrations and exhibits, arranged by the Technical Optics Department of the Imperial College, 6.30 p.m.; Paper by Mr. W. M. Hampton on "The Beam given by Dioptric Apparatus." 7.30 p.m.

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THE ELECTRICIAN

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[Closed on Saturdays in accordance with the "Five-Day Week" plan adopted by Benn Brothers, Ltd., and its associated organisations.]

No. 2664. [No. 25. Vol. CII.] Friday, June 21, 1929. Annual Subscription, 25s. Overseas, 30s.

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Current Topics.

The E.H.T. Conference.

THE present month is so occupied with conferences of interest to electrical men that some current events within easy reach of our shores are liable to be overlooked. Such a fate seems to have fallen to the Fifth Biennial International Conference on Large Electric High Tension Systems in Paris, where many important topics have been discussed, and although the attendance of British electrical engineers is this year greater than it has been at any of the previous meetings, the comparative smallness of the British party is apt to give a mistaken impression abroad of the ability of our engineers. The Conference exists for the interchange of information and the free discussion of matters of technical interest between government, municipal, consulting and manufacturing engineers, and also professors and others interested in the many and varied problems associated with the operation of big power systems. The special reports of the Conference, printed in this and the preceding issue of THE ELECTRICIAN, clearly indicate the importance of the matters that have engaged the attention of the delegates, and the subject matter of some of the group papers—of which those dealing with researches on oils may be cited as a typical example—demonstrates the value of international conferences as leading to co-ordinated effort, with concentration by the various participants on certain special factors for the benefit of the other researchers. Another interesting point brought out by the congress is the use which can be made of cinema films for instructional purposes. At one of the sessions Messrs. Brown Boveri showed a series of what might be termed progressive films, by the aid of which, beginning with elementary features, such as the mutual attraction or repulsion of conductors, the tendency of a circuit to enlarge itself to open switch links and so on, can be demonstrated in such a way as to be understood by an average child of elementary school age. The A. E. G. at a later sitting showed instructive films on power transmission, and the design and testing of high tension insulators. It almost looks as if, in the future, when a contract of some magnitude is to be let, rival firms will show films "featuring" the operative and constructional virtues of their wares. Even the proprietors of cinemas at home have some social duties towards their clients, many of whom would be glad of something really interesting as a change from the trash served up by so many film renters. In France and in some other countries several of the more progressive power undertakings are giving cinema shows in towns and villages demonstrating the use of electricity, and in view of the enormous sums now being spent in this country on national education and the poor results so often obtained, films on elementary electricity and kindred scientific subjects would undoubtedly be of benefit to the community.

Our Overseas Trade.

THE favourable trade movement indicated in April showed still more certain signs of existence during May, and although the Board of Trade returns reveal that imports exceeded exports by no less than £25 583 679 during last month, comparison with May, 1928, indicates that the balance has been reduced by £3 452 540. Taking the figures for the first five months of this year, imports increased by £7 513 445 when compared with the corresponding period of 1928, and decreased by £4 413 251 when compared with 1927. Exports for the five months showed an increase of £13 089 489 on last year, and £22 489 627 on 1927. Increases were recorded in May under four of the five divisions compared with the corresponding month of 1928, manufactured goods alone accounting for £6 953 333 out of a total increase of £8 882 122, when compared with May, 1928. The returns for the heavy industries were also satisfactory, exports of coal having improved by £778 729 during May, while under the heading of vehicles, which includes locomotives and ships, an increase of £1 810 820 was recorded. Under the section classifying raw materials every item, with the exception of silk, showed an improvement.

The Electrical Position.

ON the electrical side, detailed figures of which are given elsewhere in this issue, exports for May improved by £250 994, while imports increased by £150 672. For the five months of this year the total electrical exports, by comparison with the same period of 1928, improved by £171 277, while imports increased by £350 057, and though these figures are not as satisfactory as we would like, it is consoling to record that during May last exports were £1 231 559 in excess of imports, while for the five months the favourable balance was £5 132 978. The improvement in May export trade was largely accounted for by shipments of wire and cables, other than submarine, which between them, improved by £176 174, when compared with May, 1928. Various electrical goods and apparatus also showed a considerable increase, the amount in this case being £114 395. Bearing in mind the fact

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that Whit-Monday was lost as a working day during May these figures may be regarded as satisfactory in spite of the many orders which will have been withheld pending the arrival of visitors from overseas whose destination is the North-East Coast Exhibition.

Radio Trade and the Wavelength Problem.

CONSIDERABLE publicity has been given in the daily Press to the view that the forthcoming wavelength changes will result in many listeners being unable to separate the London and Daventry (5GB) programmes. Had the changes been proposed some four years ago we might have agreed that there was cause for alarm, but the present understanding of the selectivity problem renders any such anxiety unnecessary. The attitude adopted by many daily newspapers to the effect that all existing receivers will shortly become useless is likely to do considerable harm to a trade that is already feeling the annual competition of summer sports, and many sales may be withheld in consequence. No one will buy an expensive receiver believing that in a few months time it will have become obsolete, and though, in fact, there is no foundation for such belief, the sense of caution is already beginning to show itself. Electrical contractors should realise that radio manufacturers have so developed their tuning circuits that the separation of stations whose wavelengths give a difference of over 20 metres is not likely to give difficulty, and can furthermore be demonstrated to potential customers by tuning to stations already operating within that limit. In the case of 2LO and 5GB the difference in wavelengths will be over 20 metres, and, though we do not suggest that the average crystal set or direct coupled valve receiver will give separation, neither of these two instruments should be regarded as efficient in the light of present practice. The all-mains designs, the three and four valve cabinet sets are all, to the best of our knowledge, sharp in their tuning and free from pick-up, and though 2LO and 5GB will be using powers which will give results out of proportion to any comparison which can at present be made, manufacturers have not overlooked the coming of the regional schemes, nor have they neglected the question of selectivity as applied thereto.

An E.T.B.I. Competition.

THAT deserving organisation, the Electrical Trades Benevolent Institution, is to be associated with a competition which we feel sure will not only be popular amongst those directly engaged in the electrical industry but, once attention is drawn to it, also amongst those many crossword and other puzzle enthusiasts outside it. The Committee of the Institution has considered means whereby more funds can be raised, and amongst such schemes which have been decided upon is one which in competition form possesses a desirable electrical atmosphere without requiring of its entrants any specialised electrical training. The competition, in brief, calls for an average general knowledge, and that understanding of road maps which, in these present days, is possessed by almost everyone, in particular motor enthusiasts. The competition is a novel and ingenious idea which has every prospect of being a financial success, and is furthermore being well supported by electrical and other companies in the matter of prizes. The rules are simple and there is no entrance fee, a voluntary donation of half-a-crown to the funds of the Institution entitling one to a competition ticket. The good work done by the E.T.B.I. has already been the subject of comment in these columns, and it is expected that the electrical industry as a whole will not only take an active part in the competition referred to, but will also make a special point of drawing the attention of others to both the contest and the cause it is designed to benefit. That we wish the competition every success goes without saying, for in no instance has the E.T.B.I. failed to give relief to a deserving case, but has, on the other hand, done, with the comparatively little cash available, such good work as to make its members proud of their association with the organisation. The fact that competitions to raise money for the fund are necessary in such an industry as ours is not to our credit; let us make sure, then, that the contest will be such a success, that the publicity given to the Institute will be so wide, that at no future date will a similar scheme be necessary.

Illumination Design Courses.

THE large attendance at the Nineteenth Illumination Design Course of the E.L.M.A. Lighting Service Bureau, which was held last week, is testimony to the appreciation of the value of such courses. Of the total of 120 attending, the electricity supply interests contributed 24, electrical contractors 50, and manufacturers 46. When it is remembered that of these numbers many were compelled to stay at hotels during the period of the course, at their own, or their employers', expense, it will be realised that the question of illumination is one which is being very seriously considered by all branches of the industry, and rightly so. The course just concluded is voted the most successful yet held, and it is due in no small part to the enthusiasm of the Lighting Service Bureau that such attendances and interest are possible. The teachings of the Bureau have already made their mark in many directions and the forms of illumination now being installed, by contractors in the domestic, commercial and industrial worlds all show with striking clearness the shortcomings of the older methods. The illustrations which we produce from time to time of lighting effects designed by the E.L.M.A. Lighting Service Bureau, and others, indicate the trend of modern thought in the matter of illumination, and with a view to still further developing this side of the industry the Designs Courses are invaluable. The Lighting Service Bureau is deserving of congratulation and every encouragement, as also are those who were enterprising enough to sacrifice their time and money in order to attend last week's course in the cause of better lighting.

Electricity Supply Statistics.

THE engineering and financial statistics of the electricity supply industry, just published by the Commissioners and reviewed elsewhere in this issue, show that since the last return the numbers of undertakers holding powers of supply has increased from 593 in 1925-26 to 621 for 1926-27, the year under review. Of the latter number 367 were local authorities and 247 company undertakings. The stage of development attained by these undertakings in 1926-27 was represented by a connected load of approximately 185 W per head of estimated population, a maximum demand of about 74 W, and the sale to consumers of 133 units per annum. The total capital expended at the end of 1926-27 on such development represented an average of over £5 per head of total population, 42% being in respect of generation and 58% in respect of transmission, distribution, etc. The production of public supply involved the operation, by local authorities, of as many as 482 generating stations, containing an aggregate 4 682 069 kW of plant of which upwards of 98% was steam driven. With regard to the concentration of generating plant, 61% was contained in 57 stations, each having an installed capacity of 25 000 kW or over, and 39% was distributed between the remaining 425 stations, of which 198 had an installed capacity of less than 1 000 kW each. A net addition of about 260 000 kW was made to the plant capacity of authorised undertakings during the year 1926–27 as compared with an average annual increase of about 360 000 kW in the previous five years. Further progress was made in the equipment of generating stations with large modern units of plant and at the end of 1926-27 about 40% of all the plant installed consisted of steam turbo alternator sets having capacities of 10 000 kW or over. The industry was responsible for the direct employment of nearly 49 000 staff and workmen, this being an increase of about 3 900 in the number employed as compared with an average increase of 3 000 in each of the preceding years. The industry thus involved, on an average, ten persons for every 1 000 kW of generating plant installed.

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THE HIGH TENSION CONFERENCE IN PARIS.

Insulation Problems in Connection with H.T. Synchronous Generators—Dielectric Losses in Relation to Temperature—The Use of Auxiliary Insulating Tubes.

By THEODORE RICH, A.M.I.E.E.

(*Continued from page 729.*)

THE INSULATION OF LARGE HIGH TENSION SYNCHRONOUS GENERATORS.—By G. J. T. Bakker (of the Electricity Supply Services at the Hague) and J. C. Van Staveren (Director of the Association of Power Enterprise Managers of Holland).—This paper is the outcome of discussions on generator insulation which took place at the 1927 conference, when objections were raised regarding the testing of generator windings to high tensions as tending permanently to injure the insulation. The authors took up the investigation regarding coil insulation improvement and the means by which improved coils could be incorporated in machines.

The authors are of opinion that the pressure tests accepted by the International Electrotechnical Commission of twice the working pressure plus 1 000 V for several minutes is not sufficient. Objections have been made to such increased insulation as may be necessary to stand higher tests, on the ground that heat dissipation is checked and the mechanical strength of end winding due to the increased extension of the conductors beyond the stator ends is decreased.

The authors are not in agreement with such objections, as an intermittent earth in a junction box or through saline deposits on insulators with overhead lines can give rise to over-tensions of comparatively long duration.

In Holland, where the generating pressure is 10 000 V and connection is made direct to large networks without the intervention of transformers, not less than 24% of the generators in operation have had breakdowns, half in stators and half in rotors. These have not all been due to punctures to earth or between turns, but some to mechanical strains resulting from short circuits. Therefore it was found to be absolutely necessary to make improvements in coil insulation. Recently, as the result of an accidental ground on an aerial line of small importance, a large modern generator at the Hague power station was seriously damaged by a short between end-coils.

For some years supply authorities have been gradually raising the dielectric resistance of their networks, but corresponding improvements have not been made regarding the insulation of generators, so that they remain weak points on systems.

The authors have conducted tests on separate insulated bars and coils. Owing to difficulties through infiltration at end turns water is undesirable as a medium for testing, and the difficulty was got over by a layer of soot and lac covered with tin foil, the latter worked into the insulation with brushes. The insulated bar thus prepared is introduced into an artificial generator slot and placed inside an iron tube with plugged ends; the temperature is raised by means of a series of gas jets.

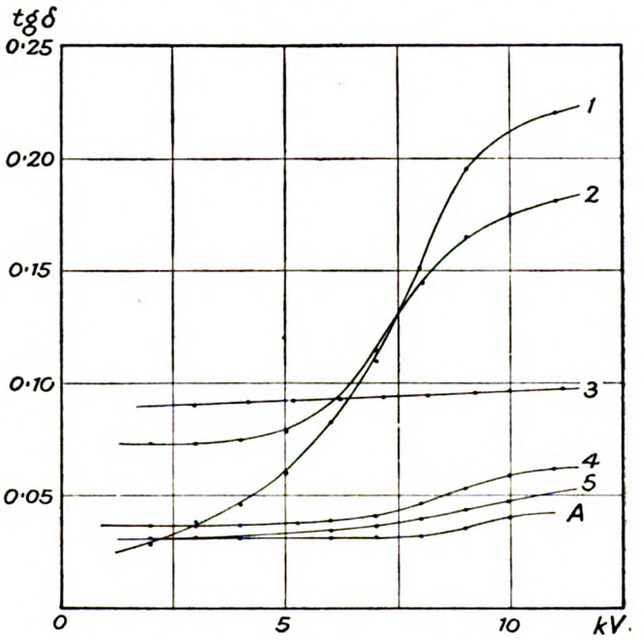

Fig. 1.

Several makers supplied test bars, and tests were made with a Schering bridge with the bars as received at room temperature, at 80 deg. C. (176 F.), and again when cold. The temperature of the bars was measured electrically.

Tests showed that the dielectric losses increased greatly with the temperature returning to values very close to those first observed. This seems to be due to the fact that the slot

One of the sessions of the High Tension Congress at Paris. The modern decorations with the new type of wall lighting fittings of pressed glass should be noted.

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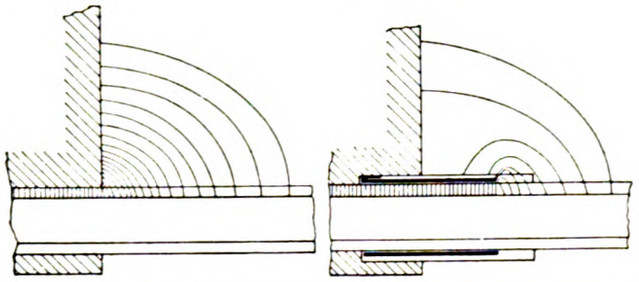
rigidity prevents delitation as similarly tested bars not in a slot show largely increased losses after heating and cooling have taken place.

It is important to eliminate as far as possible spaces between the mica sheets in which ionization could take place. The improvement on slot insulation can be made with hot irons, but, if carried too far, the mica may be pulverised. Very careful methods, especially with binding machines, can give greatly improved results. Fig. 1 shows tests of slot resistance losses taken at 20 deg. C. (78 deg. F.) made in the works laboratory of a generator maker, the curves 1 to 5 showing successive improvements in slot insulation. The sample tested for curve A was repeatedly ironed. The dielectric losses were reduced but so was the puncture voltage (owing to damage to the mica) showing that a losses test must not be relied on solely. Although tests 3 to 6 are inferior to tests obtainable with h.t. cables they show that, with careful manufacture, bars free from ionisation under working conditions with insulation 5 mm. thick can be made suitable for working pressures of 10 000 V and over, although mica is not so liable to attack as the paper in cables. For the bars examined, the tension at which ionisation begins so greatly exceeds the working pressure, that one can now be satisfied that at working pressures and temperatures such difficulties can be avoided, and for the last four generators of 25 000 to 30 000 kVA at 3 000 revs. and 10 000 V, which are on order for stations in Holland, will be satisfactory in this respect. To avoid ionisation between slot insulation and slot surface the former is covered with a semi-conducting layer.



Figs. 2 and 3, showing lines of force with air auxiliary insulating tube with conducting layer, as compared with insulation of normal type.

Tests at 55 000 V.

Further, to judge the quality of insulation, time tests for puncture and flash-over were used. To reduce field stresses the bars and their protruding ends can be covered with a semi-conducting envelope such as silicium carbide. By such means a bar with insulation 5 mm. thick has withstood a test of 55 000 V for 4 hours, and a bar end a similar test of 40 000 V for 4 hours.

Fig. 3 shows lines of force with air auxiliary insulating tube with conducting layer, of a type made by the A.C.E.C. of Charleroi as compared with insulation of the normal type, Fig. 2. The use of auxiliary insulating tubes at the ends of bars tends to increase both their electrical and mechanical resistance.

In the discussion Mr. GOODLET said that a power factor test gives average results only and does not necessarily prove the absence of small bad places or voids which may give trouble in time. He also pointed out that end windings gave more trouble than slot insulation.

Mr. WILCZEK (of Buda Pesth) said that too much reliance on power factor tests might force manufacturers to adopt insulation of a type that might not stand up to temperatures such as 115 deg. C.

Mention was made by M. MAGRINI of h.t. machines which had been at work in Italy for 25 years, despite the fact that dielectric loss tests had never been made. He also mentioned the 33 000 V Parsons-Rosen alternators recently installed in England, at the Brimsdown station of the North Metropolitan Electric Power Supply Co.

M. DARREUS (of Paris) said that the design of alternators had been influenced by the lack of appreciation of factors relative to dielectrics, and that it was only recently that the systematic study and research regarding dielectrics had begun to be carried out in a way comparable to those regarding iron losses which had been taking place for a considerable number of years.

Mr. BAKKER said he believed in a combination of Cos φ and pressure tests. The tight clamping in the slots prevented the trouble of formation of voids through swelling and subsequent cooling.

FRENCH STATIONS USING HIGH PRESSURE AND HIGH TEMPERATURE STEAM. By M. Dubertret, of Paris.—The author pointed out that in accordance with the doctrine of Carnot the temperature range in steam stations is being increased by the use of higher temperatures and pressures and better vacuum at the exhaust end; the theoretical limit of efficiency with 35 deg. C. (0·85 lb. absolute) at the condenser and 300 deg. C. and 1 251 lb. per sq. in. absolute at the steam end, being 38·5% under Rankine's cycle as compared with 31·2% with 200 deg. C. and 16 kg. (227 lb. per sq. in.) absolute, the efficiency being materially influenced by bled steam for feed heating and inter-stage superheating.

During the year 1928 orders were placed with French makers for 34 turbines with an output of 360 000 kW for plant working between 400 and 420 deg. C. and 422 and 570 lb. per sq. in.

Some of these are two-cylinder turbines; others are arranged to supply a mid-pressure range. Material developments have been and are still taking place regarding the efficient combination of the functions of boilers, reheaters, evaporators and de-aerators.

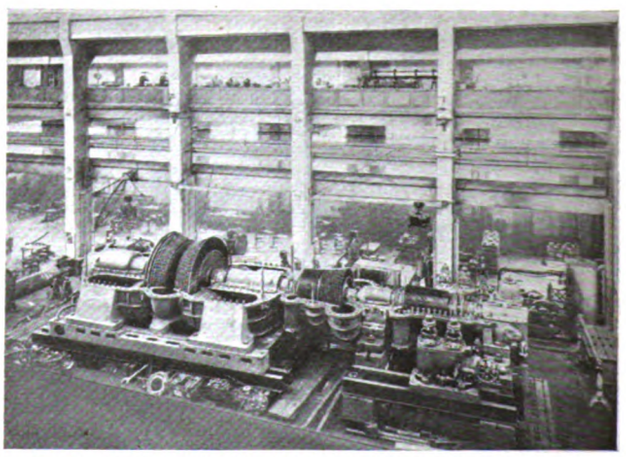
An interesting unit is being installed for the Compagnie Parisienne at Issy-les-Moulinaux. It is of the Brown-Boveri type 35 000 kW capacity at 1 500 r.p.m., and is to be fed with steam at 35 kg. (497 lb.) at 425 deg. C., the feed water being heated up to 170 deg. C.

The operating conditions usually met with in France, especially regarding power and load factors, have not yet justified the use of the much higher pressures to be found in some German and American stations.

The Discussion.

In the discussion, M. MEYER said that beyond 450 to 475 deg. C., there was a tendency for metals to creep, there being a modification of molecular structure tending to shorten life, necessitating the study of special alloys to counteract this effect. It was pointed out that the study of the properties of metals at very high temperatures brings nearer the advent of the gas turbine. M. NICOLINI said he had seen an installation which had been in operation for a year at 100 kg. per sq. cm. (1 400 lb. per sq. in.), and he was informed that the steel used for the pipework, etc., was of a hard commercial quality, 60 to 67 kg. per sq. cm. (38 to 42 tons per sq. in.) resistance.

Senor CARLO CHIODI, of Milan, presented a paper on a filter bridge for measuring alternating current waves, which form a residue beyond those which are perfectly sinusoidal, and on continuous curves of tensions which are not perfectly constant. This paper dealt with a modification of the measuring bridge originally proposed by M. Belfils, which he used for the measurement of the higher harmonics. The power required for the measurements has been made lower than would be otherwise necessary through the adoption of a thermo-couple milliamperemeter in lieu of an electrodynamometer voltmeter. The system is explained and analysed, and examples given. The bridge is so arranged that only currents which are outside those of regular frequency and form pass through the measuring branch.



Three cylinder turbines, 35 000 kW., under construction at the works of the Compagnie Electro-Mecanique (Brown Boveri) at Le Bourget, Paris, for the Issy-les-Moulinaux power station of the Cie Parisienne.

(To be continued.)

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ELECTRICITY SUPPLY STATISTICS.*

Electricity Commissioners' Return of Engineering Statistics Covering Authorised Undertakings for Period 1926-27.

THE Return just published by the Electricity Commissioners, of engineering and financial statistics relating to electricity supply in Great Britain, covers all authorised undertakings holding statutory powers at the end of 1926 in the case of company undertakers, and 1926-27 in the case of local authority and other undertakers.

The Return points out that the number of separate undertakings authorised by existing Acts and Orders largely exceeds the number of undertakers holding the powers, but for the purposes of the statistics reviewed it has been necessary to adopt a reduced figure for the number of undertakings in operation. Allowing for cases where the same undertakers hold power of supply not only in England but also in Wales and Scotland, the Return deals with 621 separate authorised undertakers.

At the end of 1926-27 supplies were being given or had been commenced in 566 cases, representing an addition of 30 (19 local authorities and 11 companies) to the number at the end of 1925-26, the period of time covered by the last return. Apart from the Central Electricity Board there were 54 cases in which powers had not been exercised, while in 36 instances the statutory powers of supply were obtained subsequent to 1924. The company undertakings dealt with in the Return include one company possessing bulk supply powers only, and 28 power companies, of which 29 companies, 22 were supplying at the end of 1926-27. In certain of the remaining cases powers were in process of being exercised.

The figures quoted are based upon: (a) Where the component undertakings relate to contiguous areas of supply, they have been regarded as constituting one combined undertaking; and (b) where the component undertakings relate to geographically separated areas with independent sources of supply, they have been counted as separate undertakings.

On this basis, the undertakings of the 339 separate local authorities (including joint boards) who were supplying at the end of 1926-27 are regarded from the engineering standpoint as numbering 339; while those of the 227 separate companies who were then supplying are similarly regarded as numbering 257, making 596 undertakings in all.

Number of Generating Stations.

The generating stations belonging to authorised undertakers in Great Britain, of which particulars are given in the return, numbered 482 in all, local authorities owning 272, and companies 210 stations. The total capacity of the plant installed at the end of 1926-27 was 4 682 069 kW, the division of this total being local authority stations 3 157 031 kW and company stations 1 525 038 kW. The additions to the plant capacity during the year was mainly accounted for by extensions of existing stations, and amounted to 260 467 kW. Of this total 2 821 kW was accounted for by adjustments in the ratings of generator sets included in previous returns. An analysis of the types of prime movers and generating plant installed in all stations, subdivided between the stations of local authorities and of companies, is given and compared with the position at the end of 1925-26, there was an increase of 305 445 kW in the amount of steam turbine plant, a decrease of 55 109 kW in the amount of reciprocating steam plant, and an increase of 9 361 kW in the amount of oil engine plant. The total generating plant installed at the end of 1926-27 was subdivided as follows, namely: A.c. plant, 4 348 400 kW, or 92·88% of the total; and d.c. plant, 333 669 kW, or 7·12% of the total. During the year there was an increase of 298 461 kW in the amount of a.c. plant and a decrease of 37 994 kW in the amount of d.c. plant. The latter comprised units having rated capacities ranging from a minimum of 6 kW to a maximum of 6 000 kW. The a.c. plant comprised units having rated capacities ranging from a minimum of 10 kW to a maximum of 40 000 kW. The predominant sizes of the units installed are given, from which it may be observed that 133 a.c. units of 10 000 kW or over were installed by authorised undertakers, the aggregate capacity of the units in question amounting to 1 875 250 kW, and representing about 40% of the total capacity of the plant installed by all authorised undertakers.

A classification is given in summary form of the voltages of a.c. and d.c. generation at the 482 generating stations dealt with in the return, of which 156 stations generated a.c. only, 103 both a.c. and d.c., and 223 d.c. only. Of the 259 stations at which a.c. was generated, in 159 cases a voltage of 6 000 V or upwards was adopted either wholly or in part, a large majority of these cases representing three-phase 50-cycle generation at 6 600 V. In 15 cases a.c. generation was carried out at voltages below 650 V, and in 76 other cases at voltages below 650 V, and in 76 other cases at voltages ranging between 1 000 and 3 000 V. With regard to d.c. generation, the voltages in the majority of cases ranged from 400 to 550 V, but as many as 65 stations contained d.c. plant generating at pressures not exceeding 250 V. At two company stations d.c. generation was carried out at high tension at voltages over 1 000 V.

The Frequency Position.

The generation of a.c. was carried out by authorised undertakers at 14 different frequencies, the accepted standard frequency of 50 cycles per second being the predominating one and in vogue at 233 stations, the other principal frequencies being 25 cycles (18 stations) and 40 cycles (11 stations). As compared with the position at the end of 1925-26, there was an increase of 218 611 kW in the amount of 50-cycle a.c. plant installed, and an increase of 79 850 kW in the amount of non-standard a.c. plant. The aggregate capacity of the 50-cycle generating plant installed at the end of 1926-27 was 3 338 526 kW as compared with a total of 1 009 874 kW for all other frequencies, representing respectively 77% and 23% of all the a.c. plant installed. The predominating non-standard frequencies of 25 cycles and 40 cycles together accounted for 903 760 kW, or over 89% of the non-standard plant. It will be observed that over 71% of all the a.c. plant installed was three-phase 50-cycle plant.

An analysis of the systems of supply adopted at the 596 undertakings is given in the return, and excluding the Bournemouth undertaking, where supplies were given for public purposes only, the systems of the other 595 undertakings were a.c. only in 177 cases, a.c. and d.c. in 234 cases, and d.c. only in 184 cases. In the case of 20 undertakings (15 local authority and 5 company undertakings) where supplies to ordinary consumers were given on the d.c. system only, generation was carried out wholly or in part on the a.c. system, or an a.c. bulk supply was taken and converted to d.c. for distribution. While a.c. generation was carried out by authorised undertakers at 14 different frequencies, supplies of 16 different frequencies were distributed. In one of the additional cases, a bulk supply at 33⅓ cycles per second was obtained by the undertaker from a railway generating station, and in the second case, where the supply system was in process of being changed from 77-cycle a.c. to 50-cycle a.c., supplies at the former frequency were still being given through frequency changers. At the end of 1926-27, supplies at two or more different frequencies were being given by 21 undertakings, but in a number of these cases steps were in progress by the undertakers to eliminate the non-standard frequencies.

The principal declared voltages at which supplies were given to consumers, including cases of h.t. supplies and of bulk supplies, the predominating voltages for low and medium pressure supplies were: (i) A.c. supplies: 400 V (181 undertakings); 230 V (168 undertakings); 240 V (73 undertakings); and 200 V (69 undertakings). (ii) D.c. supplies: 240 V (133 undertakings); 460 V (113 undertakings); 220 V (91 undertakings); 240 V (80 undertakings); and 480 V (69 undertakings).

The preceding figures include 159 cases (129 local authority and 30 company undertakings) in which a.c. supplies were given at 400 and also 230 V; and 113 cases (86 local authority and 27 company undertakings) in which d.c. supplies were given at 460 and also 230 V. The diverse character of the declared voltages in force at the end of the period covered by this return is indicated by the fact that low and medium pressure supplies at voltages ranging from 100 to 480 V were being given at 35 different voltages in the case of a.c. supplies, and 24 different voltages in the case of d.c. supplies, the total number of declared voltages within the range in question for both classes of supply, taken collectively, being 40. These figures include associated pairs of voltages. It may be noted

* Electricity Supply, 1926-27: H.M. Stationery Office. Price 12s. 6d. net.

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there were 10 declared voltages exceeding 100 V but less than 200 V, and 17 declared voltages exceeding 200 V but less than 400 V. Taking account of declared voltages ranging from 100 to 480 V only, 206 undertakings (142 local authority and 64 company undertakings) were operating with three or more declared voltages within the range in question, 97 having four or more declared voltages, and 28 having five or more different declared voltages.

Particulars are given of the amount of energy generated and purchased by authorised undertakers during 1926–27, the amount sold in bulk to distributors for retail to consumers, the amount used on works by undertakers, the net sales to consumers, and the amount of energy lost in transmission, distribution, etc., and unaccounted for. The number of the units generated showed an increase of about 5½% on the figures for 1925–26. The total units generated by local authorities and companies respectively were approximately in the ratio of the capacities of the generating plant installed by the two classes of undertakers. The sales to consumers in 1926–27 were nearly 5% more than in 1925–26. The figures bear evidence of the effects of the prolonged coal strike and unsettled industrial conditions in 1926–27, the actual increase of 262 million units sold, as compared with the previous year, showing a marked falling off from the average increase of about 620 million units per annum during the four preceding years. As compared with the previous year the sales of electricity for lighting and domestic purposes increased by 199 million units, while the sales for power purposes showed an increase of 7 million units only.

For Great Britain as a whole, on the basis of the estimated population of 44 million in 1926, the sales of electricity by all authorised undertakers in 1926–27 represented an average consumption of approximately 133 units per head of population, as against 82 units per head in the year 1920–21.

As compared with the previous year, the sales of energy in bulk more than doubled in 1926–27, the actual increase amounting to 616 million units. Of this total, over 400 million units were sold by the London Power Co., Ltd., to its constituent companies.

The figures for 1926–27 represent, on an average, a maximum demand of the order of 74 W per head of the estimated population in 1926.

The statistics indicate that economies continued to be effected in the utilisation of fuel at steam-driven generating stations during the year under review, but that improvements in this direction were more than offset by the increased cost of coal. Public supply undertakings were consumers of coal and coke to the extent of over 7 000 000 tons in 1926-27, and the average cost of such fuel amounted to 31s. per ton, as compared with 18s. in 1925-26. The analyses of the average costs of generation given in the present and previous returns emphasise the importance both of fuel economy and also of fuel cost upon the working expenses of authorised undertakers, and hence upon the prices at which energy can be supplied to consumers.

The total expenditure charged to capital account by authorised undertakings amounted at the end of 1926-27 to £238 727 634, of which 42% was in respect of generation and 58% in respect of transmission, distribution, etc. The average expenditure for all purposes per kW of generating plant installed was £51, the corresponding figures for local authority and company undertakers being £48·4 and £56·2 respectively. The capital expenditure during the year 1926-27 amounted to over £21 000 000, an increase of about 10% on the expenditure at the end of 1925-26. The average revenue in 1926-27 from the working of all authorised undertakings per £100 of capital expenditure amounted to £21·2, this figure being reduced to £19·2 if revenue from the intersale of energy in bulk between authorised undertakers is excluded. The actual revenue in 1926-27 was about £50 000 000, as compared with a figure of about £43 000 000 in 1925-26. The total revenue from working in 1926-27 represented an average of 1·71d. per unit sold, the corresponding figure for the previous year being 1·66d.

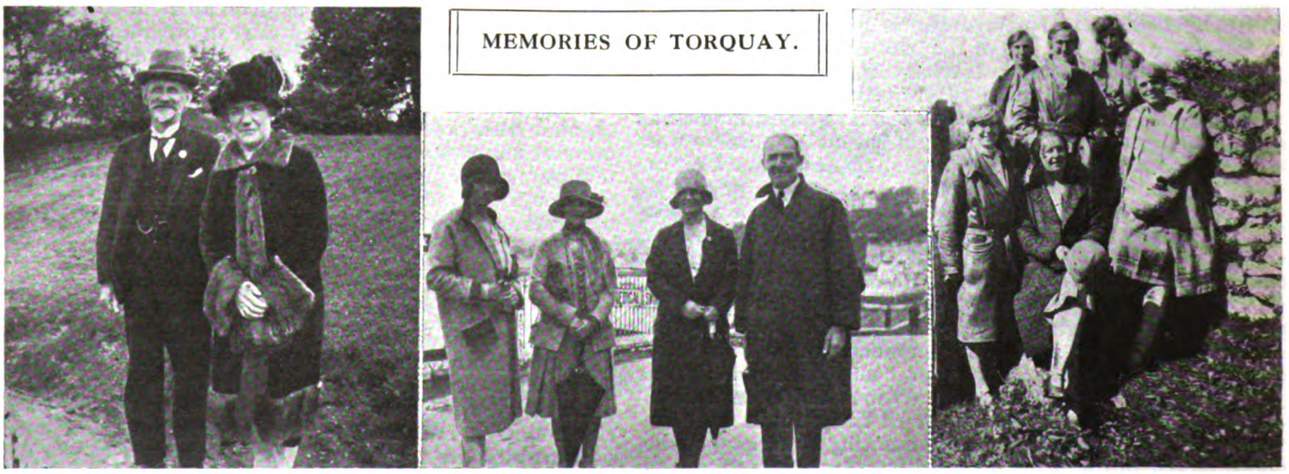
Mainly on account of the higher prices for coal during the year, the total working expenses (including the cost of all energy purchased in bulk by authorised undertakers but excluding capital charges) absorbed 66% of the corresponding revenue from working in 1926-27, as compared with 57% in 1925-26. The outstanding working expense was the cost of generation, this item accounting for over 47% of the total. Of the other principal items, distribution, management, and rents, rates and taxes respectively accounted for substantially equal percentages of the working expenses. The excess of revenue from working over working expenses represented 7·2 on the capital expenditure at the end of 1926-27, as compared with 8·5% in the preceding year.

In the case of local authority undertakers, the gross surplus which in 1926-27 represented 34·8% of the total revenue, was itself appropriated to the extent of 41·9% for interest charges on loans and deposits; 49·7% for repayment of loans and transfers to sinking funds and to reserve and renewals funds; 11·5 % for capital expenditure; and 5·1% in relief of local rates, the latter item representing a net contribution of £551 593. These appropriations involved a decrease of over £890 000 in the balances on net revenue account.

In the case of company undertakers, the gross surplus in 1926 represented 37·7% of the total revenue, and was appropriated to the extent of about 64% for interest charges and dividends, and to the extent of approximately 30% for transfers to depreciation and reserve funds. Some 3% of the gross surplus represented the increase in the balances on net revenue account. The average rates of the preference and ordinary dividends calculated on the corresponding capital raised at the end of 1926 were 5·58% and 7·4% respectively.

The position at the end of 1926-27 was that the capital (or loan) accounts of authorised undertakers were overdrawn to the extent of nearly £12 000 000; the balances in depreciation, reserve and renewals funds, including sinking funds in the case of local authority undertakers, amounted to upwards of £23 000 000; and the balances on revenue account amounted to over £1 800 000.

MEMORIES OF TORQUAY.



THESE snapshots, taken during the I.M.E.A. Convention at Torquay, show left, Mr. and Mrs. Taylor, who entertained members of the Electrical Association for Women on Thursday afternoon; Mr. Taylor is chairman of Torquay Electricity Committee and Mrs. Taylor is to be a member of the proposed new Torquay Branch of the Electrical Association for Women. The centre picture shows Lt.-Col. and Mrs. W. A. Vignoles and Mrs. Wheelwright (Blackburn), while on the right are Miss Partridge, Miss Rowbottam and a group of apprentices.

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NATIONAL PHYSICAL LABORATORY.

Novel Exhibits shown on Annual Inspection Day—Many Demonstrations of Measuring Apparatus—New Short Wave Equipment—X-ray Protective Materials—Power Equipment for High Voltages—Standards for Telephonic Frequencies.

THERE was a considerable gathering at the National Physical Laboratory, at Teddington, on Tuesday, on the occasion of the annual inspection by the General Board, when the following experiments and apparatus were shown in the departments named.

ENGINEERING DEPARTMENT: Here were shown an electrical method of integrating the intensity of the pressure of the wind over a large area and an efficiency test of the reverse gear of a heavy lorry gear-box, using a 100 H.P. electric dynamometer and Froude brake. Estimation of efficiency by the torque difference method and apparatus for the determination of the elastic constants of single crystals of tungsten by oscillation methods were also shown, while experiments on the X-ray examination of stressed single crystals; the determination of the rates of creep of nickel-chromium, stainless chrome-vanadium steels and " staybrite " (to 600 deg. C.), duralumin and phosphor bronze (to 500 deg. C.), and Muntz metal (to 350 deg. C.); creep tests on Armco iron to determine the relations between strain hardening, temperature hardening, stress, rate of creep, etc.; creep tests at 800 deg. C. on nickel-chromium and nickel-copper alloys in an atmosphere of hydrogen, and creep tests on a superheater drum steel in superheated steam at 400 deg. C.—500 deg. C, formed other items of interest.

METALLURGY DEPARTMENT: The exhibits here included a study of alloys for use at high temperatures; specimens of cast and wrought alloys prepared at the laboratory; graphs of properties; microstructures of metals and alloys shown as transparencies; methods for the determination of surface tension of molten metals; thermal curves and X-ray crystal structure models; mechanism of age-hardening; a study of the changes in properties during age-hardening in aluminium alloys; potentiometer-type temperature recorders; and methods of making contacts for the study of electrical resistivity at high temperatures.

Measuring X-ray Energy.

PHYSICS DEPARTMENT: Among items to be seen in this department were methods of determining thermal conductivities of furnace materials; specific volumes of refrigerants; thermal and electrical conductivities of alloys up to 800 deg. C. Another exhibit demonstrated sound pulse photography in its application to the acoustics of buildings; and a three-dimensional model of an auditorium for the investigation of acoustical properties was exhibited. Cathode-ray tube apparatus was featured and the measurement of the speeds of vacuum pumps was demonstrated. Other demonstrations were the measurement of the energy of X-rays employing a valve-rectifier and condenser-smoothed generator. Thermal conductivity of insulating materials. Testing of radiation pyrometers; thermo-couple testing equipment was shown, as well as a valve-controlled high-frequency vacuum furnace for determining international standard freezing points at high temperatures. The testing of X-ray protective materials and the investigation of the scattering of X-rays, together with methods of testing X-ray protective materials at voltages above 100 kV on the X-ray tube, were inspected, while X-ray crystal analysis with special reference to industrial problems, the testing of X-ray pastilles and the measurement of X-ray intensities in terms of the International Unit, and alpha-ray tests of radio-active materials were also seen.

ELECTRICITY DEPARTMENT: In this department were shown standard alternating current apparatus in operation; precision current transformers with nickel-iron cores; a precision voltage transformer (ratio 0·5, 1 and 2 to 100 V) with nickel-iron core; 200 A non-inductive air-cooled resistances; a design of mounting of standard oil-sealed resistances for 1 Ω and upwards; precision resistances ranging up to 10 000 Ω constructed of two materials of opposing temperature coefficients, and standard water-cooled resistances for 10 000 A. In the High Voltage Building, power equipment for high voltages, single, two and three-phase was shown, together with apparatus for the measurement of peak voltage; a shielded air condenser for 150 kV; a water tube resistor for 150 kV of zero effective inductance; while three-phase phenomena at high voltages was another exhibit. Amongst the items relating to lighting were life testing of electric lamps; measurements of luminous flux; spectrophotometry; a vacuum furnace for spectral energy measurements and a ten-foot sphere for testing lighting fittings. In the Electrical Standards and Measurements Division of the department the main items of interest were a series of standards of self and mutual inductance for work at the higher telephonic frequencies; the measurement of the effective resistance and effective inductance of coils at the higher telephonic frequencies; the balancing of earth capacity effects in the comparison of unequal mutual inductances at the higher telephonic frequencies; the measurement of the increase in the inter-electrode capacities of thermionic valves due to the presence of the space charge; equipment for accurate calibration of wavemeters and other radio-frequency standards, including auxiliary generators for frequencies up to 50 by 10 cycles per second.

Further Measuring Equipment.

Other items were a Schering bridge suitable for frequencies from 50 to 1 000 000 cycles per second, for measurements of permittivity and power factor of dielectrics; effective resistance and capacity of condensers; effective resistance and reactance of high impedances such as radio-frequency chokes, and of other inductive coils; an interferometer for the examination and measurement of the deformation of piezo-electric resonators and oscillators of various forms; apparatus for the measurement of the piezo-electric constant by statical pressure on plates of quartz; a beat tone oscillator forming a source of alternating current of smoothly variable frequency from 25 to 10 000 cycles per second, of good wave form and constant voltage of about 100 V; equipment for the measurement of the amplification of valve amplifying systems for frequencies between 25 and 6 000 cycles per second. The phase displacement between input and output voltages was also measured; while equipment for the measurement of current and effective resistance at radio frequencies; a temperature regulated oven and enclosure for temperature control of apparatus and dielectric specimens under radio-frequency test were also exhibited.

Equipment for testing the permeability and hysteresis of materials by ballistic galvanometer methods, including magnetic testing yoke and magnetising coil with windings for producing very uniform magnetisation of test bars and strips was another exhibit, together with special switchgear for obtaining permeability curves and hysteresis loops on bars and strips of high permeability material under conditions of uniform magnetisation. Equipment for measurement of the total power losses at power and telephonic frequencies in magnetic sheet materials by wattmeter methods was also shown, this equipment including apparatus for the determination of form factor, whereby the losses may be separated into their hysteresis and eddy current components. A Campbell bridge for the measurement of a.c. permeability and total power losses at power and telephonic frequencies, and apparatus for the determination of the electrical properties of insulating materials were also exhibits of considerable interest.

Portable Wireless Transmitters.

In the Wireless Division the exhibits included a portable wireless direction finder, with a wavelength range of 40 to 2 000 metres; a portable transmitter having a wavelength range of 30 to 2 000 metres, for use in field experimental work. Amongst the experimental short wave transmitting and receiving apparatus were transmitters with a wavelength range of 1·8 to 100 metres; receivers with a wavelength range of 4 to 100 metres; a Lecher wire system for wavelength measurements; laboratory valve oscillators for the generation of undamped or modulated oscillations with a wavelength range of 4 to 20 000 metres; sensitive apparatus for the rapid measurement of the capacity and power factors of condensers; and cathode-ray oscillograph equipment for the delineation of alternating-current wave forms. There was also inspected a screened room for containing receivers under test and a screened cabin containing radio and audio-frequency oscillators for overall tests on wireless receivers.

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THE I.E.E. SUMMER MEETING.

Visits to the Paris Power Stations—Experiments at 1 000 000 V—The Ivry Power Station—Interesting Transformer Designs.

THE summer meeting of the Institution of Electrical Engineers took place in France by the invitation of the Société Française des Electriciens, and began on Tuesday, June 11th, when a party of about 100 members and their friends left Victoria Station in the morning, arriving in Paris about 4 p.m. the same afternoon. The meeting of the Institution was divided into two parts, the first of which took place in Paris up to Saturday, June 15th, the remainder of the time in France being spent in a journey to points of interest in the Pyrenees, to be completed on June 23rd, when the party is due to arrive back in London.

On June 12th, one party visited the power stations at St. Ouen and Gennevilliers, the former being the principal station for the supply of lighting and industrial power for Paris proper, the latter giving a supply in the main to the suburbs outside the line of the old walls and for many miles radius round the city.

Saint Ouen.

The Saint Ouen station belongs to the Compagnie Parisienne de Distribution d'Electricité, generally known as the C.P.D.E.; this company is an amalgamation of a series of companies which operated at several frequencies. The original station contained eight turbines of 10 000 12 500 kW at 1 255 r.p.m., giving a frequency of 41⅔ per second, and was equipped with 40 boilers, 30 of which were of the Babcock type, the remainder being of the Delaunay Belleville type.

The auxiliaries of this section are electrically driven. After the war a new station was arranged alongside the old one to deal with the rapidly increasing load and units of 30 000 kW were chosen, with an overload capacity of 35 000 kW at Cos φ 0·08, arranged to operate at either 1 255 r.p.m. 41⅔, or at 1 500 r.p.m., 50 periods, so that the units could be changed over with sections of the area. The boilers are of the Sterling-Fives-Lille and Sadd-Belleville types, with a continuous duty of 132 000 lb. per hour, with Riley stokers. The circulating, air and condenser sections are driven through gears by means of independent steam turbines; the boiler ashes are cleared on the water flush system. When the site has been fully developed the whole station will have a capacity of about 400 000 kW, and considerable ingenuity has been used in order to keep pace with demands, especially while the process of unification of periodicity has been in progress.

The Gennevilliers station was started after the war to supply the outside area in bulk. A great deal of the power produced is passed through 60 000 V mains, partly underground and partly over aerial lines. The original six units were of 40 000 kW capacity each, the newer units are of 50 000 kW capacity. A feature of the station is the arrangement of the main transformers inside a large shed; in some ways it might be termed an outdoor transformer lay-out, but put indoors. The building of the Gennevilliers station enabled several smaller stations to be shut down. The owners, the Union d'Electricité, who might be termed the outer Paris bulk supply company, were pioneers in the use of underground single cables on a circuit with 60 000 V across phases (neutral earthed). The cables are laid in concrete troughs, the three phases in triangular formation. The company supplies a certain amount of power to the Orleans Railway, but the circuits are arranged so that, as the development of the water power stations on the southern central plateau of France enables a surplus of power to be available beyond the requirements of the railway itself, then such surplus will be fed into the Paris area for general power purposes to an extent beyond that which may be drawn by the railway from Paris during times of minimum water flow.

As an alternative to the above, a tour was made first to the million volt laboratory of the Compagnie Electro-Ceramique (formerly Messrs. Sailly-Caillet), at Ivry. This laboratory is of the combined indoor and outdoor type; a triple bank of step-up transformers is arranged inside a lofty darkened shed with testing bus-bars arranged so that various insulators of the pin, suspension and bushing types can be tested and photographed by themselves or in combination with supports or structures. By opening big doors at one end of the shed the same voltages can be applied to strings of insulators and so on attached to full-sized towers standing in the open under daily varying atmospheric conditions.

The generating station at Ivry Port was also visited. This station, which has only been running a comparatively short time, is placed on the river Seine above the Paris boundaries close to the junction with the now historic river Marne. It has been designed to share with the station of St. Denis the duty of supplying power to the Metropolitan Underground Railway, and eventually to certain other traction undertakings. It belongs to the Société Electricité de La Seine, the allied company, the Société Electricité de Paris, being the owners of the Saint Denis station. The station is designed for a first instalment of 60 000 kW, to be eventually increased to 150 000 kW.

The boilers are of the Babcock type, partly with chain grates and partly with pulverisers. The main coal conveying gear drawing from trucks or barges is of the telpher gravity-cum-automatic-creeper type, discharging into big bunkers. Ladder screens are used for the condenser water, and, except in the turbine house, armoured concrete is extensively used, special care being taken regarding the whole station so that it can continue to function with floods of the river Seine equal to the highest on record.

The turbines operate at 3 000 r.p.m., and are of the tandem type. They generate at 10 500 V with 50 periods. The substations on the Metropolitan Railway are being gradually converted to use this periodicity in lieu of the 25 periods for which the railway was originally arranged. A concrete cantilever cable bridge with three superposed cable passages has been built across the river Seine alongside the station by the City of Paris to carry power from the station, to take cables connected with the general bulk supply of Paris, and to eventually link up the future step-down station in the suburbs on the south side of the river, which will be built to handle hydraulic power from central France, with the power centres on the northern side.

In the afternoon of Wednesday the Ecole Supérieure d'Electricité was visited. This school was originally founded by the Société Française d'Electriciens alongside their laboratory to give young men trained in mathematics and natural philosophy a twelve months intensive course in practical electricity. Its lecturing professors are nearly all men in daily contact with practical electrical and engineering matters of the day, and many of its students come from the highest grade schools, the Ponts et Chaussées, the agricultural engineers, the Civil Services, the Army and the Navy sending students for a one year's course. The technical equipment is very well arranged, a difficulty being to allot places to the numerous candidates for the courses held.

The Banquet.

On the evening of the same day a banquet was given at the Continental Hotel by the Société Française des Electriciens the Compagnie Parisienne de Distribution d'Electricité and power companies in the Paris suburbs.

M. Bunet, the president of the Société Française, speaking in English, after patriotic toasts, welcomed the members of the Institution. He recalled the visit made to Paris by members shortly before the war, and the cordial feeling that existed during the years of struggle. He said his institution differed from ours in that it was smaller in numbers, but all the same it had achieved and was achieving results of which he was proud. Their school at Malakoff was equipped for 200 students, and their laboratory would shortly be removed to the same place.

Col. K. Edgcumbe (the president of the Institution of Electrical Engineers), speaking in French, said his first visit to Paris was in 1878, at a time when the first electrical exhibition was being held, and the Jablochkoff candle was on view; but, being only five years old, he did not appreciate much. He thanked the Société Française d'Electriciens for the splendid work it had done during the last forty years in the cause of electricity.

On Thursday, June 13th, the wireless station at Sainte Assise was visited, followed by a visit to Versailles.

On Friday an excursion was made to the Chateau at Chantilly, while on Saturday one party visited the new station of the Cie Parisienne at Issy-les-Moulinaux, for which turbines operating at high temperatures and pressures have been made, Another party visited the National Laboratory at Belleville and saw a magnet of 46 000 gauss designed for special work.

(*To be continued.*)

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I.E.E. SUMMER MEETING SNAPSHOTS.

THESE pictures, taken during the first part of the meeting show: (1) *Mr. S. W. Melsom and Mr. R. Borlase Matthews;* (2) *Major R. Amberton, Mrs. Lawson and Mrs. Garrard;* (3) *Dr. C. C. Garrard and Mr. H. L. Howard;* (4) *Mr. P. F. Rowell and Major Amberton;* (5) *M. Bunet, President of the Société Francaisé des Electriciens;* (6) *Mrs. and Dr. Garrard, with Mr. Howard;* (7) *Col. K. Edgcumbe (President I.E.E.) and Dr. W. E. Sumpner;* (8) *another group of tourists, including Messrs. Melsom and Harmer;* (9) *Mr. and Mrs. Johnston and Mr. D. S. Munro (chairman, Scottish Centre);* (10) *champagne and cake at the Ivry Station;* (11) *Mr. Borlase Matthews and the President;* (12) *Mr. and Mrs. Rowell;* and (13) *a gathering at the Ivry Station.*

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ADVERTISING FOR CONTRACTORS.

The Best Medium to Use—Planning the Campaign—Linking up with the E.D.A.—Continuity an Essential—Interesting Examples.

By "PUBLICITY CONSULTANT."

(*Continued from page* 473.)

POINTS for the electrical contractor advertiser mentioned in my last article included a passing reference to the possibility of conducting quite a useful newspaper advertising campaign in a surprisingly small unit space. I

WHEN Milly Volt got engaged to Harry Watt, the young engineer, they thought it would be years before they could marry.

His salary was not very large, and Milly said she could never do without a maid Cooking in hot kitchens, washing clothes, and sweeping rooms, would spoil her temper and her complexion. And then they found out about the Electric way They have an electric stove: cool and fool-proof and it costs only 2½d. a day to run.

And the electric washing-machine Milly's uncle gave them will do all the washing and save Milly's back and hands, all for 1½d. every four hours. And the vacuum cleaner, Milly says, will make doing rooms more like play than work. And all *it* costs is 1½d. for 8 hours!

Good luck to them. Here they are, home from their honeymoon.

A successful and amusing way of telling the electrical story.

emphasise this point because there are still many potential advertisers who only think of advertising in terms of front pages of national papers, and who, on finding the cost of such propaganda prohibitive, decide that newspaper advertising is not for them. Even supposing that a contractor could afford to buy large space in such a paper as The "Daily Flail" it would do him little, if any, good. His announcement would be read by people in many parts of the country, and the vast proportions of these readers would be too far away to think of popping into the advertiser's shop. Unless he is running a mail-order line, the electrical retailer does not need to bother about the national dailies, and, even with this exceptional case, he only needs to consider the use of spaces of not more than two column inches.

For all ordinary purposes, the best advertising medium for the electrical contractor is his local daily or weekly. In such papers the advertising rates are usually quite moderate, and in these circumstances small spaces, intelligently used, are a potential source of profit to all who employ them.

Much real inspiration can often be derived from a regular and critical perusal of all kinds of current advertising, and the small-space advertiser who takes the trouble to study the current announcements of Buoyant chairs, Schweppes soda water and similar well-known proprietary articles will readily appreciate that the attracting and selling power of an advertisement is not of necessity in direct ratio to the space it occupies.

Fill a whole page with any sort of rubbish—the firm's name and a few prices, set in ugly type and badly laid out—and you cannot help but get some results. Fill a three-inch single column space with one outstanding message or offer, dressed up nicely in easily readable type and accessories to match, and you will also get results; possibly better than you would from the badly filled full page. So it is not so much the size of the space you use, as what you put into that space, that really counts in advertising.

To say that advertising is cumulative is only to state a truism, but, as recognition of this fact is of fundamental importance in the planning of a publicity campaign, no apology need be offered for dwelling on it. Obviously the man who issues one advertisement and then leaves off is wasting his money. He might just as well have left advertising severely alone, for his solitary announcement might, perhaps, sell a few of his goods for him, but it would trick people into thinking that a trader they believed to be "dead" in the business sense, had come to life.

It is not the solitary effort that builds up the sales of a business, but the persistent, carefully-planned reiteration of a message and a name; not the size, but the frequency of advertising that matters. Week by week and month by month, the advertiser's public must be reminded of his continuing existence. As time goes on—assuming that the advertising and the goods are sound—the public response to that advertising will increase; valuable goodwill having been created over a period of time. If the advertiser, being satisfied with the increased trade that advertising has brought him, decides to cut out what may seem to him an unnecessary expense, he will soon find that he is forgotten in the hurry and scurry of this modern age.

It will be seen, therefore, that no matter what sum may be available for advertising in a given period, it should be spread out in such a way as to afford the maximum number of individual appeals.

Having decided on the allotment or appropriation for advertising, the size and frequency of the announcements can easily be determined. To get the best results from those spaces is a more difficult matter, though it should not present insuperable difficulties to anyone of average intelligence. One thing that should be decided at the outset is a rough plan of campaign for the period. It is of little use to sit down on Monday in search of some item or items to be advertised in Wednesday's paper. In the electrical business a good many items of domestic equipment are more readily saleable at certain times of the year than at others; suction cleaners in March and April, refrigerators and fans in the summer months, and so on. The task of deciding when to push particular lines, as indicated, is greatly multiplied by the seasonal selling programme which is being popularised this year by the Electrical Development Association. One has only to follow this to be sure not only of pushing certain lines at an appropriate time but also of valuable support in the way of general publicity on those very lines conducted simultaneously by the E.D.A. By linking up with those E.D.A. announcements the local advertiser encounters far less resistance than he would otherwise do if there had been no general preparation.

Housewives all over the country are to-day hearing of the advantages of electric fans and electrical refrigerators. All they need to be told, to complete the cycle, is, where to get these desirable appliances. They have, it is true, been told that the equipment is to be had from any electrical shop, but it must not be assumed that they will immediately set out in search of such a shop. Even if they did, the chances are that they would go to a competitor's shop in preference to yours. You have, then, to tell them in effect that yours is one of the places where the apparatus can be obtained, and if you can show them effective reasons why they should visit you before a competitor you will have solved the major problem of retail advertising.

It has already been mentioned that continuity is an essential in advertising, but mere continuity of insertions is not sufficient if the advertising is to be really successful. There must be continuity also in the general style and appearance of the advertisements so that the reader will in time almost automatically associate the advertiser's name with a particular announcement, and vice versa.

The use of some distinctive feature, such as a hand-lettered name block, or a special kind of border, is an effective way to

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ensure such continuity without sacrificing the continual change of subject-matter which is essential in local advertising.

Special care should be given to the design of the name-block. A large proportion of those seen in advertisements fail to achieve their primary purpose of legibility. Lettering can be distinctive and expressive of character without being tortured into grotesque shapes or being freely hooked up to curlings and scrolls. Its first purpose is to tell the fleeting reader what your name is ; its second and subsidiary purpose is—perhaps—to associate that name with distinctions and certainly with continuity. It is well worth while to get a competent commercial artist to evolve a name-block. It should be designed to last, and it should therefore be so free from the passing whims of current advertising typography that it will not look out of place in the advertisements of which it will form a part in five or even ten years' time. It is worth paying several shillings a letter to get this detail right at the outset.

Borders, too, require sound consideration, and it is well to regard the border as the frame of a picture. A fine etching requires a quiet, unobtrusive frame, which, in conjunction with a considerable area of plain mount, shows up the beauty of etching at its best. A bolder subject naturally requires a bolder frame. Too heavy a frame or over-elaboration of design "kills" the picture. So it is with the frame in which you put your advertisement. If you always think of it as a picture frame and arrange your "copy" inside it accordingly you will, after a time, produce well-balanced advertisements.

The illustration reproduced on the previous page—the original measured 7½ in. by 4¼ in.—shows one successful and happy way of putting over the electrical story. Taken from a series which originally appeared in the Dublin evening newspapers, this announcement was issued by the Dublin Corporation Electricity Department. The series was specially planned to make more widely known the numerous advantages of electricity in the home, and particularly to emphasise the superiority and economy of electric cookery. The basic idea of the imaginary characters Milly Volt and Harry Watt is clever, and, being carried right through the series, this happy couple achieve that continuity which has previously been emphasised as being an important desideratum. It must also be observed that a similar layout and similar type was used throughout, thus further strengthening the cumulative effect. One can, in fact, imagine the reader of this series waiting eagerly for the next of the Newlywed Watt items, much as certain people wait for their favourite comic strip in the morning paper.

A notable publicity enterprise undertaken by Messrs. H. J. Galliers, the electrical contractors of Brighton, is worthy of notice here. It takes the form of an attractively produced monthly electrical bulletin, the June issue of which is the fourth of the series and runs to 12 pages of really interesting information.

The issue opens with a feature called "Between Ourselves," which is described as a monthly editorial chat. Then comes a simply-worded page, "Concerning the Kelvinator." There are notes on an electric washer for the small house, gramophone notes, and a well-written page on country house wiring, concluding with an invitation to those interested in country house lighting to see a complete plant at work at the Sussex Agricultural Show.

Of the remaining contents, an excellent piece of copy, "On keeping cool" simply asks to be quoted. Here it is :—

"Unfortunately, some of our summer days are such that the problem is not how to keep cool, but how *not* to keep cool. But all the same we can rely on our heat waves—several of them—times when we shall all gasp and perspire. So if it happens to be cold when you read these notes, remember the heat waves that are on their way. If you haven't got an electric fan, the day will come when you would give *anything* for one. Why not get it now ?

"Memorandum to business men : When the thermometer goes up to 80 the energies of your staff go down to zero. A fan or two will pay for themselves handsomely during the heat waves by preventing much of the falling-off in output owing to heat."

The production is streets removed from the ordinary catalogue, and, though it gives a maximum of interesting reading with a minimum of open advertising talk, it never lets the reader forget the service that electricity can render if only he will allow it to. A special word of praise must be allotted to the typography and lay-out, which are of a very high order of excellence.

(To be continued.)

TRANSMITTING AERIALS.

Considerations in the Design of Equipment for Frequencies of 500 and Upwards.

IN a recent paper read before the Institution of Electrical Engineers on "The Design of Transmitting Aerials for Broadcasting Stations," the authors, Messrs. P. P. and T. L. Eckersley and H. L. Kirke, deal first with the aerial as a radiator theoretically, and then go on to the theory of attenuation of waves of frequencies between 500 and 1 500 kilocycles per sec.

In the introduction attention is drawn to the higher standard of service now demanded by radio listeners. The technical difficulties have not been lessened by the somewhat haphazard methods adopted by some foreign stations. The proper method of dealing with the problem of mutual interference between stations and limitations of service area is to attempt the design of an aerial which only produces a direct ray or ground ray, i.e., a ray initially parallel to the earth's surface. It is the indirect ray which causes difficulties, by interfering with distant stations and producing fading and bad quality in the service area.

These considerations lead to a theoretical discussion of the aerial as a radiator. Curves are presented illustrating fading effects derived from theoretical reasoning, when using $\frac{1}{2}\lambda$ instead of $\frac{1}{4}\lambda$ aerials. "Effective height" usually taken as $2/\pi$ actual height for a $\frac{1}{4}\lambda$ aerial, is a somewhat misleading term. Some experimental tests with various lengths of aerials supported from a kite balloon are described and experimental results compared with theoretical data. Theoretical and practical effective heights do not always agree, the former being in general less than the latter. Effective height should, therefore, be measured rather than assumed. Relative power efficiencies tend to increase with increased height of aerial, but if it extends much beyond $\frac{1}{2}\lambda$ there is a rapid decrease in direct ray radiation, as the phase of the current in the upper part changes over. This has led to the Franklyn type, with as many as three aerials one above the other.

Some experimental tests of fading were conducted. The outstanding fact is that high aerials appear to be necessary, but this means high masts and increased costs. The wavelength allocated for broadcasting is between 550 and 200 m., roughly 1 800-650 ft. Thus masts for $\frac{1}{2}\lambda$ aerials would be about 1 000-400 ft. high, and with two $\frac{1}{2}\lambda$ aerials twice this height. Mechanical and economic conditions set a limit of about 800 ft., so that Franklyn aerials cannot be used for wavelengths greater than about 700 ft. (213 m.) in length. The T form of aerial is suggested as a possible compromise.

The next section of the paper deals with attenuation of waves. This question is discussed theoretically, and a summary of experimental tests is also given. The British Broadcasting Corporation undertook to find attenuation curves, in a given territory, for all frequencies between 500 and 1 500 kilocycles per sec. The results, obtained at Potters Bar, are presented in a series of diagrams in the original paper.

The chief conclusions which emerge from these investigations are :—

(1) The design of aerials for broadcasting should aim at using the energy to produce the strongest possible horizontal radiation, whilst diminishing upward radiation.

(2) To produce this desirable end, high aerials are a *sine qua non*.

(3) Nothing that is done with special aerials will prevent a serious limitation of the service area, relative to that obtained with the longer waves, when the shorter waves are used.

(4) Nevertheless, organisations must employ such waves which are more efficiently used by the employment of high aerials.

The use of shorter waves is quite economical in densely populated districts. The set of curves accompanying the original paper will serve to show the effectiveness of different wavelengths for the production of service area. Excellence of service can only be judged by the degree of freedom from interruption experienced by the majority of listeners. For this reason Capt. P. P. Eckersley defines service area in terms of signal strength alone, but points out that densely populated areas require a greater field strength than do rural areas.

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THE INDUSTRIAL PRESS AND TRADE.*

Views on the Electrical Press—The Manufacturers' Shop Windows—The Overseas Markets and Overseas Editions—The Society of British Advertisers—An Illustration of the Practical Value of Co-operation.

By VICTOR WATLINGTON, M.B.E., M.I.E.E., A.C.G.I.

IT is obviously impossible for any one person to be familiar with the whole field of industry and my remarks are based on knowledge of the engineering world, and more particularly of the electrical branch. That industry needs the great services which the industrial press so ably renders is I think attested by the fact that many of our trade journals have been in existence for well over half a century, but, just as we have to scrap obsolete plant in factories if we are to remain competitive, so must we be prepared to scrap equally ruthlessly old ideas which do not meet the conditions of to-day.

Mr. V. Watlington.

The technical press offers manufacturers a shop window in which their goods may be displayed, but, just as it would be useless for a shop to fill its windows with goods in which it had no confidence and of which the owner of the shop had no knowledge, so it is useless to take advertising space unless manufacturers take the trouble to explain their products and their policy to the technical press, and unless the latter is willing to take the trouble to absorb this information and to identify itself with the result. My own experience leads me to think that neither the industrial press nor the industries which that press represents have realised sufficiently the value of co-operation, more particularly with respect to opening up and expanding our overseas markets.

I feel that the technical press should not be regarded as something separate which can exist by itself, but rather as an integral part of industry, and therefore vitally interested in the welfare of industry and willing to take its share in its development. I also feel that industry must not look on the technical press as a rapacious monster whose only function is to extract as much money as possible from manufacturers, but as a part of its own organisation which must of necessity be kept fully posted as to the views and aspirations of that particular industry.

The publishers of the trade press of this country can render assistance to manufacturers—(*a*) By propaganda for the industry they can help to create confidence in British manufactured goods, thereby bringing a greater demand from existing markets and aiding in the development of new ones; (*b*) by giving reliable news and information relating to the state of the markets and the possible consumer demand; (*c*) by keeping their advertising rates at a reasonable figure, consistent with quality and service, thereby enabling the manufacturer to spread his campaign over as wide a field as possible.

The industrial press of this country covers, I think, very satisfactorily the market at home. The only observation I should like to make in relation to this point is that one marvels sometimes at the multiplicity of these publications and wonders how it is that industry can find sufficient money to support so many. Whether industry could be better served by the merging together of some publishers and in consequence fewer and more comprehensive publications, is a matter for conjecture.

In the overseas markets I am firmly of the opinion that the trade press of this country, whilst doing very admirable work, has room for considerable expansion and improvement. I find in certain industries American and German publishers have more or less the monopoly of many markets overseas, and in some places it is practically impossible to purchase certain British trade journals. This, I think you will agree, is a matter which should receive your serious attention. British manufacturers would also appreciate all the support which the trade press can give them through the creative power of publicity in fostering goodwill and confidence in their products. Whether it would be possible for a number of trade papers representing a particular industry to combine in the production of joint overseas editions I cannot say, but this is a point which I think it would be useful to discuss between manufacturers and publishers.

I take it that the technical press in this country is primarily interested in helping the home manufacturer, and, if this is agreed, then combination would enable a particular industry to put its views and needs before the world in a manner which is impossible at present. I think much could be done by publishing technical papers in foreign languages, and, as this is purely a question of expense, it seems to me that joint effort might make this possible.

On the technical side of advertising there is already, I know, a strongly expressed desire on the part of British advertisers, as represented in the Incorporated Society of British Advertisers, to confer with other parties in advertising when any matter affecting the interests common to both advertiser and publisher is involved. I should like to recommend to manufacturers the services which the Society of British Advertisers provide; it is the corporate voice for the expression of the advertisers' views and interests, and should receive the support not only of national advertisers, but particularly those, who, like myself, are in the habit of using the trade and technical press.

As an instance of the usefulness to industry of joint conferences with publishers and advertisers, I may perhaps refer to the recent meeting arranged by the Engineering Section of the Incorporated Society of British Advertisers, with the Committee of the Trade and Technical Section of the Advertising Association, and a number of independent proprietors of trade papers, when the question of the standardisation of page size was discussed. As a result of this conference a Committee representative of all interests has been appointed and will now agree on standards and consider ways and means of giving effect to the principle. This, I think you will agree, illustrates the practical value of such co-operation, which brings mutual benefit to all parties, and in this case simplifies the work of the advertising expert and enables him to spend more efficiently his appropriation.

* Extracts from a Paper read before the Advertising Association Convention, 1929, Newcastle-upon-Tyne, on Monday..

CORRESPONDENCE.

The Editor welcomes the free expression in these columns of genuine opinion on matters of public interest, although he disclaims responsibility alike for the opinions themselves and the manner of their expression.

The Menace of the Amateur.

[TO THE EDITOR.]

SIR,—Mr. Harry Moss's pertinacious efforts for "the elimination of the unfit in contracting" are all to the good. I feel, however, that not enough attention is given to what I would term "the menace of the amateur."

Whilst education has been receiving an increasing amount of critical attention, there has been a remarkable growth of technical knowledge and of the "handyman" faculty among the general public. This has been due to a number of causes. In the first place, the educational system (undoubtedly deficient in some respects) has, at any rate, aroused a certain amount of interest in scientific subjects. Again, the newspaper and semi-technical press have aided and abetted the creation of a vast number of handymen.

The irrepressible handyman was always with us, doing much useful and economical (and, occasionally, fearsome) work in the domestic sphere, but nowadays you will meet him much more often, and further afield! At the same time, the popularity of the motor vehicle (more especially as regards the owner-driver type of man) infers a certain amount of ultimate—though, perhaps, only semi-efficient—"tinkering about" with tools.

Then, too, the astounding development of radio, and particularly the overwhelming number of home-made sets, has probably awakened more technical and practical interest than any of the other causes: and this is not without its

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peculiar implication when we consider the effect of blunder-headed amateurism upon electrical engineering.

The distinction between the amateur and the professional is bound to become a somewhat invidious one when the former attains, or even surpasses, the skill (though hardly the experience) of the latter, and in one or two fields of endeavour the result is quaint. In some directions the professional can regard the amateur's efforts with either scorn or equanimity, but it is inevitable that the amateur can seriously interfere with the professional's work, and, more especially, his livelihood. This, in most people's judgment, is the crux of the position.

Having presented this aspect, we can usefully examine more personal factors. We may grant and welcome the existence of the ubiquitous amateur; the work of the serious amateur (as in the peculiarly broad and virgin regions of the radio world) can even be encouraged and his co-operation invited; but we must be alive to the fact that there is a certain menace in amateur efforts which requires our open-mindedness to be qualified.

In the Case of House Wiring.

Need I say that in electrical work, such as house-wiring, the amateur can be the direct cause of grave complications? We have been accustomed to that stock phrase in journalese of "the fusing of an electric wire" so frequently "trotted out" in reference to conflagrations (to use another favourite term of the reporter). The phrase has generally excited our amusement whenever we have paid it any attention, though it can, naturally, be a perfectly legitimate technical reason.

There is, of course, no gainsaying the fact that indifferent wiring is a latent danger—a danger, moreover, which increases with the age of the installation. On the other hand, it has been suggested in various quarters, that in certain residences in which outbreaks have occurred, the original wiring was installed by contractors of repute, and the work carried out with probably more than ordinary care. Installations such as these having been completed, however, they are left to the tender mercies of non-electrical men (chauffeurs, handy-man-gardeners, and the like). These individuals, with the best intentions in the world, attempt to follow in the footsteps of the contractor's men, and not only "maintain" the installations, but have the hardihood to effect extensions.

It is not to be wondered at that eventually disaster results. Electricity, which is a long-suffering servant, at last revolts. Wiring which has been carried out on "motor car wiring lines" by a good-intentioned handyman breaks down at some point or other, and perhaps an old mansion is burnt to the ground. This type of handyman brings to the job a peculiar kind of enthusiasm, under the spur of which he may even complete the work in his own time! Thus is the skilled man robbed of a job, and an insidious danger introduced. The handyman, though doing his dubious work in the course of his paid duties, ought to be classed as an amateur—and a dangerous one at that.

The well-meaning ignoramus is not unknown to us. Treating an electrical installation as he would a gas one, a liberal application of soap on worn "flex," or even inside lamp-holders, is the very cure for a "leak"; while, without any malicious intent, a hairpin or the like in a fuse or current-limiter proves extremely effective! But, accepting the wide definition of an amateur as given above, I consider that we must include all those engineers and others in works, etc., who, with or without a rudimentary knowledge of electricity, attempt to maintain quite a large and complicated installation.

Slogans to Broadcast.

From the very nature of electricity we must therefore take careful measure of this menace in amateurism as it affects electrical work. "Call in an electrician," "Employ an electrical man," are injunctions which should be consistently broadcast. The subtle suggestion (for which the ordinary newspaper press must be blamed) as to electricity's liability for fire outbreaks must be countered by reasoned propaganda: electricity, though so adaptable and willing, must be treated with respect.

At the same time, that hardy tribe of semi-skilled hangers-on of the electrical industry should be rigorously dealt with—as firmly discouraged as the ubiquitous amateur. The registration of contractors and wiremen is vital, while the valuable features of the scheme relating to the training of engineers in the electric power industry have advantages regarding adequate training and so forth which might be applied over a wider field.

I suggest, too, that the insulation test carried out by a supply undertaking on the installation of a new consumer might be repeated periodically—say, every 3 years, or when a routine meter change is carried out. Such step would make evident those defects which do not at once show in faulty work, and also test unknown additions to the wiring; all domestic appliances could similarly be examined. I submit that such periodic insulation test would redound to the benefit of the industry, and particularly of the supply undertaking.

With the inevitable improvement which will result from these safeguarding steps there could follow a moderation of the tedious and costly precautions upon electrical work in some directions. The steady and encouraging progress of electricity would accordingly be quickened still further.—I am, etc.,

"EXPERTO CREDE."

Newcastle-upon-Tyne.

Mains Operated Wireless Sets.

[TO THE EDITOR.]

SIR,—Every wireless set whether mains operated or not, clicks when a light is switched off or on. It is impossible to obviate it altogether but, by increasing the size of the outdoor aerial and decreasing the amplification, the local disturbance can be limited.—I am, etc.,

W. I. JONES.

Swindon,
June 14th.

A Window with a Voice.

[TO THE EDITOR.]

SIR,—In your issue of June 14th, page 720, under the paragraph "The Window with a Voice," I notice that you state one of London's leading stores has been using a microphone and loud speaker, and also that this form of window selling has probably never been used before in this country.

May I correct this, and inform you that during an exhibition of household appliances held at my showrooms from April 8th-20th last, a microphone was placed in a window where cooking was being shown, and the demonstrator addressed a large crowd outside the window through a loud speaker. The microphone was in turn passed along to other windows demonstrating electric cleaners, ironing, etc. The whole was a complete success.

I feel sure that the demonstration at the London stores referred to by you, must have taken place subsequent to my demonstration,—I am, etc.

H. J. GALLIERS.

Brighton,
June 14th.

North-East Coast Exhibition.

[TO THE EDITOR.]

SIR,—With reference to the letter published under the above heading in your issue of June 7th, I note with interest that there is no criticism by other readers in your current issue of the views it expressed. This, in itself, seems to indicate that those associated with the North-East Coast Exhibition are more inclined towards a quiet life rather than start an argument, which in turn suggests that the beating of drums in the cause of the exhibition is too much to expect. It is true we have an exhibition in the North, but, so far, the whole enterprise appears to be confined to local interests. Since the purpose of the show, as far as I understand it, is to bring prosperity to the industrial North, it seems somewhat futile, does it not, to look for that prosperity amongst its own already hard hit neighbours?—I am, etc.,

ANOTHER NORTHERNER.

Berwick.
June 18th.

BOOKS RECEIVED.

"Journal of the Institution of Electrical Engineers." Vol. 67, No. 388. April. (London: E. and F. N. Spon.) 10s. 6d. net.

"The Case of Benn *v.* Maxton." (London: Ernest Benn, Ltd.) Pp. 215. 5s. net.

"Vibration Problems in Engineering." By S. Yimoshenko. (London: Constable and Co.) Pp. vi+351. 21s. net.

"Sir Joseph Wilson Swan, F.R.S." A Memoir by M. E. S. and K. R. S. (London: Ernest Benn, Limited.) Pp. 183. 7s. 6d. net.

"Press Tools." By N. F. Fieldsend. (London: The Technical Section, Association of Engineering and Shipbuilding Draughtsmen.) Pp. 37. 2s. net.

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NEWS IN BRIEF.

Electric Pumping Plant at Nottingham—Ilford's Loan for Apparatus Hiring—Irish Free State's Increased Electrical Imports—Appointments Vacant.

NOTTINGHAM Corporation's new electrical water pumping station has just been put into operation.

Forfar Sheriff Court House Committee has asked for a Government grant towards the cost of an electric light installation in the Sheriff Court House, Forfar.

Hull Electricity Committee has appointed a sub-committee to consider the question of purchasing a site for a central showroom and administration building in the city.

There is a vacancy for a civilian education officer, Grade III, at the Royal Air Force Electrical and Wireless School.

At a recent meeting of the E.C.A. it was decided to make a donation of £200 to the E.D.A. in addition to the annual subscription of £400 as in past years. A donation of £50 to the Electrical Association for Women was also approved.

The steamer, "La Marea," owned by the United Fruit Co., is to be lengthened, and is to have its present propulsion equipment replaced by turbo-electric plant made by Messrs. Workman, Clark (1928), Ltd. The present equipment comprises four oil engines driving electric generators.

Practically the whole of New Zealand was affected on Monday by a severe earthquake shock. The electric power houses at Nelson and Takata were wrecked, telegraph and telephone wires throughout the islands were broken, and electricity supply services in many districts were interrupted. A severe shock was felt at Wanganui, but up to the time of going to press no news is to hand of its effect upon the generating station of the Wanganui-Rangitikei Electric Power Board.

A Rugby football match is to be played at night at the McGill University Stadium, Montreal, between McGill and Balmy Beach, Ontario, the lighting being supplied by twenty 1 000 W lamps.

The provisional judicial decree in favour of the Klangfilm-Tonbild group forbidding the showing of the Western Electric film, "The Singing Fool" in Berlin, which it was alleged infringed the Telefunken patent, has been rescinded.

The Gatineau Power Co. has started the second 25 000 H.P. generator in its Bryson, Quebec, hydro-electric plant. The company's aggregate installed capacity is 562 600 H.P., all hydro-electric. In the first three months of this year the output was 482 859 000 kWh.

The Borough Electrical Engineer of Wimbledon has reported to the Baths Committee that the regulations of Surrey County Council regarding the licensing of the new hall for music and dancing, etc., require the installation of an emergency system of lighting. The chairman (Coun. Drake), the vice-chairman (Coun. Snell), the Borough Electrical Engineer and the Baths Superintendent have been directed to decide upon the most satisfactory system of providing such emergency lighting and domestic apparatus, and to have the work put in hand.

A gigantic electric sign over the tramway shelter at the Old Steine was one of the special attractions arranged at Brighton in connection with the opening by Prince George of the new Aquarium on June 12th. The sign, in the form of an arch, was 52 ft. in width, and was supported on two translucent, coloured towers, each 25 ft. high. The arch bore the greeting, "Welcome to Sunny Brighton, Queen of the South," and the lettering, the towers and the beams of the "sun" which formed part of the design, were lit by about 1 500 electric lamps.

Canteens and recreation rooms are features of Liverpool Corporation's new tramcar depot at Edge Lane.

Birkenhead Corporation is to carry out alterations to the lighting system at the art gallery, at an estimated cost of £266.

Bradford Electricity Committee has placed contracts for the erection of transformer chambers in connection with the supplies to J. Thornton and Sons, Thackley, and Thos. Obank and Sons, Ltd., Thackley.

LOOKING BACKWARD.

FIFTY years ago THE ELECTRICIAN, *dated June 21st, 1879, recorded that :—*

The British Electric Light Co. was arranging to light the camp of the 3rd Northampton Volunteers.

* * *

The Select Committee of the House of Commons on Electric Light reached the decision that the time had not yet arrived to give general powers to private electric companies for street lighting. Facilities for experiments were, however, recommended.

* * *

Twenty-five years ago it was recorded in THE ELECTRICIAN *of June 24th, 1904, that :—*

It was anticipated that the Board of Trade would sanction e.h.t. cables being taken into factories and works requiring large supplies of power.

* * *

The first annual dinner of the non-commissioned officers and men of the 1st and 2nd Divisions of the Telegraph Battalion Royal Engineers was held during camp at Lewes.

* * *

Ten years ago, according to THE ELECTRICIAN *dated June 20th, 1919 :—*

Mr. C. Turnbull, borough electrical engineer of Tynemouth, was selected by the I.M.E.A. to give evidence before the Royal Commission with regard to a proposal to establish a decimal system of coinage.

The lighting at the Great Western Railway's Swindon Station is to be converted from gas to electricity.

Croydon Electricity Committee has authorised the purchase of apparatus for hire up to the amount of £11 000.

Worcester City Council is to purchase a second thrust-boring machine, to be used in connection with laying cables across and along roads.

At the annual demonstration of the North-Western Fire Brigades' Association at Chorley, on June 15th, British Insulated Cables Ltd. took third place in the hose cart drill.

"N.E.L.A. Public Opinion" states that in the United States 73 publishing companies have installed 121 electrically heated stereotype pots ranging from ¾ ton to 9 tons in capacity, and with an aggregate loading of about 12 000 kW. It is stated that with electric heating and automatic control poor castings, due to improper or uneven temperature of the metal, are eliminated.

Electric Day was celebrated throughout Japan on March 25th. Under the auspices of the Electric Industrial Association 152 persons were rewarded for having been in the service of the same employer over 25 years.

Ilford Electricity Committee has applied for sanction to a further loan of £5 000 for apparatus to be let on hire to consumers.

Imports of electrical goods into the Irish Free State in April, 1929, were valued at £51 464, compared with £32 353 in April, 1928. Imports for the four months January to April, 1929, included electrical goods valued at £202 122, against £151 600 in the corresponding period of 1928.

The Saskatchewan Power Commission appointed by the Provincial Government has reported in favour of Government ownership and operation of the production and distribution of electrical energy, and has recommended the immediate purchase of the municipal plants at Regina, Moose Jaw, and Saskatoon as the initial step. The scheme envisages a capital investment of $6 700 000 to meet an anticipated demand of 150 000 000 kWh in 1935.

The Post Office has issued to telephone subscribers a folder calling attention to the facilities now available for cheap, evening, long distance telephone calls. On the cover are maps printed in six colours, indicating the zones to which the various fees are applicable. An alphabetical list of places with particulars of charges is also given, as is also information regarding the fees for prolonged use of lines and monthly subscription rates for regular nightly calls.

It is reported that the Manitoba Government has appointed a Royal Commission to investigate the corruption charges made by the Conservatives regarding the lease of the Seven Sisters 200 000 H.P. site on the Winnipeg River to the Winnipeg Electric Co. The lease was given by the Bracken Commission, composed of Chief Justice Macdonald, Judges Dysart and Kilgour. At the Island Falls Power site the Flin Flon Co. is building a 75 000 H.P. plant.

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PERSONAL.

MISS Rosalind Haslett has been appointed as buyer for the electrical department of Shoolbreds, Ltd.

Mr. A. H. Darker, chief electrical engineer of J. Stone and Co., Ltd., who has been on a world tour, has now returned to London.

Senator Marconi was received by the Pope last week to discuss details of the construction of a wireless station within the Vatican city.

Dr. Lewis F. Richardson, who is in charge of the Physics Department, Westminster Training College, has been appointed principal of Paisley Technical College.

The marriage arranged between Mr. J. A. Benn and Miss Ursula Hankey will take place on Tuesday, July 23rd, at St. Margaret's, Westminster, at 2.15 p.m.

Lieut.-Col. K. Edgcumbe, president of the Institution of Electrical Engineers, and Mrs. Edgcumbe will give a reception at the Natural History Museum, London, on July 4th.

Mr. H. F. G. Woods, late borough electrical engineer of Torquay, took up his appointment as general manager of the East Devon and Exe Valley Electric Supply Co. last week.

With reference to the paragraph concerning Mr. T. H. Gait, which appeared in our last issue, this should have read to the effect that Mr. Gait is assistant to Mr. H. Faraday Proctor, chief electrical engineer of the Bristol undertaking, and not as printed.

Mr. W. H. Peak has resigned his appointments as managing director of the Marconiphone Co., Ltd., the Sterling Telephone and Electric Co., Ltd., and the Relay Automatic Telephone Co., Ltd. Private communications should be addressed to 17, Holland Park, London, W.11. See page 769.

The only paper to be read at the annual conference of the Institution of Mechanical Engineers, which is to be held at Manchester at the end of this month, is one by Mr. R. W. Bailey, director of research for the Metropolitan-Vickers Electrical Co., Ltd., on "Contribution of Manchester Researches to Mechanical Science."

Mr. Thos. J. Francis, who has been engaged at the Bolton electricity works for the past 4½ years and for 6 years has been part-time lecturer at the Bolton Technical College and the Manchester High School of Commerce, has been appointed lecturer in mechanical and electrical engineering at the Plymouth and Devonport Technical College.

It is announced that Sir Felix Pole, general manager of the Great Western Railway, has accepted the position of chairman of Associated Electrical Industries, Ltd. Sir Felix Pole is 52. He began his career with the G.W.R. at the age of 14, when he became a clerk in the telegraph department at Swindon. He was soon transferred to Port Talbot and to Truro, and at the beginning of 1893 to the electrical department at Paddington, where he remained three years. Thenceforward his promotions were frequent. For several years he was attached to the personal staff of the chief engineer, and he became assistant to the general manager in 1919, succeeding to that post itself two years later, at the unusually early age of 44. He was knighted in 1924. The resignation of M. Howard C. Levis, the former chairman, is also announced. See page 769.

Obituary.

MR. R. W. PENNINGTON, director of Gilbert Gilkes, Ltd., turbine makers, Kendal, aged 55 years. He had been associated with the firm during the whole of his business life.

Mr. CHARLES FRANCIS BRUSH, aged 80 years. Mr. Brush was the inventor of the Brush arc light, and in 1880 sold his arc lamp patents to the Anglo-American Brush Electric Light Corporation, which was succeeded by the present Brush Electrical Engineering Co., Although an American, Mr. Brush was of pure English descent. When only 15 years of age he invented a plant for turning gas street lamps on and off by electricity. At the University of Michigan, Ann Harbour, he graduated as a mining engineer, and later conducted the business of an analytical chemist. He resumed his electrical investigations later, and in 1876 completed his first dynamo. In 1877 he constructed his first commercial arc lamp, and soon after this he produced his series arc lamp having a regulating shunt circuit of high resistance. Amongst his other inventions were a multiple carbon arc lamp, for all-night burning, and his fundamental storage battery invention. He was a Fellow of the American Association for the Advancement of Science and a Life Member of the British Association. He was awarded the Rumford Medal by the American Academy of Arts and Sciences in 1899 and he received the Edison Medal in 1913.

OVERSEAS TRADE.

Electrical Exports for Five Months Exceed Imports by over £5 000 000.

EXPORTS of electrical machinery, apparatus and material shipped from the United Kingdom during May, 1929, amounted to £1 850 244, as against £1 599 250 for the same month last year, the increase being £250 994. Imports for the same month were valued at £618 685, as against £468 013 for May, 1928, an increase of £150 672. For the five months of this year the total electrical exports were £7 973 835, or £171 277 more than for the same period last year. Total imports for the five months were £2 840 857, as against £2 490 800, an increase of £350 057.

These figures show that May exports were in excess of imports by £1 231 559, while for the five months the balance was £5 132 978.

Export items which improved during May last as compared with the same month last year include rubber insulated wires and cables other than telephone and telegraph, increase £62 260; similar wires and cables other than rubber insulated, increase, £47 646; telegraph and telephone wires not being submarine cables, increase, £66 268; and various electrical goods and apparatus, increase, £114 395.

On the import side the same comparison shows in the case of electrical machinery, an increase of £37 000; telegraph and telephone instruments, excluding wireless valves, £52 439; and various electrical measuring and other instruments, £10 379. The following are detailed figures.

	Month of May		Five months	
	1928	1929	1928	1929
	£	£	£	£
IMPORTS.				
Electrical Machinery	147 128	184 128	741 697	757 342
Electrical Wires and Cables, Insulated—				
Rubber Insulated (not being Telegraph or Telephone Wires or Cables)	9,737	24 499	65 321	98 736
Insulation other than rubber (not being Telegraph or Telephone Wires or Cables)	44 762	58 035	218 933	241 991
Telegraph and Telephone Wires and Cables (not being Submarine Cables)	3 016	3 488	41 958	25 363
Submarine Telegraph and Telephone Cables	—	—	—	—
Telegraph and Telephone Instruments and Apparatus (except wireless valves)	50 515	102 954	245 730	510 699
Carbons, Electric	14 404	9 880	62 643	76 398
Electric Lamps and Parts thereof—				
Electric Glow Lamps	27 138	23 000	220 121	138 726
Arc Lamps and Electric Searchlights	1 009	207	2 507	3 645
Parts thereof (except Carbon Rods)	3109	908	10 208	3 819
Batteries and Accumulators (including parts)	47 440	51 019	214 300	237 746
Electrical instruments (other than telegraphic and telephonic): Commercial (including ammeters, voltmeters, etc.), House Service Meters, and Scientific	18 939	29 338	111 165	106 166
Switchboards, other than Telegraph and Telephone	28	—	454	1 339
Electrical Goods and Apparatus, all other sorts	100 788	131 229	555 763	638 887
Total of Electrical Goods and Apparatus	468 013	618 685	2 490 800	2 840 857
EXPORTS.				
Electrical Machinery—				
Railway and Tramway Motors	64 376	23 916	255 111	149 257
Other Motors and Generators	210 157	212 091	1 041 871	960 617
All other Sorts	332 036	325 349	1 540 546	1 623 297
Electrical Wires and Cables, Insulated—				
Rubber Insulated (not being Telegraph or Telephone Wires or Cables)	115 863	178 123	583 954	664 004
Insulation other than Rubber (not being Telegraph or Telephone Wires or Cables)	114 332	161 978	613 400	682 175
Telegraph and Telephone Wires and Cables (not being Submarine Cables)	72 104	138 372	444 148	471 101
Submarine Telegraph and Telephone Cables	10 301	15 361	93 609	57 438
Telegraph and Telephone Instruments and Apparatus (except wireless valves)	279 945	271 430	1 331 837	1 209 532
Carbons, Electric	908	384	8 462	2 812
Electric Lamps and Parts—				
Electric Glow Lamps	51 322	61 203	211 087	250 844
Arc Lamps and Electric Searchlights	789	577	4 673	4 341
Parts thereof (except Carbon Rods)	1 422	135	3 238	3 440
Batteries and Accumulators (including parts)	92 640	85 864	437 113	420 829
Electrical Instruments (other than telegraphic and telephonic): Commercial (including ammeters, voltmeters, etc.), House Service Meters and Scientific	38 851	47 379	170 096	161 067
Switchboards, other than Telegraph and Telephone	4 445	3 928	35 421	28 759
Electrical Goods and Apparatus, all other Sorts	209 759	324 154	1 021 992	1 284 322
Total of Electrical Goods and Apparatus	1 599 250	1 850 244	7 802 558	7 973 835

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LEGAL INTELLIGENCE.

Settlement of Litigation between Ferranti, Ltd., and Measurement, Ltd.

A SETTLEMENT was announced, in the King's Bench Division on Thursday, of litigation between Messrs. Ferranti, Ltd., of Bush House, W.C.2, and Measurement, Ltd., of Townsend House, Greycoat Place, Westminster.

Mr. G. O. Slade appeared for Messrs. Ferranti, the plaintiffs, and Mr. W. T. Monckton for the defendants. The settlement was announced to Mr. Justice Avory.

Mr. Slade said the litigation, which was between two well-known companies manufacturing electrical meters, would not be continued. The action was an action for libel, and the plaintiffs complained of advertisements inserted by the defendants in issues of electrical trade papers in June and July, 1927. For the plaintiffs, he was instructed to say that they admitted that the words of which they complained were not defamatory, and they desired to withdraw the action. It had been agreed between the parties that each should pay their own costs. That being so, his friend, Mr. Monckton, for the defendants, agreed that there was no need for any order of the court to be drawn up.

Mr. Monckton said he agreed that no order was necessary, and he consented to the withdrawal of the action on these terms.

Cables and Wireless Merger.

In the Chancery Division, on Monday, Mr. Justice Clauson refused the motion of the Venture Trust, Ltd., who sought an injunction against the Marconi's Wireless Telegraph Co., Ltd., Senator Marconi and the other directors.

It was asked that the defendants should be restrained from carrying into effect a merger scheme with the three leading cable companies or selling or transferring any of the assets of the Marconi Co., or taking any other steps for the purpose of carrying the scheme into effect until judgment in the action or further orders.

The Venture Trust, Ltd., were the holders of a number of debenture shares, which they exchanged, under an option they possessed, into £1 shares. Subsequently, upon reduction, the ordinary shareholders consented to their £1 shares being reduced to 10s.

When the merger scheme with the cable companies was placed before the shareholders it was found that the holders of these ordinary shares were to be placed practically upon the same footing as the plaintiffs, who were the owners of £1 shares, which, in accordance with the terms of their acquisition under the option, were still £1 shares.

Plaintiffs alleged that the proposal of the company would put the holders of 10s. shares on the same footing as themselves, and would have an injurious effect upon the value of their holding.

The Counsel were Mr. C. E. E. Jenkins, K.C., Mr. Gavin Simonds, K.C., and Mr. E. Riviere for the plaintiffs; Mr. Wilfrid Greene, K.C., Mr. Lionel Cohen, K.C., and Mr. Cecil Turner for the defendants.

Mr. Jenkins, for the Venture Trust, recalled that the merger between the Marconi and cable companies was broadly approved by the Imperial Conference, which suggested, however, that it should be split into two parts. He argued that the scheme must stand or fall as a whole, and it was the defendants' view that if they could not carry out their plan for dividing the shares in the merger on what the plaintiffs said was an unfair basis, the whole plan would fall to the ground.

The Marconi Co. made two answers to the claim of the Venture Trust—that they had power to sell their assets, and that the directors had the power to exercise the powers of the company. He submitted that the directors of the Marconi Co. had arrogated to themselves the right to say "It is for us to say how the shares are to be allocated." The directors of the Marconi Co. said that they wanted to carry out the scheme for the sale of the company's assets to the new imperial Communications Company, but they could not do that unless the plan in regard to the merger company went through.

"I am asking your lordship," said Mr. Jenkins, "to make an order restraining the Marconi Co. from selling these assets as part of this plan and proceeding with this scheme. We say that the directors of the Marconi Co. were unfairly using their powers to induce the merger company, on the board of which they are, to carry out the second branch of the scheme. What they say is 'We must not give to our shareholders the chance to come into this merger on the footing of their getting such proportion of the shares in the merger company as is attributable to their rights in the Marconi Co.'"

Mr. Simonds submitted that the directors had taken a course which—he did not say it offensively—was designed by them to affect the rights of the shareholders.

Without calling upon Mr. Cohen, K.C., for the Marconi Co., Mr. Justice Clauson gave judgment. He said that he did not see his way to make the order asked for by the notice of motion.

After describing the arrangements for the formation of the merger company and dealing with the position of the £1 and 10s. shareholders in the Marconi Co., he said that the grievance of the £1 shareholder was that the merger company was not offering him twice the amount of interest in the merger company as the 10s. shareholder was going to get. He had nothing to do with the question whether the offer to the £1 shareholders was fair or not, however, and as the merger company was not a party to these proceedings he could not interfere with their offer to buy the shares of the Marconi shareholders.

With regard to the proposed sale of certain assets of the Marconi Co. to the imperial Communications Company, he said that he could not assume that when the directors did sign the contract for the sale they would sacrifice the interests of the company. He pointed out that throughout these proceedings there was no imputation whatever against the personal character of the directors.

"It is impossible for me," he went on, "to interfere with something, the details of which are not yet settled, which the directors propose to carry out in the future, and which I must assume will be a sale carried out fairly and honestly. At present I cannot see that the £1 shareholder is hurt at all. If he refuses the offer, he is in just the same position as if the scheme had never been invented. Therefore the motion is refused, and the respondents' costs will be costs in the action."

Mr. Jenkins asked for leave to appeal.

Mr. Justice Clauson said that was quite unnecessary. He had a right to appeal.

Marconi Royalty Appeals Succeed.

In the Chancery Division on Tuesday, Mr. Justice Luxmoore delivered his reserved judgment allowing the two appeals by the Marconi's Wireless Telegraph Co., Ltd., against the decisions of the Comptroller-General of the Patent Office in favour of the applications of the Brownie Wireless Co., Ltd., and the Loewe Radio Co., Ltd.

Mr. Justice Luxmoore allowed both appeals, and instructed that the orders of the Comptroller-General be discharged. He held that it was not in the public interest, as the Brownie Co. claimed, that a licence should be granted to them, that the terms of the licence offered by the Marconi Co. were not unreasonable, and there was no evidence to support their contention that the reduction of royalty they asked for would have the result, as they claimed, of bringing into existence a new class of valve-receiving set purchasers who were now prevented from purchasing such sets by the prevailing prices.

In the case of the Loewe Co., the judge held that there had been no refusal to grant a licence by the Marconi Co., as terms were never defined, and, therefore, the time had not arrived when the Loewe Co. were in a position to apply for a compulsory licence. He thought the establishment of a factory by the Loewe Co. in this country would be in the public interest, and he hoped the parties would come to terms.

Rating of Sky Signs.

The Manchester City Stipendiary Magistrate has given his decision in regard to the appeal of Electrical Signs, Ltd., against an assessment of rates levied by the Manchester Corporation in respect of illuminated sky-signs erected at the junction of Market Street and Cross Street. It was held by the stipendiary that the defendants were liable for the rate from the moment the signs were used. He said that overseers were entitled to claim payment of rates for a period prior to the date of the assessment, or amendment. He agreed to state a case.

A hydro-electric power plant has started operation at the Imatra Rapids, Eastern Finland. The plant is generating 81 000 H.P., and it is intended to extend it up to a capacity of 220 000 H.P.

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THE SOCIAL SIDE.

WE give below the results of matches in the Electricity Supply Rifle League shot during May, together with the result of the first round of the " Knock-out " Competition.

DIVISION I.

Central A. (Lee 99) ..	580	City B. (Millar 99)	573
,, (Pearce 99) ..	584	Shoreditch A. (S. Thomas 98)	566
,, (Lee 99) ..	584	County A. (Coleman Brown 98)	576

Scores.

	Shot	Won	Lost	For	Against	Points
Central A.	4	4	0	2 331	2 293	8
City B.	2	1	1	1 157	1 156	2
City A.	2	1	1	1 154	1 154	2
Shoreditch A. ..	3	0	3	1 713	1 744	0
County A.	1	0	1	576	584	0
B. & K.	0	0	0	—	—	0

DIVISION II.

St. James' (Andrews 98)	567	Greenwich (R. Coveney Heath 94)	548
,, (Andrews Johnson 99)	580	Shoreditch B.	525
K. & K.	560	,, ...	548
Greenwich (Andrews 95)	555	K. & K. (Collingwood Fortescue 94)	553
City C. (Hobbs 96) ..	564	,, (Jennings 96) ..	563
Greenwich (Balfre Reggler 95)	559	Barking (Jackson 94) ..	531
,, (G. Coveney 97)	569	Central B. (Greig Marriott 96)	561
Central B. (Greig, Bowers, Lee 96)	569	Shoreditch B. (Perry 95) ..	536
,, (Greig 98) ..	568	Barking (Passey 95) ..	537
,, (Lee 98) ..	572	City C. (Bindon, Cornerford, Gascoyne, Hobbs 96)	569

Scores

	Shot	Won	Lost	Drawn	For	Against	Points
Central B. ..	5	4	1	0	2 835	2 773	8
Greenwich ..	4	3	1	0	2 231	2 212	6
St. James ..	3	2	0	1	1 715	1 641	5
City C.	4	2	1	1	2 272	2 217	5
K. & K. ..	4	1	3	0	2 238	2 232	2
Shoreditch B. ..	3	0	3	0	1 609	1 709	0
Barking ..	3	0	3	0	1 582	1 698	0
Hackney ..	0	0	0	0	—	—	0

" KNOCK-OUT " COMPETITION.
(1st Round.)

Central	6		B. & K.	B.	Scratched
St. James'	2	299	K. & K.	3	287
City B.	(winner)	298	Central	4	298
K. & K.	1	300	Central	8	299
City A.	(winner)		County	F.	Disqualified
County	B. ..	300	County	D.	298
Central	5 (winner)	299	Shoreditch	D.	Disqualified
Central	2	296	Shoreditch	C.	283
St. James'	1 (winner)		B. & K.		Scratched
Central	3	299	Shoreditch	A.	295
County	C. (winner)		Central	7	300
Shoreditch	B. (winner)		Hackney		Disqualified
K. & K.	2 (winner)		County	E.	,,
City	D. ..	300	City	C.	294·5
Central	1	299	Central	9	298
County	A.	298	K. & K.	4	295

Disqualifications were for having shots outside the scoring rings and ties were decided by the graduated gauges.

The annual dinner of the League has been fixed for November 30th.

The annual sports of Siemens Brothers and Co., Ltd., were held at the sports ground of the Siemens Sports Club, Park Lane, Charlton, on June 15th, when fifty-three events were staged, excluding a " toddlers' " race. The prizes were distributed by Sir William and Lady Bull and, in spite of the threatening and occasionally chilly weather, a large crowd followed with evident enjoyment the whole of the contests.

This was the seventh annual event, and, as usual, the items followed one another with clockwork regularity.

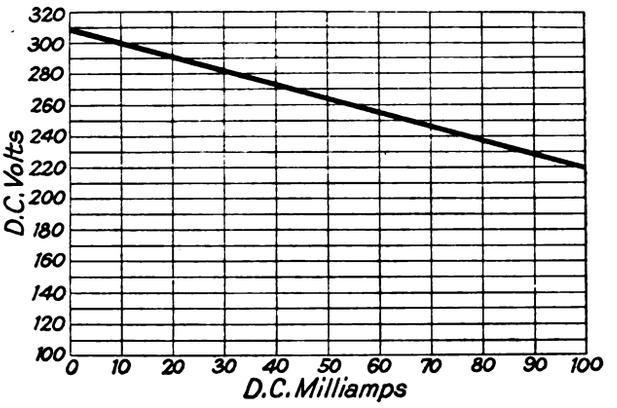
Interspersed with the more serious items were items of a more light-hearted nature, including the " band lucky spot march," pillow fight, tilting the bucket, climbing the greasy pole, and so on.

The musical entertainment was contributed by the Greenwich Royal Hospital School Band.

The hydro-electric plant installed in Switzerland at the beginning of 1929 amounted to about 2 142 000 H.P., distributed among 6 012 stations, of which 56 of more than 10 000 H.P. each accounted for 1 675 500 H.P. At the time mentioned eight hydro-electric works of a total rating of 539 000 H.P. were in course of construction.

NEW BATTERY ELIMINATOR.

WE have received for test from FERRANTI, LTD., of Hollinwood, Lancs, one of the new B.E.M.I. high tension supply units for use with wireless receivers. The unit is designed for connection to 200/250 V, 40/100 cycles supply mains and has an output of 100 mA at 200 V d.c. with corresponding outputs at other voltages. The unit consists of a filter



The voltage regulation curve of the mains transformer and metal rectifier used in the " B.E.M.I." h.t. supply unit.

comprising resistances and chokes in combination with a " Westinghouse " full-wave metal rectifier, fed by a mains transformer. The whole of the parts are contained in a fireproof sheet steel safety box fitted with two flexible cables for connection respectively to the mains and the receiver. The anode feed system developed by Ferranti, Ltd., is incorporated in the unit, and need not therefore be employed in any receiver operated from a supply unit of this type. The box in which the unit is assembled is fitted with an automatic switch so arranged that on the lid being raised all the accessible parts are " dead," being disconnected from the mains, and the unit complies with the I.E.E. Wiring Regulations.

The unit has been designed primarily for use in conjunction with receivers employing one or two stages of screened grid h.f. transformer coupling, an anode bend or grid leak rectifier, and one or two audio frequency stages up to a total audio frequency amplification of 5 000 times. It will also operate satisfactorily receivers employing one tuned anode h.f. screened grid stage or one neutralised h.f. stage provided that, in the latter case, neutralisation is properly carried out. It is also, of course, suitable for operating receivers without high frequency stages. Two flexible cables are fitted, one containing three wires for connection to the mains by means of a power plug, and the other containing six wires coloured and marked according to the receiver stage. When the eliminator is used with an ordinary neutralised h.f. stage, it is necessary to make a few simple alterations in the arrangement of the resistances contained within the unit, but since these are extremely easy and fully described in the instructions given there need be no difficulty in this conneciton.

The unit in question was, for purposes of test, first connected to a two-stage screened grid h.f., rectifier, single stage l.f. receiver, and then to a single screened grid h.f., rectifier, two l.f. equipment. In both cases results were in accordance with the manufacturer's claims. The unit was also tried with a neutralised high frequency circuit, and though it was necessary to readjust the neutralising condenser, the set finally remained stable over a 200-600 metre wavelength band. On longer wavelengths, therefore, stability may be assumed.

With a milli-ammeter in series with the common h.t. negative lead, various readings were recorded against measured voltages and the outputs obtained were such as to be ample for supplying even the largest set likely to be used by the broadcast listener. With the milli-ammeter connected in individual leads results were again satisfactory, the previously noticed margin in all output requirements being confirmed.

The unit is extremely flexible as to the types of valves it will accommodate, and the makers give in their instructions a complete list of resistance values for the various receiver stages and valve types.

The instrument is compact and for apparatus of its kind is not unusually heavy, weighing only 25 lb. It may furthermore be thoroughly recommended for use with domestic or similar wireless receivers, including those cases where neither technical knowledge nor operating ability are available.

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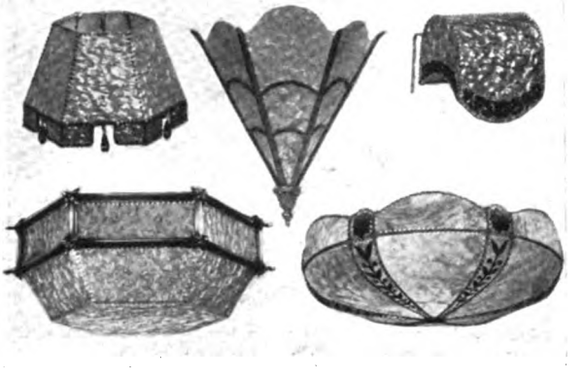
ELECTRICAL DOMESTIC APPLIANCES.

New Equipment of Interest to the Electrical Contractor—Special Lanterns for Porch Lighting—A Screen-Grid Valve for A.C. Mains.

AMONGST the latest appliances developed for domestic use may be mentioned health motors, and an entirely British model, known as the "Emesay," is manufactured and sold by the MEDICAL SUPPLY ASSOCIATION, LTD., of 167-185, Gray'sInn Road, London, W.C.1. This motor is intended both for curative massage, and for general vibratory manipulative massage. Our representative, who was given a demonstration in the showrooms of the makers, states that the motor is of very neat and durably-constructed appearance, and that the force applied can be varied quite easily and gradually between wide limits, by the simple expedient of causing the part of the body treated to put more or less tension on the belt. The small electric motor imparts motion to the belt through the medium of two cranks at opposite ends of the shaft; the oscillations are passed on to two hooks which project through the housing protecting the cranks. The flex supplied enables the motor to be run from any light or power socket. It is suggested that the medical practitioner will in many cases welcome the opportunity of adding this comparatively. inexpensive, revenue-producing novelty to his surgery equipment. The operation of the "Emesay," moreover, may be left in the hands of an assistant with entire safety, so that little of his time need be sacrificed to this additional source of income. The device is portable, and can be attached with the necessary firmness to the end of a table or any other suitable support. Once it is set in motion by the switch it needs no further attention.

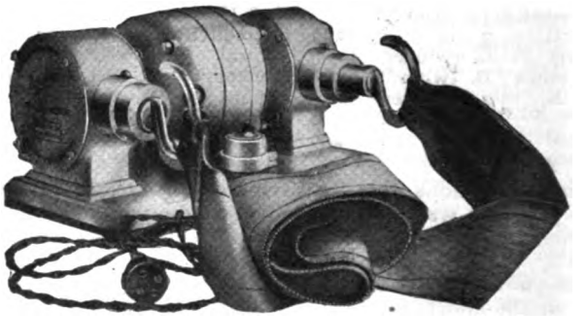


A range of "Opalac" fittings offered by Galsworthy, Ltd.

GALSWORTHY, LTD., of 16, Newman Street, Oxford Street, London, W.1, have, among the large variety of fittings offered, one or two innovations deserving special notice. A table illuminant which has just been designed comprises in effect a combined shade and table standard. The bounding lines used in the design are all straight, and the shading is arranged for by a square horizontal "Opalac" panel at the top together with four pentagonal panels, set vertically, between the four turned wooden legs. This lamp will certainly appeal to those searching for the unconventional, for, at first sight, the observer does not easily guess for what purpose the device is intended. A new bedroom light should perhaps be termed "the vanity lamp," but has at present been given only the rather prosaic title of "dressing table lamp." A cursory glance at this fitting reveals only an ordinary table lamp, but on closer inspection it is found that one of the panels of the shade is cut away. This is to allow of the shade being tilted back on the pair of hinges provided, through an angle of 45 deg. When the shade is in this position, a silvered concave reflector—normally placed vertically above the bulb—is horizontally behind the filament, so that a strong beam of light is directed straight on the person sitting before the dressing table mirror. One of the newest of Messrs. Galsworthy's "Opalac" standard lamps has an inverted shade which is very pleasingly coloured. The design, too, though unorthodox, is distinctly attractive. The shape chosen can best be described as the frustrum of a fluted cone, most of the light being thrown up to the ceiling through the large opening at the top. The material which this firm terms "Opalac" is certainly a useful one for many lighting purposes. It gives many opportunities for introducing variegated colouring, and is, we understand, durable, unaffected by heat or damp, and suitable for tropical climates. Being of a chemical composition, it is not damaged by insects. The accompanying illustrations give a good idea of the different ways in which Galsworthy, Ltd., adapt "Opalac." In addition to these and similar models there are some unusual nearly flat table lamps of French design with a cubist bias. These are intended only for locations where the rear of the lamps will be near the wall. "Opaloid" is also of a chemical composition, but appears more like alabaster than Mother of Pearl (which "Opalac" resembles). It can be tinted and decorated in a similar manner to "Opalac," but is less expensive. Both materials are mounted on wire frames and attached by leather thongs.

Many people will have dismal recollections of trying to identify houses in unlighted country roads on dark nights. Even when the houses are numbered the searcher may have no matches, or be prevented by wind from striking a light. To alleviate these unpleasant conditions Galsworthy, Ltd., offer an electric porch lantern, which displays the name of the house in illuminated letters and at the same time floods with light door, steps, and pathway. The lantern is hung under the porch, or from a wall bracket. This simple device is supplied in iron or copper, complete with chains and hooks, and requires only one lamp.

A useful addition to the Point 8 series of valves for a.c. mains working has been made by the GENERAL ELECTRIC CO., LTD., of Magnet House, Kingsway, London, W.C.2, in the production of the S. Point 8. This is a new screen-grid valve having working characteristics comparable with those of the S.215 valve, but with the additional advantage of an a.c. filament. The S. Point 8 is a specially-designed high-frequency amplifying valve, which, with the introduction of a screening grid, develops a magnification considerably in excess of that obtained with ordinary valves in stabilised circuits. In outward appearance, it is similar to the Osram two-volt screen-grid valves. The amplification factor of the new valve is nominally 160, and its impedance, measured at anode volts 120, screen-grid volts 80, is 200 000 Ω. The normal slope in milliamps per volt is 0·8, a figure which represents a very high efficiency in a valve of this type. In common with other valves of the same series, the filament characteristics are 0·8 A, at 0·8 V. These characteristics result in a short, thick filament which, when heated with a.c. through a suitable step-down transformer connected to the mains, operates without any audible trace of mains hum. When in use, the control grid (as distinct from the screen grid) must be negatively biassed by about one volt. The following table gives the relation between the values of anode volts, negative grid bias volts and screen-grid volts, for the correct operation of the valve.



The "Emesay" health motor of the Medical Supply Association, Ltd.

Anode volts.	Negative G.B. volts.	Screen-grid volts.
120–150	0–1·5	80–90
100–120	0–1·5	60–80

A new four electrode, screen grid amplifier valve, UY-224, embodying a 2·5 V heater element which permits operation from a.c., has been placed on the market by the RADIO CORPORATION OF AMERICA, New York. The valve is recommended for use primarily as a radio frequency amplifier in circuits especially designed for it, but it may also be used in special circuits as a detector or as an audio frequency amplifier.

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BUSINESS OPENINGS.

Latest Particulars of Electrical Engineering and Wiring Installation Contracts for which Tenders are being Invited at Home and Abroad.

WE give below the latest particulars of contracts for which tenders are invited. The closing date is given, where available.

DUNDEE EDUCATION AUTHORITY.—Electric lighting work in connection with alterations at Blackness and Ancrum Road Public Schools. Specifications from the Master of Works, Education Offices, Dundee.

EDINBURGH CORPORATION, June 22nd.—Electric lighting and power installations in 16 houses and 10 shops at Gorgie housing shopping centre. Specification from the Electrical Engineer, Devon Place, Edinburgh; deposit £1 1s.

DR. GUTHRIE'S GIRLS' SCHOOL, GILMERTON, June 22nd.—Electric lighting installation. Specifications from the Secretary's office, 22, Hill Street, Edinburgh; deposit £1.

Electric Wiring.

HEPTONSTALL SLACK BAPTIST CHAPEL, June 22nd.—Electric wiring of chapel, school premises and manse. Specifications, etc., from Mr. D. S. Dearden, Rydal Dene, Keighley Road, Hebden Bridge, or Mr. D. Walton, Mytholm Works, Hebden Bridge.

NEWPORT CORPORATION, June 22nd.—One 1 250 kW motor convertor, and switchgear. Specification (M3), etc., from Mr. A. Nichols Moore, Town Hall, Newport, Mon; deposit £3 3s.

STOKE-ON-TRENT CORPORATION AND STAFFORD COUNTY COUNCIL, June 22nd.—Electric light and power installation in new buildings at North Staffordshire Technical College, Stoke-on-Trent. Further particulars from the Clerk to the Governors, Town Hall, Hanley; deposit £5 5s.

BICESTER URBAN DISTRICT COUNCIL, June 24th.—Electric light installation in premises in the Causeway, Bicester. Particulars from the surveyor, Mr. H. T. Smith.

GLASGOW EDUCATION AUTHORITY, June 24th.—Electric lighting and heating installation at King's Park Temporary School. Specification, etc., from Education Offices (Property Department), 129, Bath Street, Glasgow; deposit £1 1s.

HARROGATE CORPORATION, June 24th.—Wiring, etc., of 58 houses, included in Devonshire Place housing scheme, No. 7. Specifications from the Borough Engineer.

NOTTINGHAM CORPORATION, June 25th.—Supply of general stores to electricity department for 12 months. Forms of tender from the Engineer, Electricity Works, Talbot Street, Nottingham; deposit 5s.

REIGATE CORPORATION, June 25th.—Construction of refuse disposal works, including electricity generating plant. Forms of tender, etc., from Borough Engineer, Municipal Buildings, Reigate; deposit £5 5s.

ACTON EDUCATION COMMITTEE, June 27th.—Electric lighting installations in schools. Specifications from the Borough Engineer, Municipal Offices, Acton, London, W.3; deposit £1 1s.

BELFAST CORPORATION, June 27th.—Electrical installation in fire brigade station, Ardoyne. Specification, etc., from the City Electrical Engineer.

ST. THOMAS' CHURCH, HENBURY, June 28th.—Electrical installation. Specification from the Rev. H. A. Potbury, Henbury Vicarage.

SALISBURY CORPORATION, July 1st.—Electric light installation at new police station. Particulars from Mr. W. J. Goodwin, city engineer; deposit £2 2s.

BELFAST CORPORATION, July 2nd.—Twelve sets of upholstered spring seats for tramcars. Tenders to the Town Clerk.

HOLYWOOD URBAN DISTRICT COUNCIL, July 2nd.—(1) Three-phase transformers; (2) l.t. underground and overhead mains, laying and erection; (3) l.t. switchboard, erected; (4) h.t. armour-clad switchgear, erected; (5) h.t. truck type switchgear, erected; (6) h.t. cable, laid and erected. Specifications from the Town Clerk, Town Hall, Holywood, co. Down; deposit £1 1s. per specification, or £2 2s. per set.

STAFFORDSHIRE EDUCATION COMMITTEE, July 2nd.—Electric light installation in Kingswinford Brockmoor Council School and in new buildings on the adjoining site. Specification, etc., from Messrs. Moffett, Rosher and Mann, consulting engineers, Union Chambers, Temple Row, Birmingham; deposit £5 5s. Only registered electrical contractors are invited to tender.

STEPNEY (LONDON) GUARDIANS, July 4th.—Installation of two electric lifts at South Grove Lodge, and one electric lift at St. George-in-the-East Hospital, Raine Street, Old Gravel Lane. Specifications from the Clerk, Bancroft Road, Mile End, E.1; deposit £1 1s. for each.

LONDON COUNTY COUNCIL, July 8th.—Manufacture, supply and maintenance of (*a*) 150 electric tramcar bodies; (*b*) 150 sets of swing bolster bogie trucks; (*c*) 150 sets of electrical equipment for tramcars, with assembly of bodies, trucks, electrical equipment, etc., into complete tramcars; and (*d*) 150 sets of magnetic track and wheel brake equipments. Specifications, etc., from the Clerk, County Hall, Westminster Bridge, S.E.1; deposit £2 for each section or £7 for the four.

SUNDERLAND CORPORATION, July 8th.—Manufacture and supply of 12 months' requirements of (*a*) paper insulated, lead sheathed cable, (*b*) rubber insulated wire, (*c*) consumers' meters, and (*d*) gasfilled and vacuum lamps. Specifications from the General Manager, Electricity Offices, Dunning Street, Sunderland; 10s. deposit for each section. Applications must state the classes of goods for which specifications are desired.

WEST MIDLANDS JOINT ELECTRICITY AUTHORITY, July 10th.—Supply and erection at Ironbridge power station of three boilers, each having normal rating of 225 000 lb. of steam per hour, with economisers, air heaters, fans, ironwork, pipework, coal pulverising plant, ash handling plant, etc. Specification (No. 3), etc., from Mr. E. F. Hetherington, chief engineer and manager, Phœnix Buildings, Dudley Road, Wolverhampton; deposit £2 2s.

ILKLEY URBAN DISTRICT COUNCIL, July 12th.—Supply and erection of 11 000 V combined cubicle and truck type switchgear, transformer kiosk, 300 kVA and l.t. feeder gear; and 11 000 V feeder and l.t. distributors. Specifications from Mr. S. H. Fowles, Electricity Offices, Chantry Drive, Ilkley; deposit £1 1s. for each.

CENTRAL ELECTRICITY BOARD, July 22nd.—Supply and erection of central indicators and telephones in connection with the Central Scotland Electricity Scheme. Specification (C.S.-S.S 15) and form of tender from Mr. R. H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

CENTRAL ELECTRICITY BOARD, July 27th.—Supply and erection of 132 000 V overhead transmission lines, in connection with the Mid-East England Electricity Scheme. Specification (No. M.E.E.-P.L.1), etc., from Mr. R. H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, Charing Cross, W.C.2; deposit £2 2s.

Overseas.

UNLESS otherwise stated, particulars of overseas contracts are to be had from the Department of Overseas Trade (Room 52), 35, Old Queen Street, Westminster, London, S.W.1. *Note.—An asterisk denotes that local representation is, in practice, esssential.*

COPENHAGEN MUNICIPALITY, June 21st.—Supply of switchgear in connection with extensions to Faelledvej sub-station. (Reference B.X. 5 367.)

NEW SOUTH WALES PUBLIC WORKS DEPARTMENT, June 22nd.—Supply and erection of transformers, with certain spares, for Burrinjuck hydro-electric development (contract No. 29/29). Reference B.X. 5 230.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, June 25th.—Supply of protected type telephone cable terminal boxes (schedule C. 430). (Reference B.X. 5 231.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, June 25th.—Supply of underground and aerial telephone cable (Schedule C. 443). (Reference B.X. 5 346.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, June 25th.—Supply of hard drawn copper wire, tinned soft copper wire, and cadmium copper wire. (Reference A.X. 8 040.)

NEW ZEALAND GOVERNMENT RAILWAYS DEPARTMENT, June 26th.—Supply and delivery of trailing cables for portable electric machines. (Reference B.X. 5 277.)

VICTORIAN RAILWAY COMMISSION, June 26th.—Alternating current power point mechanisms (contract 42 669). (Reference B.X. 5 334.)

VICTORIAN RAILWAY COMMISSION, June 26th (extended from May 15th).—Supply of geared three-phase, electric winding engine. (Reference A. 7 650.)

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SOUTH AFRICAN RAILWAYS AND HARBOURS, June 27th.—Supply of 2 200 and 660 V cables and accessories (tender No. 1466). (Reference B.X. 5 343.)

SOUTH AFRICAN POSTS AND TELEGRAPHS, June 27th.—Automatic wall and table pattern telephones (tender No. 158). (Reference B.X. 5 273.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, June 30th.—Supply of two 5-ton electrically driven hoist blocks, complete with overhead conductors, and switches. (Reference A.X. 7 867.)

CHILEAN PORTS ADMINISTRATION, July 1st. (extension of time).—Four electric travelling cranes for Valparaiso and 12 for Anzani. (Reference A. 8 122.)

VICTORIA STATE ELECTRICITY COMMISSION, July 1st.—Supply and delivery of 44 000 V transformers. (Reference B.X. 5 293.)

MELBOURNE AND METROPOLITAN TRAMWAYS BOARD, July 3rd.—Supply of two electrically-driven rail grinding machines (contract 704). (Reference A.X. 8 097.)

NEW ZEALAND POSTS AND TELEGRAPHS, July 3rd.—Supply of black adhesive insulating tape. (Reference B.X. 5 378.)

TURKISH ADMINISTRATION OF RAILWAYS AND PORTS, July 4th.—Supply of electric wire and cables and general lighting accessories. (Reference B.X. 5 368.)

INDIAN STORES DEPARTMENT, July 8th.—Supply of 30 kW oil-engine-driven generating set for Military Engineering Services, St. Thomas Mount, Madras. (Reference B.X. 5 364.)

LOURENCO MARQUES PORT AND RAILWAYS BOARD, July 8th.—Supply of two 5-ton electric portal cranes (Circular No. 60). (Reference A.X. 7 994.)

STATE ELECTRICITY WORKS, MONTEVIDEO, July 8th.—Construction and equipment of 50 000 kW power station.

POSTMASTER - GENERAL'S DEPARTMENT, MELBOURNE, July 9th.—Resistances and reactances. (Reference B.X. 5 281.)

NEW SOUTH WALES GOVERNMENT RAILWAYS, July 10th.—One 750 kW turbo-alternator; 2 200 V ironclad switchgear; two switch operating batteries; and two motor generator sets. Specifications from the Chief Electrical Engineer, 61, Hunter Street, Sydney.

PORT ELIZABETH MUNICIPALITY, July 11th.—Transformers, overhead line equipment, etc. (Reference B.X. 5 375.)

EGYPTIAN MINISTRY OF THE INTERIOR, July 15th.—Supply and erection at Mena power station of one Diesel engine driven a.c. generating set of 250 kVA. (Reference B.X. 5 331.)

VICTORIAN ELECTRICITY COMMISSION, July 15th.—Two 750 kVA transformers and spares (No. 29/42). (Reference B.X. 5 325.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, July 16th.—Supply of 250 galvanised steel transmission line towers to carry copper conductors, or 190 towers to carry steel-core aluminium conductors. (Reference A.X. 7 735.)

Telegraph Instruments.

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, July 23rd.—Telegraph instruments (schedule C. 436). (Reference B.X. 5 323.)

VICTORIAN RAILWAY COMMISSION, July 24th.—Electric overhead travelling cranes, spare motors, and down shop trolley wires (contract No. 42 672). (Reference A.X. 8 092.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, July 25th.—Supply of two 2-ton electrically-driven hoist blocks (tender No. 1 471). (Reference A.X. 8 072.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, August 1st.—One 10-ton electrically-driven overhead travelling crane, for Maritzburg workshops (tender No. 1 487). (Reference A.X. 8 105.)

SOUTH AFRICAN POSTS AND TELEGRAPHS, August 1st.—Supply of telephone cable (tender No. 160). (Reference B.X. 5 345.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, August 6th.—Supply of 120-ton, four-motor, overhead travelling crane and runway (specification No. S.M. 358). (Reference A.X. 7 810.)

NEW ZEALAND POSTS AND TELEGRAPHS, August 7th.—Enamelled and silk covered resistance wire (No. P. and T. 151/1497). (Reference B.X. 5 322.)

SOUTH AFRICAN POSTS AND TELEGRAPHS, August 8th.—Telegraph material, including g.i. tubular side-arms, insulators, paper sleeves, insulator spindles, etc. (tender No. 161). (Reference A.X. 8 112.)

NEW SOUTH WALES PUBLIC WORKS DEPARTMENT, August 12th.—Supply and erection at Burrinjuck of auxiliary hydro-electric generating plant. (Reference B.X. 5 365.)

EGYPTIAN MINISTRY OF THE INTERIOR, August 13th.—Supply of electric power plant, with underground and overhead network, for the town of Maghagha, Minieh Province, (Reference B.X. 5 318.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, August 13th.—Water turbine driven generating sets and switchgear, for Waitaki power development (section 2). (Reference B.X. 5 278.)

PIETERSBURG (TRANSVAAL) MUNICIPALITY, August 13th.—Supply of h.t. and l.t. cable, lamps and sundries, in connection with extensions of the electricity undertaking. (Reference B.X. 5 312.)

PIETERSBURG (TRANSVAAL) MUNICIPALITY, August 13th.—Supply and erection of steam raising plant, engine, alternators, and switchgear (contract A). (Reference A.X. 7 983.)

AUCKLAND ELECTRIC POWER BOARD, August 19th.—Single-phase transformers. (Reference B.X. 5 324.)

NEW ZEALAND GOVERNMENT RAILWAYS, September 4th.—Supply of motor generator (specification 287). (Reference B.X. 5 308.)

Tenders Accepted.

SMETHWICK CORPORATION.—Walker and Co., electric light installation at Mallin Street baths, £45.

SPENBOROUGH URBAN DISTRICT COUNCIL.—F. W. Birkett and Sons, electrical work at new library.

MANCHESTER CORPORATION.—Harland Engineering Co., Ltd., conversion of automatic rotary converter plant.

GREAT YARMOUTH EDUCATION COMMITTEE.—Lincoln and Egerton, electric wiring and fitting at Greenacre School, £729.

LEYTON CORPORATION.—Crompton Parkinson, Ltd., consumers' motors of new voltage in connection with change-over.

ROTHERHAM EDUCATION COMMITTEE.—Anderson and Thomson, Ltd., supply of electric dental engine, for school clinic, £42 (recommended).

SEAHAM HARBOUR URBAN DISTRICT COUNCIL.—Harrison Bros., electric wiring of 140 houses, £41 14s. 8d. per block of eight; £20 17s. 4d. per block of four, and £10 8s. 8d. per block of two.

MARYLEBONE (LONDON) BOROUGH COUNCIL.—Cables for 12 months; British Insulated Cables, Ltd., Enfield Cable Works, Ltd., Callender's Cable and Construction Co., Ltd., and Pirelli-General Cable Works, Ltd.

BRADFORD CORPORATION.—Supply of three-phase transformers: Hackbridge Electric Construction Co., Ltd., six 400 kVA and six 600 kVA; Bruce, Peebles and Co., Ltd., six 400 kVA; English Electric Co., Ltd., fourteen 600 kVA.

BIRKENHEAD CORPORATION.—W. T. Henley's Telegraph Works Co., Ltd., removal of portion of overhead line at Neston, £173 13s.; Liverpool Electric Cable Co., Ltd., supply of two miles l.t. 7·064 in. single core v.i.r. cable, £305; W. T. Glover and Co., Ltd., supply of 260 yards 0·1 sq. in. 11 000 V cable, £165 2s.

YORK CORPORATION.—A. Reyrolle and Co., Ltd., supply of switchgear for Foss Island Works, £1 361, and for Lendal Bridge sub-station, £1 220 3s.; George Ellison, supply of switchgear, for Kent Street sub-station, £768 9s.; for Scarborough Bridge sub-station, £633 11s.; for Groves sub-station, £422 10s.; for Burton Lane sub-station, £319 13s.; and for South Bank sub-station, £324 9s. (Both recommended).

PORTSMOUTH CORPORATION.—Mather and Platt, Ltd., supply and installation of four electrically driven vertical circulating pumps, each capable of pumping 10 000 galls. of water per min., £4 117. Also tendered: Vickers-Armstrong, Ltd., £3 150; Mirrlees, Watson Co., Ltd., £3 300; Gwynnes Pumps, Ltd., £3 597; Pulsometer Engineering Co., Ltd., £3 717; Drysdale and Co., Ltd., £3 970; Worthington, Simpson, Ltd., £4 070; W. H. Allen, Sons and Co., Ltd., £4 210; Lilleshall Co., Ltd., £4 355 and £4 485; General Electric Co., Ltd., £4 417 and £4 425; Rees Roturbo Mfg. Co., Ltd., £4 545.

RICHMOND (SURREY) GUARDIANS.—Richmond Electric Installation Co., re-wiring work at Grove Road Institution, £850 and (alternative) £795. Also tendered: Telephone and Electric Maintenance Co., £1 590 and £1 700; Troy and Co., £791 and £759; Stone and Co., £784 and £744; Tredegars, Ltd., £1 014 and £910; J. Passmoor, £881 and £838; Howson, Jones and Co., £750 and £680; Richmond Electric Light Co., £1 090 and £1 150; Clark, £1 341 and £1 248; General Electric and Maintenance Co., £1 985 and £1 817; Higginbothams, £1 150 and £1 150; Langston-Jones and Co., £929 and £849; Skase and Co., £3 250 and £2 850. Burdett and Co., £925 and £850; Vigor and Co., £998 and £1 030; Carr Bros., £553 and £454.

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ELECTRICAL ENGINE TESTS.

Interesting Equipment for Testing Engines at Hillman Car Works.

THE Hillman Motor Works, Coventry, have recently been fitted with automatic electrical engine-testing sets, manufactured by the General Electric Co., Ltd., at their Witton works. Six of these sets have been installed up to now, and each unit consists primarily of a large steel plate cubicle which accommodates the electrical testing machine (which runs either as a motor or generator) in the lower part, and the various control apparatus in the upper part. The control apparatus comprises a main contactor panel, also various relays, grid resistances, meters, push buttons, speed regulating handles, etc. Mounted above the cubicle is a series of coloured lamps so that the stage of the test which is being carried out may be ascertained at a glance at any given time.

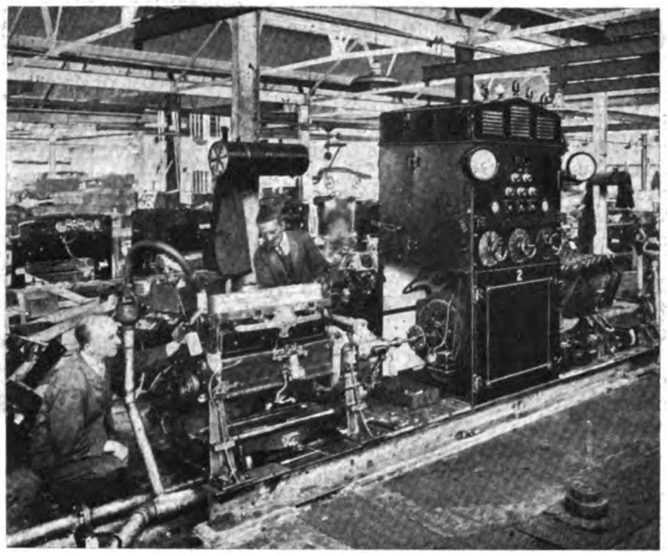
On each side of the testing unit is an engine seating to which an engine may be clamped. The provision of the two seatings makes it possible for an engine to be fixed for testing on one seating while another on the other seating is undergoing test. The whole of the control equipment is so designed that running in either direction of rotation can be obtained. The equipment first drives the engine in order that the wearing parts may become eased. Subsequently, the engine is fitted with carburettor, plugs, magneto, etc., and it is then started in the usual way. It drives the electrical machine which functions as a generator and feeds back to the line.

When the engine has been clamped in position, a push button on the front of the cubicle is pressed, and the motoring run begins. Any further action on the part of an operator is then unnecessary, the whole of the run being controlled by a special sequence drum, which governs the speed from its initial value of 300 r.p.m., accelerating gradually as required until 50 000 or any other fixed number of revs. has been completed, when one of the special signal lamps is lit. Automatic relays safeguard both engine and apparatus, one cutting off the current to the machine if the engine shows signs of seizing, and another preventing any acceleration if the initial friction does not decrease at a certain rate.

When the motoring run is finished, the pressing of a second push button enables the electrical machine to be connected to a section of the resistance grids in order that the engine may be run very slowly under its own power, while adjustments are being made to the valve tappets, etc., in readiness for the full speed generating run. The latter is accomplished by pressing the " re-start " push button, when the set automatically starts up to full speed again and the engine begins to fire. It is caused to feed back into the line by the simple adjustment of a hand wheel, and then the final run takes place, during which the engine under test supplies some proportion of the electric power required in the factory. Again the apparatus is safeguarded by relays, there not only being one to take care of any overload, but a second which would shut down the set if the field current of the generator were to fail, and a third which would come into action if the connection to the electricity main were to be broken, either of which faults would remove the load from the engine.

General view of G.E.C. automatic electrical testing sets for car engines, at the Hillman Motor Works.

Another interesting feature of the apparatus is that by means of an automatic paralleling device and field relay, should an engine seize, it is immediately disconnected from the line. Should, however, it overcome the trouble it picks up its running again. As rotation in both directions can be provided, separate accelerating contacts are fitted, which by an interlock are caused to function only for the correct direction of rotation in each case. Further, the set will test two types of engines, namely, the four and eight cylinder capacities, one change-over switch making all the necessary modification in the circuit. Another useful provision is that for swivelling the meters, so that they are conveniently in sight of the tester at either side.



View of one of the testing units coupled to a 4-cylinder engine.

BUSINESS ITEMS.

ENA ELECTRICAL APPLIANCES, LTD., have removed to 30, Church Road, London, N.1.

The SOUTH EAST KENT ELECTRIC POWER CO., LTD., has opened offices and showrooms at 4, The Exchange, Queen Street, Deal.

E. AND E. KAYE, copper wire manufacturers, of Ponder's End, Middlesex, have changed their telephone numbers to Enfield 2701-2.

The ELECTRIC HOMES CO., dealers in electric light fittings and domestic appliances, have opened premises at 73, Park Street, Bristol.

The lighting effects at Malvern Town Hall, Melbourne, were carried out by W. TOLSON AND CO., LTD., of that city, using G.E.C. equipment.

Mr. F. F. C. KING, wireless engineer, of 87, St. Aldate's, Oxford, is shortly opening a new branch business at 235, Banbury Road, at that city.

The whole of the cables for power and lighting at the North-East Coast Exhibition were supplied, laid and jointed by British Insulated Cables Ltd.

Messrs. ROUCH AND PENNY, electrical engineers and contractors, of 17, Prince Street, Bristol, have now removed to 8, Old King Street, Broadmead.

The offices of the Newcastle " Evening World," which were recently opened by Mr. Lloyd George, are fitted with electric conveyors throughout, manufactured by the IGRANIC ELECTRIC CO., LTD.

PHILIPS LAMPS, LTD., announce that, as from June 24th, the address of the Nottingham branch will be Trivetts Square, Short Hill, Nottingham. The telephone number will be as before.

It is announced that the business of EDWARDS AND ARMSTRONG, LTD., electrical engineers and contractors, has been merged with the WESTERN ELECTRICITY SUPPLY CO., LTD., whose head office is at Cainscross, Stroud.

L. C. MITCHELL AND CO., electrical engineers, of Northgate, Gloucester, had an attractive stand at the Three Counties Agricultural Show held at that city last week, and the judges of trade stands gave the firm a first class award of merit for their display of electrical and wireless goods.

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ELECTRICITY SUPPLY.

New Machinery for Stalybridge, Hyde, Mossley and Dukinfield Electricity Board—Extensions in the Liverpool Area—Wimbledon to Confer with Amsterdam—Supply in Northern Ireland—Enterprising Farmers.

CARLISLE Electricity Committee is to extend mains at a cost of £1 101.

Croydon Corporation is to extend mains at a cost of £1 367.

Irlam District Council has nominated the Surveyor to investigate the Council's powers and also the powers of any other electricity undertakers to give a supply in the area.

London County Council Highways Committee has recommended that the standard price of 0·469d. per kWh fixed by the County of London Electric Supply Co. in respect of railway and traction supplies be approved.

Stalybridge, Hyde, Mossley and Dukinfield Electricity Board has decided to apply for borrowing powers for £25 000 to cover the cost of new machinery which will be required to answer the needs of the Electricity Board.

Bradford Electricity Committee seeks sanction to a loan of £5 000 for the erection and equipment of a transformer chamber at Harrogate Road. The Committee has approved a scheme for a transformer chamber at Keighley Road, Frizinghall, at a cost of £5 151.

Mr. W. Sheridan, addressing the Limerick Rotary Club recently, said farmers in Tasmania after a time saw the great advantage of electric current, with the result that the Government hydro-electric scheme (for which, as a member of the Legislature, he had pressed 14 years ago) was now successful.

A number of extensions are to be carried out in the various areas served by the Liverpool electricity department. These will involve an expenditure of about £19 000. An application is to be made for a Fringe Order to give a supply to premises in the Halewood district and also for authority to extend an overhead electric line.

Glasgow Corporation Statute Labour Committee has appointed a sub-committee to confer with representatives of the Electricity Committee and the Clyde Navigation Trustees as to the proposed expenditure on cables, etc., which would be incurred if the new cantilever crane at Stobcross quay were to be driven by electric power.

Bolton electricity department will shortly be in a position to supply electricity from overhead lines to premises in the Over Hulton district of the borough which are now being supplied by the Lancashire Electric Power Co., Ltd., and it has been decided that three months' notice be given to the company to terminate the agreement in respect of the supply.

Mr. A. E. McKenzie, borough electrical engineer, of Wimbledon, has reported upon certain phases of development of the electricity undertaking at Amsterdam, particularly in regard to night-loads, and the Wimbledon Electricity Committee has authorised Mr. McKenzie and the Chairman of the Committee (Ald. Hickmott) to visit Amsterdam for a conference with the electrical engineer of that city.

Thornaby Corporation demands that a portion of the Cleveland and Durham Electric Power Co.'s trunk line passing through the town should be underground, and the Great Ayton U.D.C. desires that steel instead of wood standards should be erected to carry the cables in its area. The company states that it is complying with Government regulations in taking the cables overhead over particular highways which are not much used.

Stamford Electricity Committee has reported that the Committee, using as a lever their power to purchase the local electricity undertaking, had succeeded in obtaining a reduction in the price of current. Electricity for lighting purposes will be 9d., for power 3d., and for household heating 2d., provided the Council accepts the suggestion of the company to grant a monopoly to them for 40 years. The Committee has been authorised to accept the terms.

Colchester Corporation has received sanction to loans of £4 776 for main transmission line to Wivenhoe, switchgear, etc., and £28 670 for further plant at the Hythe generating station. The following terms have been offered to the Walton-on-Naze Urban Council for a supply in bulk: First 100 kVA and 120 000 kWh per annum, £5 per kVA and 0·8d. per kWh; next 100 kVA and 120 000 kWh, £4 15s., and 0·75d., next 100 kVA and 120 000 kWh and beyond, £4 10s. and 0·7d.

Hull Housing Committee has decided that electric cookers and wash boilers be fitted in 12 houses on both the North Hull estate extension and the Willerby Road housing estate, and that the British Gas Light Co., Ltd., be requested to afford a supply of gas for gas coppers to the remainder of the houses on the same estates on the terms put forward by them, viz., The Corporation not to place any restrictions on the installation and use of gas apparatus by the tenants other than for lighting purposes and to pay to the company at the rate of 3% per annum for 15 years on the capital expended. The Health Committee has adopted a scheme for electric lighting for the roads at the infectious diseases hospital, at a cost of £1 000.

In a paper by Mr. James Boyd, which was read at the recent annual conference of the General Council of Municipal Authorities in Ireland, it was stated that the capital which would be involved in a Northern Ireland electricity supply scheme would be from £40 to £50 per kW, whereas the cost of extending the Belfast Harbour power station, which would be sufficient as a primary generating station for many years would be from £8 to £13 per kW.

Stoke-on-Trent Electricity Committee has obtained sanction to borrow £10 000 for general sub-station extensions; £1 535 for mains in the Cannon Street area, Hanley, and £20 000 for general mains extensions. The Committee has decided that supply be given to Messrs. G. R. Wood and Son's 20 kW baking oven at ¾d. per kWh, provided that such supply be not taken during winter peak load hours, or that it be so taken that the load factor shall not be less than 20%.

Cape Town Electricity Committee has approved a scheme put forward by the City Electrical Engineer for an electrical installation in the café of the new pavilion at Muizemberg. The initial cost and maintenance of the plant for 12 months will be borne by the Electricity Committee upon the understanding that the expenditure will be refunded by the Improvements and Parks Committee in instalments, plus interest at 5%, spread over 5 years. The cost is estimated at £2 500.

Norton R.D.C. has decided to make formal objection to the application of the Holderness Trust, Ltd., for an Order to supply electricity in the Council's area, on the grounds that there is only a small number of villages which could be supplied, and that the time allowed for consideration of the Order was not sufficient. The Council has decided to call a conference of local authorities concerned, with a view to concerted action. The Northern Electricity Supply Co., Ltd., which has powers for supply in the Norton urban and rural districts, also intends to object to the application.

At the recent inquiry by Mr. Gordon Tucker, on behalf of the Ministry of Health, into the application of the Central Electricity Board for powers to take overhead cables through Southwick for supplies of current to Worthing, Southwick U.D.C. opposed the application and urged that the cables should be placed underground. Mr. J. E. Dell, representing Southwick Council, said high tension cables would radiate from the supply station to all the surrounding districts and the amenities and beauties of the Downs would be seriously injured by the presence of high masts and cables running over them.

Mr. J. Milne Barbour, Minister of Commerce, in a recent speech in the Northern Ireland Parliament, said no less than one-third of the population of Northern Ireland now had a public supply of electricity available at its doors. A h.t. transmission line, from which cheap power could be obtained for factories, now ran between Belfast and Lisburn, and before the end of the year another link would run from Holywood to Bangor, and would be extended to Newtownards. They looked forward in the near future to extension down the Lagan Valley and to the linking up of the principal towns in co. Antrim.

The Ministry of Health has notified Eastbourne Health Committee that the Council's proposal for regulating the use of the electrically-heated baths at Devonshire Baths is not sufficient, as the supervision of a medical practitioner is required therefor.—The Town Planning Committee has decided to send a letter to the Central Electricity Board protesting against the proposed erection of the Eastbourne-Folkestone overhead h.t. cable through the area, which it is alleged, would spoil the rural scenery, and the Board is to be asked to consider again the possibility of laying the cable underground.

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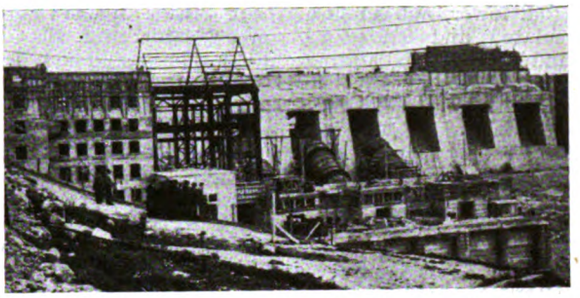
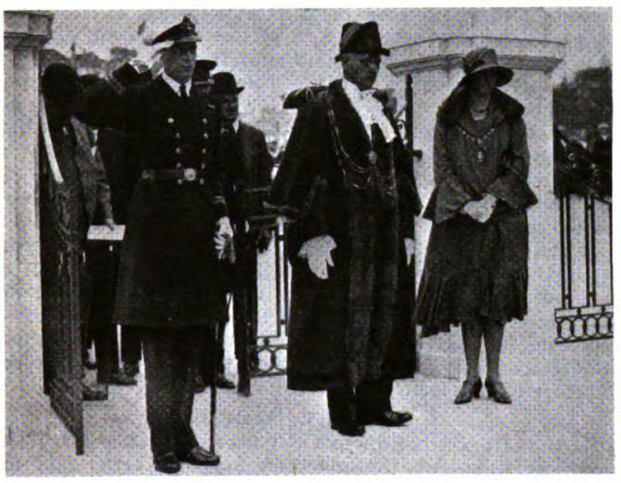
ELECTRICAL NEWS OF THE WEEK IN PICTURES.

Mr. W. H. Peak, who has resigned the managing directorships of the Marconiphone Co., Ltd., the Sterling Telephone and Electric Co., Ltd., and the Relay Automatic Telephone Co., Ltd. (P. 761.)

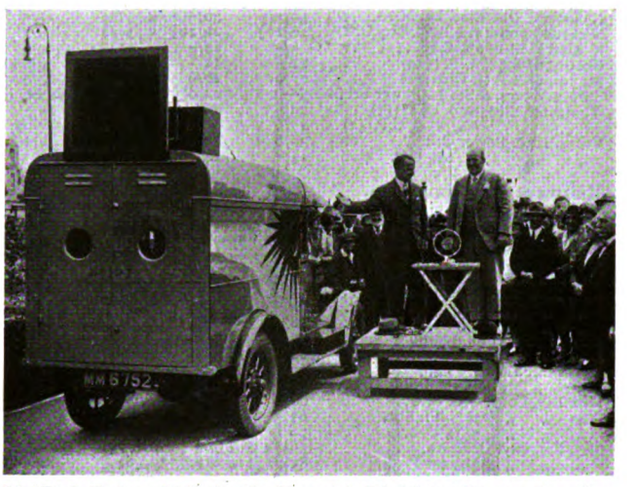


The work in connection with the Shannon Electricity Scheme at Ardnacrusha is now taking shape, and this recent photograph of the intake buildings shows two of the pipe lines being placed in position.

Sir Felix Pole, the general manager of the Great Western Railway, who, it is reported, has accepted the chairmanship of Associated Electrical Industries, Ltd. (See page 761.)



Prince George with the Mayor of Brighton, Ald. H. J. Galliers, on the occasion of the opening of the new Aquarium last week. It will be remembered that Ald. Galliers, besides being a well-known Brighton contractor, is also a member of the E.C.A. Council.



Mr. P. J. Pybus, M.P. for the Harwich Division of Essex, handing to Mr. J. E. Ball, chairman of Clacton Council, the broadcasting publicity van which he has presented to the Clacton Development Association. Mr. Pybus is, it will be remembered, a director of the English Electric Co. and other electrical companies.

Group taken outside the Institution of Electrical Engineers, showing those who attended the Nineteenth Illumination Design Course of the E.L.M.A. Lighting Service Bureau. The course was concluded last week and was voted the most successful yet held. Of those attending, the electricity supply interests were responsible for 24, electrical contractors 50, and manufacturers 46. A note on the subject appears on page 748.

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COMPANY NEWS.

Henley's Shares Still Improving—India Rubber Co. Denies Amalgamation Rumours—Extension of Madras Electric Supply Corporation's Plant—Calcutta Trams' Increased Dividend—Appreciation of British Electric Traction Stock.

HENLEY'S ordinary shares have risen a further 3s. 9d. during the past week, from £6 6s. 3d. to £6 10s.; but Siemens shares, at 31s. 3d., are 1s. 3d. down. Callender's are quoted at 75s., with the share bonus deducted. General Electrics are 1s. 3d. up, but Ever Readies are 1s. 6d. lower, and smaller declines are shown by British Insulated and Thomson-Houston shares. Marconi's Wireless and International Marine have both improved half-a-crown. Underground Electric Railways ordinary shares have shed 6d., and London Electric, Metropolitan District, and Metropolitan United Tramways debenture issues are a couple of points down.

Last Annl. Divd.	Description.	This Week.	Last Week.	1926 to 1928. Highest.	1926 to 1928. Lowest
%	**Electricity Supply.**				
(d)	Brompton & Kensington Ord. ..	26/-	26/-	35/6	23/9
4	Central Elec. Sup. 4% Deb. ..	94½	94½	95½	88½
(a)	Charing Cross Elec. Ord. (£1) ..	26/6	26/-	51/-	24/3
4½	" " " 4½% C.P. (£1)	17/6	17/6	18/3	16/6
(b)	Chelsea Elec. Sup. Ord.	26/6	26/6	45/3	24/-
10	City of Lond. Elec. L'ting Ord. ..	33/1½	33/1½	52/10½	26/-
6	" " " " 6% C.P.	23/-	23/-	24/3	21/6
10	County Lon. Elec. Sup. Ord. ..	55/6	55/6	68/6	25/9
6	" " " " 6% C.P.	23/-	23/-	24/-	21/3
(c)	Kensington & K'bridge Ord. (£1)	26/6	26/6	27/6	23/9
1/9⅜	Lon. Elec. Sup. Ord. (£1) ..	28/-	28/-	37/6	23/-
1/9⅜	Metro. Elec. Sup. Ord.	47/6	47/6	53/-	24/9
4½	" " " 4½% C.P. ..	17/6	17/6	18/3	16/3
7½	N'castle & Dis. Elec. Ltg. Ord. ..	30/-	30/-	31/9	17/6
£/2⅝	N'castle-upon-Tyne Elec. Sup. Ord.	26/10½	26/10½	30/3	19/3
6	N Metro. Elec. 6% C.P.	23/-	23/-	23/9	20/10
6	Notting Hill 6% C.P. (£10) ..	11	11	11½	9½
(c)	St. James & P.M. Ord (£1) ..	27/6	27/6	28/6	23/6
6	Shrops. Worcs. & Staffs. Power Pref.	—	22/6	—	—
£/9½	W'minster Elec. Sup. Ord. (£1) ..	26/-	26/-	52/9	24/-
4½	" " " 4½% C.P. (£1)	17/6	17/6	17/10½	16/7½
8	Yorks. Elec. Power Ord.	36/6	30/6	38/9	24/6
6	" " " 6% C.P. ..	24/-	24/-	26/9	20/7
	Railways and Tramways.				
8	Brit. Elec. Trac. Pfd. Ord. Stk. ..	130½	130½	152	117
6	" " " 6% Pf. Stk.	127½	127½	133	103½
4	Cent. Lon. Ry. Ord. Stk. (asstd.)	72	72	72	54
4	" " " 4% Deb.	80	80	83	77½
4	City & S. Lon. 4% Perp. Deb. ..	78½	78½	81	76½
5	Lon. Elec. Rly. Cons. Ord. Stk. ..	73½	73½	75½	42½
4	" " " " 4% Pf. Stk.	73	73	77	68
4	" " " " 4% Deb. ..	78*	80	83	76½
5	Lon. & Sub. Trac. A. Deb. ..	95½	95½	97½	74
4	Lon. Un. Trams. 1st Deb.	62	64	63	39
4½	Met. Elec. Trams, 4½% Deb. ..	72	72	73½	62
5	" " " 5% Deb. ..	67½	67½	70½	65½
3½	Met. Rly. Cons. Ord. Stk.	60½	60½	81	54½
3½	" " " 3½% Pf. Stk. ..	63	63	67	60½
3½	" " " 3½% Deb. ..	70	70	73½	67½
5	Met. Dis. Rly. Ord. Stk.	76½	76½	77½	52½
4½	" " " 4½% 1st Pref. ..	81½	81½	84	74½
6	" " " 6% Perp. Deb. ..	114½*	116½	118½	110
4	S. Met. Elec. Trams, 4% Deb. ..	70	70	70	64½
7	Underground Electric Rlys. Ord.	22/6	23/-	28/2	11/-
—	Yorks. (W.R.) Trams, Ord. ..	5/-	5/-	16/-	3/-
4½	" " " 1st Deb. ..	59	59	73	60
	Electrical Manufacturing.				
7	Brit. Elec. Transformer 7% C.P. ..	13/9	13/9	19/10	4/6
25	Brit. Insulated Cables Ord. ..	71/10½	72/6	86/3	50/-
6	" " " 6% C.P. ..	22/6	22/6	23/10	21/-
7	British Thomson-Houston Pref. ..	23/3*	23/9	24/9	19/7
7	" " " 7% Deb.	103½	103½	109½	102½
10	Brush Electrical Ord.	27/6	27/6	30/9	24/-
25	Callender's Cable Ord.	75/-†	87/6	91/3	66/-
6½	" " 6½% C.P. ..	25/-	25/-	25/9	22/-
7½	" " 7½% B. Pref. ..	27/6	27/6	28/3	25/-
8	Crompton-Parkinson 8% Cum. Pf.	25/-	25/-	27/-	14/-
6	" " 6% Cum. 2nd Pf.	17/6	17/6	19/6	9/7
7½	Edison Swan Elec. 1st Pref. ..	25/7½	25/7½	13/-	7/4½
5	" " " 1st Deb. Stk.	86½	86½	92	81½
7½	Elec. Construction Ord.	18/9	18/9	32/6	23/6
7	" " 7% C.P. ..	22/6	22/6	22/9	21/-
—	English Elec. Ord.	6/3	6/3	15/9	5/-
—	" " 6% C.P. ..	8/1½	8/1½	18/9	7/-
7	Ericsson Telephones 7% Pref. ..	20/-	20/-	22/7½	17/6
35	Ever Ready (Gt. Britain) Ord. ..	22/-*	23/6	92/3	18/1
6	Ferranti 6% Pref.	18/-	18/-	19/4½	10/9
7	" 7% 2nd Pref.	21/3	21/3	19/3	13/9
10	General Elec. Ord.	53/9	52/6	46/6	26/6
£25	W. T. Henley's Ord.	130/-	129/3	129/-	69/3
10	Johnson & Phillips Ord.	36/3	36/3	67/11	34/-
7½	Lon. Elec. Wire. & Smith's Pref. ..	23/9	23/9	25/-	22/3
7½	Siemens Bros. & Co. Ord. ..	31/3	32/6	36/6	24/9
10	Telegraph Const. Ord. (£12) ..	24½	24½	30½	20
	Telegraph.				
3½	Anglo-Am. Tele. Ord. Stk. ..	61½	61½	63½	56½
10	Eastern Ord. Stk.	265	265	273	135
3½	" 3½% Pref. Stk.	67½	67½	70½	59
4	" 4% Deb.	78½	78½	81½	74
10	Eastern Extension Ord. (£10) ..	26½	27½	27½	14
22	Gt. Northern Telegraph (£10) ..	31½	31½	43½	26
10	Indo-European (£25)	50½	50½	48½	30
20	Marconi's Wireless T. Ord. ..	77/6	75/-	84/4	12/-
15	" Int. Mar.	65/-	62/6	90/-	16/6
10	Western Tel. Ord. (£1)	20½	20½	27½	12½

(a) 19.⅞d. per share. (b) 1s. 9·3d. per share. (c) 1s. 6·949d. per share.
(d) 1s. 8·700d. per share. (e) 1s. 7·181d. per share. ‡ Including 1s. bonus.
* Ex dividend. † Ex share bonus.

J. G. WHITE AND CO., LTD.—Pft. for past year £71 661, plus £5 157 brt. in. Deductg. div. already paid, amtg. to £72 000, leaves £4 818 to carry fwd.

YORKSHIRE (WEST RIDING) ELECTRIC TRAMWAYS CO., LTD.—Intm. div. in respect of half-year endg. June 30, 1929, on 6% cum. pref. shs. of 3% (6% p.a.) is announced. No div. has been paid on ord. since that of 1925.

REES ROTURBO MANUFACTURING CO., LTD.—Gross pft. for 1928, £11 068, agst. £4 378. Pft. and loss acct., after providg. for deb. int., shows deficit £1 532, compared with deficit of £8 599. Obsolete stk. amtg. to £658 has been written off. As values of plant and machinery were written down under cap. reconstructn. scheme, no provisn. has been made in this year's accts. for depreciatn.

INDIA RUBBER, GUTTA PERCHA AND TELEGRAPH WORKS CO., LTD.—Directors state, in their rpt. on co.'s progress during first half of current financial year, that on this occasn. they again regret that, although there is a small aggregate improvemt. on correspondg. period of last year, actual results are still far from satisfactory. Output has been fairly well maintained, but only at reduced selling prices in several important sectns. Resultant loss of pft. can only be met by considerably increased sales and reduced exes., and everything possible is being done in this directn. Positn. at co.'s French works is decidedly better. Serious losses of recent years have been stopped and directors are confidt. that this factory will soon contribute to co.'s pfts. Reorganisatn. of steam and power plant at Silvertown is in progress, and this, when completed, should yield further substantial economies. There has been some improvemt. in results of Burton factory, and small increase in pfts. from foreign branches; submarine cable dpt. and cable ship "Silvergray" have had little employmt. during recent months, but both the dept. and the ship are maintained in constant readiness. Directors cannot, in present circumstances, recommd. paymt. of a div. to hldrs. of ord. shs., but pref. div. due July 1 will be paid on that date. Attentn. of directors has again been called to various rumours appearing in the Press as to impendg. combines or amalgamatns. affectg. the co., and they take this opportunity of statg. that there is no foundatn. for these rpts.

Company Meetings.

MADRAS ELECTRIC SUPPLY CORPORATION, LTD.—Mr. J. G. B. Stone, presiding at the meeting on June 12th, said good progress had been made with the erection of their new plant. The second 6 000 kW set was now running, one of the 60 000 lb. Babcock boilers had been completed, and the erection of the second was proceeding. The balance at the credit of revenue account was £114 363, plus £4 930. Dividends from investments, etc., debenture interest and sinking fund required £18 081, depreciation and renewal fund £25 000, and provision for income tax £10 278. A balance of £65 935 remained as net revenue, to which had to be added £6 657 brought forward. The directors recommended provision for three months' preference dividend accrued to December, 1928, payment of a final dividend of 5½%, actual, on the ordinary shares, making 8% for the year, tax free, and that £9 855 be transferred to reserve and £6 906 carried forward. The report was adopted and the dividends were approved.

CALCUTTA TRAMWAYS CO., LTD.—Mr. J. G. B. Stone, presiding at the meeting on June 13th, said tramway traffic receipts showed the satisfactory increase of £37 105, and expenditure showed an increase of £5 257 only. The operation of the 'buses resulted in a loss of £12 903. Out of the available balance of £124 753, there had been allocated to the depreciation fund £80 000, and to the staff provident funds £4 566. It was proposed to pay a final dividend of 10d. per share, making 1s. 2½d. for the year, or a little over 6%, tax free, against 5% for the previous year, and to carry forward £11 020. If there were any doubts existing on the question of the tramways affording the best and most economical means of transport for the mass of the population of Calcutta, the results for the past year should have cleared them away. Nearly 90% of the total traffic receipts, amounting to £503 055, was again taken by the tramways, the actual tramways earnings for the year showing an increase of over £37 000, while those for the current year to date show an increase of

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£6 500. As stated in the report, negotiations were still proceeding with the Calcutta Corporation in connection with the company's proposals for the improvement of the transport facilities. The report was adopted and the dividend approved.

ELECTRIC SUPPLY CORPORATION, LTD.—Mr. J. G. B. Stone, presiding at the meeting on Monday, said: Gross earnings in 1928 were practically stationary, because of reductions in charges to consumers. The effect of cheaper coal upon our large power contracts accounted for nearly £2 000, and reductions during the second half of the year to the general consumers amounted to £7 000. The effect of these reductions is that we sold 11 627 623 kWh for practically the same amount as we sold 11 017 008 for in the previous year. The undertakings at Jedburgh and Dollar were disposed of as at December 31st, 1928. In the case of Hitchin, we show the capital expended on assets which had to be written off when we shut down our generating station in that town and took a supply of electricity in bulk. Working expenses amounted to £68 783, against £64 995 in 1927. The revenue, at £109 099, is £50 more than in 1927. The net revenue account shows, on the credit side, the balance brought forward from 1927, interest and rent at £1 903, against £1 168 in 1927, and the balance from the revenue account reduced as already mentioned. The dividend on the preference shares, at £15 000, is for a full year on the increased preference capital, and the interim dividend on the ordinary shares, at £10 000, is similarly on the increased ordinary capital. There is a corresponding increase in the extra remuneration to which the directors are entitled under the articles, and the balance carried to the balance-sheet, £38 902, compares with £38 025 in 1927. We have purchased the whole of the share capital of the Steyning Electric Light Co. The Steyning Co.'s area is not far distant from the area of the Hassocks and Hurstpierpoint Order, which, in turn, is close to the area of the Haywards Heath Order. Both of these two Orders are now owned by Central Sussex Electricity, Ltd., and Steyning has made application for an extension of its area which will join it up to Hassocks on one side, and will extend its field of operations westward to Pulborough. The Central Sussex Co. has applied for an extension of the Haywards Heath area, which bridges the gap between the existing area and that of the Uckfield Co. on the east, and that of the Hassocks Order on the south, and on the north includes the districts surrounding Balcombe and Ardingly. The Alton Co. has applied for an extension to its area to cover the whole of Alton rural district, and the Petersfield Co. has applied for the whole of the Petersfield rural district, with a small portion of Midhurst rural district. At Petersfield we have not yet obtained a supply of electricity in bulk from Portsmouth. At Alton and Newhaven we have put down additional generating plant. We are promoting a special order to enable the transfer of the Exmouth undertaking to a local company in exchange for shares in that company. At Peterhead the power station is nearly completed and the machinery is in course of erection. The report and accounts were adopted, and the dividends, 6% for the year on the preference shares and the final dividend of 7% on the ordinary shares, making 11% for the year, less tax, were approved.

BRITISH ELECTRIC TRACTION CO., LTD.

Increased Profits—Sale of Certain Investments—The Improvement in the Value of the Deferred Stock—Mr. Garcke's Retirement from the Deputy-Chairmanship.

MR. J. S. Austen, presiding at the 33rd ordinary general meeting of the British Electric Traction Co., Ltd., at Winchester House, Old Broad Street, London, E.C., on Monday, said: Ladies and gentlemen, our profits for the past year show an advance of £17 000 on those of the previous year. To some of you that may not seem a particularly large sum, but I can assure you that when a company derives its sole income from dividends, that is a material amount even for a company of our size. We have sold our holding in the London and Suburban Traction Co. That was an amount of nominally over £850 000, and was the largest holding which we had in any single undertaking. I have no doubt whatever that the money which we got for those shares will be worth more to us than were the shares, which were paying us no dividend at all. I have also to mention the sale of the Shropshire, Worcestershire and Staffordshire Power Co. That was a company in which we held about a one-third interest, and the practical control of it was in our hands. It was a venture which was entered into after the war, and was entirely the creation of Mr. Garcke. It is rather difficult to give you the exact amount of profit which we made out of the deal, because the shares were mainly held by associated companies, of which we do not hold the entire share capital, but you may take it that the profit came to nearer £700 000 than to £600 000.

Now I want to say something about the value of our deferred stock. When that stock was created I told you that it was not our intention to pay large dividends upon it, but that it was a stock to which you must look for appreciation of capital value, and I think you will all agree with me that that appreciation has come with a vengeance. It is quoted to-day upon the Stock Exchange at round about £1 400 for £100 of stock. I have no recollection of any stock, as distinguished from shares, which has commanded such a price. Now that I have told you that this stock was given to you in order to obtain an appreciation of capital value, it is only reasonable that you should ask me what that stock is worth, and I feel that it is an obligation upon me to give you the best answer that I can to that question. It is a perfectly simple matter for a competent person to make a valuation of that stock, and I do not know that there is anyone who is more competent to make it than am I, but if I made such a valuation it would convey nothing to you, because it would depend entirely upon the basis upon which I valued it, but there are certain considerations which I now want to bring before you and which influenced my own mind in arriving at a decision as to the value of the stock. I must remind you that years ago about £1 000 000 was written off the capital of this company, and this deferred stock was given to you to represent that million. You may take it from me that in the ordinary course of the improvement in values which has taken place since that million was written off—and it was done when things were at about their worst—it has been recovered. If that million has been recovered it means that it gives a value of about 600 per cent. to your deferred stock. Then comes the question: What profits have been made in addition to that? I will take only one example, namely, the Shropshire company. Assuming that we made a profit there of £650 000, it means that that has added another 400 per cent. to the value of the deferred stock. That makes a total of 1 000 per cent., and there, I think I may perhaps leave it for to-day

I must now utter a word of warning. I say emphatically that nothing which I have said to-day must be taken to mean that the stock is worth more than its present market price, and also you must remember that whenever we give you a stock bonus, to a certain extent we water your stock. That means that when you receive your bonus the total value of your holding is more, but the average value of your stock is less. I must also say a word as to our policy with regard to dividends. It is repeating what I said last year, but I must emphasise it. It is our intention to continue the distributions at the same rate as we are making this year, but if our revenue grows and we see that we are in a position to give you an extra bonus, and then after that, for an indefinite number of years, to continue on the pfevious basis, we shall not hesitate to do so.

With regard to our earnings, I may say that just at the moment they are lagging behind our capital value. The reason for that is merely that we have received money which is not immediately remunerative. For example, taking the case of the London and Suburban Co., we had the use of the proceeds of that sale for only six months, and so for the current year we shall show an improvement on that. In the same way, with regard to our Shropshire deal, we shall for the current year get only a partial improvement from that money, but we shall have more to look for in the following year. It follows from that that if during the current year we have a material increase in our revenue you must not assume that that represents a corresponding increase in our capital value, because it will merely be that revenue is catching up capital.

The chairman then referred to the subject of Mr. Garcke's retirement, and said he expressed on behalf of the directors and himself—and he hoped he might do so on behalf of all present—the wish that he might live many years to enjoy his leisure. Mr. Howley would probably take Mr. Garcke's place as deputy-chairman.

The report and accounts were adopted, and other business was duly transacted.

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COMMERCIAL INFORMATION.

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debt. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

ADAMS, J. C., Mr., 8, Bridge Street, Rothwell, wireless dealer. £14 8s. 2d. April 29th.

BONNET PIERROT, Gaston Oliver and Wife, 2, Northland, Ayton Road, Uppingham, electrical engineers. £10 6s. 7d. April 17th.

BROOKS, Francis Edward, 9, Castle Street, Rugby, wireless parts dealer. £17 10s. May 9th.

BULLEN, A. J. AND CO., West Walls, Carlisle, electrical engineers and contractors. £16 15s. 8d. May 15th.

DAVIS, CASH AND CO., LTD., 47, Mount Pleasant, Holborn, W.C., electrical engineers. £18 0s. 3d. April 25th.

GARNETT, A. J. Mr. (trading as HAYES ENGINEERING CO.), St. Annes' Works, High Road, Hayes, electrical engineer. £33 11s. 8d. May 9th.

GUDGEON, Robert William, 23, Colebrooke Avenue, Shirley, electrical contractor. £21 19s. 4d. April 10th.

HULSEN AND CO., 7, Elswick Court, Northumberland Street, Newcastle-upon-Tyne, electrical engineers. £20 2s. 4d. May 6th,

INTERNATIONAL ELECTRIC CO., LTD., Ashley Road, Tottenham. £38 7s. 2d. May 4th.

JACKSON, W., Mr., Pie in Hand, High Street, Mablethorpe, electrical dealer. £22 14s. April 15th.

LENEY, J. A., Mr., 101, Rowlands Road, Worthing, electrical engineer. £22 1s. 1d. May 9th.

PARKER AND WHITELEY, 93, London Road, Southborough, electrical engineers. £30 9s. 3d. May 7th.

Deeds of Arrangement.

JONES, Leslie Ernest, trading as JONES BROS., 193, Fawcett Road, Southsea, electrical engineer. Dated June 7th, filed June 14th. Trustee, E. H. Hawkins, 4, Charterhouse Square, E.C., accountant. Liabilities unsecured, £400; assets, less secured claims, £180.

YORK, William Henry, trading as WM. H. YORK, 11, Alcester Road, South, King's Heath, electrical engineer and contractor. Dated June 13th, filed June 17th. Trustee, H. V. L. Heaven, 20, Waterloo Street. Birmingham, C.A. Liabilities unsecured, £1 332; assets, less secured claims, £923.

Mortgage.

[NOTE.—*The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an * —allowed by the date of the Summary, but such total may have been reduced.*]

BARNETT, (C.), LTD., London, W.C., wireless accessory dealers. Registered May 30th, £1,000 debenture to C. Manning, 5, Great Chapel Street, W., wireless dealer; general charge (subject to 1st debentures).

Satisfaction.

RADIO SERVICE (LONDON), LTD.—Satisfaction registered June 4th, £125, balance of amount registered July 26th, 1927.

Private Meetings, etc.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

VERDON CUTTS AND CO., LTD., 87, Fargate, Sheffield, manufacturers of electrical furnaces. At the statutory meeting of shareholders in the voluntary winding-up the liquidator, Mr. C. L. Widlake, C.A., of Sheffield, reported that the liabilities amounted to £7 738, all due to unsecured creditors. The assets consisted of sundry debtors, £1 335, valued at £509; work in progress, £100; and office furniture estimated at £70; making total assets of £679, from which had to be deducted preferential claims of £189, leaving net assets of £490, or a deficiency of £7 248.

The company was incorporated on June 12th, 1922, and took over a business, established in 1909, which had been carried on by Mr. Verdon Cutts, who had traded as Verdon Cutts and Co. The capital of the company was £10 000, which was later increased to £19 500. From the commencement of the trading of the company down to the date of the liquidation, continuous losses had been sustained, and the total loss to date was £19 427. When the company was established, it was considered that there was a good market for electrical furnaces, and it was hoped to get large orders from abroad, and one of the directors made periodical trips to different parts of the Empire with that object in view. Unfortunately, however, the orders were not sufficient to place the company on a sound financial basis, and throughout the period of trading the overhead charges and the expenses had generally been too heavy for the turnover. The matter remains in the hands of the present liquidator.

London Gazette, etc.

Bankruptcy Information.

DEAN, Joseph, electrician, lately 4, Gogerddan Place, Aberystwyth. Receiving Order, June 6th. Creditors' petition.

LAURENS, William Hamilton, 492, Prescot Road, Old Swan, Liverpool, radio engineer. Receiving Order, June 12th. Debtor's petition.

WARNES, Elizabeth Ann (Widow), 10, Crescent Gate, Wilmslow Road, Rusholme, Manchester, electrical and radio engineer. Receiving Order, June 10th. Debtor's petition.

WILMINGTON, Granville, 75, Railway Street, Nelson, electrical and radio engineer. First meeting, June 21st, 3.45 p.m., Official Receiver's Office, District Bank Chambers, Blackburn. Public examination, July 23rd, 11 a.m., County Court House, Bankhouse Street, Burnley.

Notice of Dividend.

JENKINS, Edward Charles, 124, Cheltenham Road, Bristol, wireless dealer. First and final dividend, 2½d. per £, payable June 21, Official Receiver's Office, 26, Baldwin Street, Bristol.

Notice of Intended Dividend.

JACOB, William Thomas, 14, Meyrick Street, Pembroke Dock, wireless engineer. Last day for receiving proofs, June 28th. Trustee, H. W. Thomas, 4, Queen Street, Carmarthen.

Bankruptcy Proceedings.

HENDERSON, John Arthur, trading as HENDERSONS, electrical contractor, 28A, Basinghall Street, E.C. The debtor filed his petition on May 30 and the statutory first meeting of his creditors was held on June 12th, at Bankruptcy Buildings, Carey Street, W.C. It appears from statements that the debtor has made that he has always been engaged in the electrical trade, and during the War was engaged in cable making. After the Armistice he acted as managing director of a limited company, and afterwards for a short time of another limited company which absorbed the former. In June, 1925, he began business on his own account as an electrical contractor under the registered name of HENDERSONS. Contract work was obtained both in London and the provinces, and he did very well for a time, but business during the past two years had fallen off, with the result that his profits have been insufficient to meet his overhead expenses. Eventually, in consequence of pressure by creditors, he filed his petition. The industrial unrest of 1926 had a severely adverse effect on his business, and he considers that he never really recovered from the losses he then sustained. The debtor, who attributes his failure to industrial unrest and general slackness in the electrical trade, roughly estimates his liabilities at £2 500, and values his assets at £351. The meeting passed a resolution for the appointment of Mr. D. C. Evans, I.A., 18, Ironmonger Lane, City, as trustee of the debtor's estate.

METAL AND CHEMICAL PRICES.

TUESDAY, June 18th.

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£77 15 0	—	10s. 0d.
Electro Wirebars	„	£84 10 0	—	5s. 0d.
H.C. Wires, basis	per lb.	11⅜d.	—	⅛d.
Sheet	„	11⅜d.	—	—
Phosphor Bronze—				
Wire (Telephone) basis ..	per lb.	1s. 2¼d.	—	⅛d.
Brass 60/40—				
Rod, basis	per lb.	9d.	—	—
Sheet „	„	10¼d.	—	—
Wire „	„	11¼d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£3 15 0	2s. 6d.	—
Galvanised Steel Wire, basis 8 S.W.G.	„	£14 15 0	—	—
Lead Pig—				
English	per ton	£25 0 0	—	—
Foreign or Colonial	„	£23 12 6	—	—
Tin—				
Ingot	per ton	£201 2 6	12s. 6d.	—
Wire, basis	per lb.	2s. 8d.	—	—
Aluminium Ingots	per ton	£95 0 0	—	—
Spelter	„	£26 0 0	—	7s. 6d.
Mercury	per bottle	£22 5 0	—	—

Sulphur—Flowers, Ton £12 0 0 *Copper Sulphate*—Ton £25 to £25 10 0
„ Roll, „ £10 10 0 *Boric Acid* (Crystals) „ £30 0 0
Sulphuric Acid (Pyrites, 168°) Ton £6 15 0 *Sodium Chlorate*—Per lb. 2¼d.
Sodium Bichromate—Per lb. 3½d.
Rubber—Para fine, 11d.; plantation, 1st latex, 10⅛d.

∴ The metal prices are supplied by British Insulated Cables Ltd., and the rubber prices by W. T. Henley's Telegraph Works Co., Ltd.

THE LEAD MARKET.

James Forster and Co. again report a quiet market with minor fluctuations, transactions being mainly professional.

Closing prices on June 14th were £23 12s. 6d. for June and July, and £23 11s. 3d. for August and September, or practically unchanged on the week.

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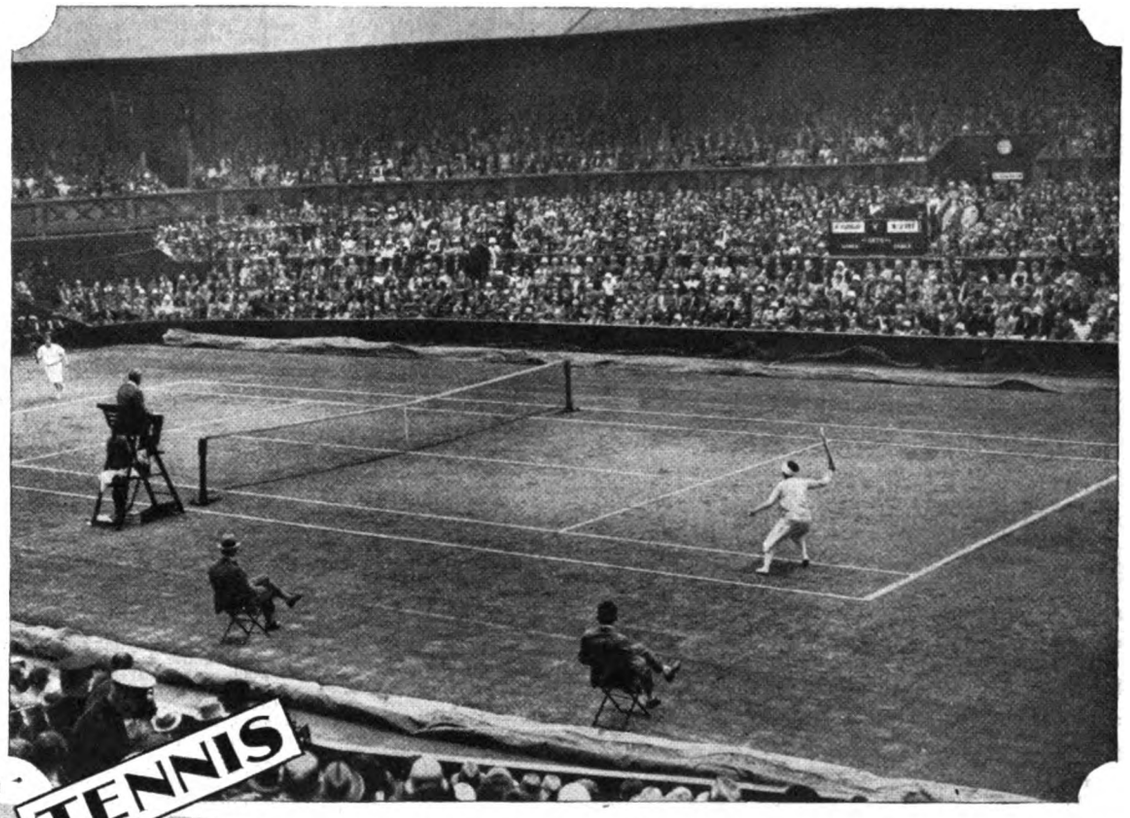
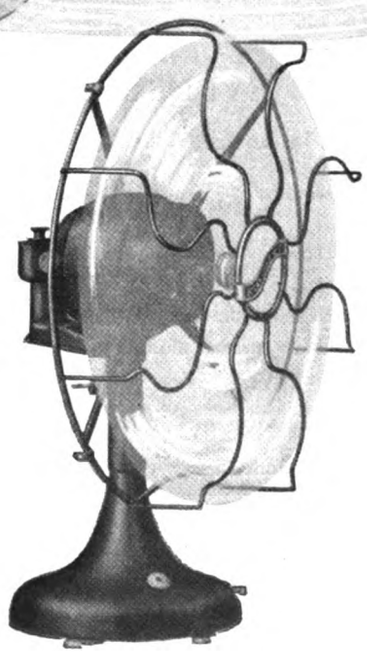
FRESH AIR SPORTS



On the Centre Court at Wimbledon. (*Sport & General Press Agency Ltd.*)



THE LURE OF THE OPEN

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Few, however, can allow themselves to be lured as often as they would like either on to the "court" or in to the "gallery".

Those who have to work during hot weather in sultry homes, in smoky factories and in stuffy offices, are prospective customers to the Electrical Contractor for

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PATENT RECORD.

The following information is prepared from the Illustrated Official Journal (Patents) by permission of the Controller of H.M. Stationery Office. Printed copies of full Patent Specifications, when accepted, may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at 1s. each.

Specifications Accepted.

310 592 British Thomson-Houston Co., Ltd., L. Griffiths and C. J. Morton. Make-and-break devices for use in electric ignition systems of the combined induction-coil and magneto-ignition type for internal-combustion engines. (15/2/28.)
310 593 T. W. Ross and Associated Electrical Industries, Ltd. Electrical relays. (15/2/28.)
310 595 J. McCallum. Metal clips and like fastening means for electric cables. (16/2/28.)
310 597 W. J. Charles and A. Watson. Electric switches. (18/2/28.)
310 605 H. S. Cooke. Electric lamps. (25/2/28.)
310 615 E. N. Bray, Ltd., and E. N. Bray. Control systems for electric motors. (15/3/28.)
310 620 J. B. Taunton and Ranton, Ltd. Electric connectors. (16/3/28.)
287 463 Marconi's Wireless Telegraph Co., Ltd. Thermionic valve arrangements. (17/3/27.)
310 625 J. Y. Johnson (I. G. Farbenindustrie Akt.-Ges.). Production and application of plates for electric condensers and the like. (22/3/28.)
287 578 Westinghouse Electric and Manufacturing Co. Electrical relay devices. (25/3/27.)
289 375 Landis and Gyr Soc. Anon. Adjusting-device for the driving systems of electric measuring-instruments of the induction type. (25/4/27.)
310 650 D. Guéron and S. Danon. Electric switches. (20/4/28.)
310 658 Siemens Bros. and Co., Ltd., S. H. Long and M. Hodge. Wireless direction-finding apparatus. (27/4/28.)
289 813 R. Frey. Lighting arrangements for power vehicles. (2/5/27.)
291 441 L. Canard. Electric radiators. (4/6/27.)
310 677 L. C. Easton. Telegraph printers. (21/5/28.)
310 682 J. R. Longworth and H. Hirst. Automatic fire-alarms. (25/5/28.)
292 120 Compagnie Pour La Fabrication Des Compteurs et Material D'Usines a Gaz, and Soc. L'Action a Distance. Electromechanical resonance device for distant control. (14/6/27.)
291 450 Dr. W. Hammer. Electrical heating of furnaces. (2/6/27.)
310 709 Savory and Moore (1928), Ltd., and J. W. Mason. Apparatus for administering radiant heat for medical purposes. (5/7/28.)
310 714 W. Fairweather (Singer Manufacturing Co.). Knee-control mechanisms for portable electric sewing-machines. (10/7/28.)
294 489 R. L. J. Laurent De La Ville Le Roulx. Telephone apparatus. (22/7/27.)
303 490 L. Renault. Arc-welding electrode holders. (5/1/28.)
308 674 British Thomson-Houston Co., Ltd. Speed-control systems for electric motors. (26/5/28.)
310 731 J. Beckmann. Electric lamp for illuminating rooms or containers filled with explosive gases or liquids. (16/8/28.)
296 355 Soc. of Chemical Industry in Basle, and H. Andriessens. Process for the economical treatment of mixtures containing hydrocarbon and nitrogen in the electric arc. (29/8/27.)
299 866 F. M. Van Gelderen. Method of and apparatus for removing insulation from insulated wire. (4/11/27.)
297 087 International General Electric Co., Inc. Electric transformers. (14/9/27.)
300 899 Siemens-Schuckertwerke A.-G. Long-distance cable for four-wire working. (19/11/27.)
304 148 W. Otto. High-frequency apparatus. (14/1/28.)
280 194 Traylor Vibrator Co. Vibrating electric motor. (2/11/26.)

Applications for Patents.

April 2nd.

10 272 M. L. E. Martenot. Electrical musical instruments. (2/4/28, France.)
10 259 M. Papalia. Device for automatic telegraphic transmission.
10 271 L. Tagliaferri. Electromagnetically controlled hydraulic governors for electric furnaces.
10 229 Telefonaktiebolaget L. M. Ericsson. Intercommunication telephone apparatus. (5/4/28, Sweden.)
10 123 A. Watson. Manufacture of insulated wire, etc.

April 3rd.

10 365 A. C. Spark Plug Co. Flexible cables. (6/2/29, U.S.)
10 349 Associated Electrical Industries, Ltd., and N. Dennes. Electrically-heated utensils.
10 337 British Thomson-Houston Co., Ltd., and H. T. Warner. Magneto-electric machines.
10 338 British Thomson-Houston Co., Ltd., and H. T. Warner. Make and break devices for magneto-electric machines.
10 339 British Thomson-Houston Co., Ltd. Electric switches. (3/4/28, U.S.)
10 340 British Thomson-Houston Co., Ltd. Amplifying systems. (3/4/28, U.S.)
10 392 H. J. Coates General Electric Co., Ltd. Electric protective systems.
10 327 Cie des Forges et Aciéries de la Marine et d'Homécourt E. Granat. Electric relays. (26/6/28, France.)
10 297 J. B. Cutting and R. E. Watts. Direction indicator for portable wireless receivers.
10 306 I.G. Farbenindustrie Akt.-Ges. Apparatus for performing electrometrical volumetric analysis. (3/4/28, Germany.)
10 341 International General Electric Co., Inc. (4/4/28, Germany.)
10 363, 10 364 Warner Electric Brake Corporation. Electromagnetic brakes. (28/4/28, U.S.)

April 4th.

10 464 British Electric Transformer Co., Ltd. Kettles, etc.
10 477 British Talking Pictures, Ltd. (L. de Forest). Reproduction of sound.
10 433 Chloride Electrical Storage Co., Ltd., and H. Dean. Accumulators.
10 407 A. C. Fothergill. Kinematographic change-over system.
10 469 H. E. Humphries and Siemens Bros. and Co., Ltd. Telephone systems.
10 399 B. Loewe. Material for high emission cathodes. (5/4/28, Germany.)
10 452 M. O. Valve Co., Ltd., and A. L. Reimann. Thermionic valves.

April 5th.

10 573 S. W. Atkinson. Electrically-driven sound recording, etc., machines.
10 618 Automatic Telephone Manufacturing Co., Ltd., T. M. Preist and S. R. Smith. Electromagnetic vibrators.
10 621 Automatic Telephone Manufacturing Co., Ltd., and L. M. Simpson. Telephone systems.
10 602 F. Bartling. Electrical purification and separation of admixtures. (5/4/28, Germany.)
10 635 P. Baxter. Motor installations.
10 644 British Thomson-Houston Co., Ltd. Frames for dynamo-electric machines. (7/4/28, U.S.)
10 645 British Thomson-Houston Co., Ltd. Amplifying systems. (7/4/28, U.S.)
10 555 H. G. Brown, D. P. Battery Co., Ltd., and B. M. Drake. Secondary cells.
10 614 Burgess Battery Co. Batteries. (28/5/28, U.S.)
10 591 D. F. Campbell and Electric Furnace Co., Ltd. Induction furnaces.
10 612 W. Dallenbach. Means for introducing current into metallic vacuum discharge vessels. (7/4/28, Germany.)
10 639 Demag Akt.-Ges. Electrically-operated edge-driven rolls. (21/7/28, U.S.)
10 617 Dominion Gramophone Records, (Foreign and Colonial), Ltd. Arrangements for converting sound waves into electrical energy. (28/4/28, U.S.)
10 643 International General Electric Co., Inc. Electric clock installations. (5/4/28, Germany.)
10 519 R. A. H. Lewin. Electrically-driven time-keeping apparatus, etc.
10 606 A. H. Midgley. Electrical amplifying systems.
10 564 E. K. Sandeman and Standard Telephones and Cables, Ltd. Telephone transmission systems.

April 6th.

10 724 A. W., S., and W. V. Butterfield and W. E. Evans. Electric switches.
10 656 J. H. O. Harries. Wireless, etc., signalling.
10 725 C. Traygott. Submarine cables.

April 8th.

10 768 F. S. Blakey. Contacts for electric fuses, etc.
10 850 A. F. Bulgin. Screen grid thermionic amplifiers.
10 853 Condit Electrical Mfg. Corporation. Motor-controlling switches. (30/11/28, U.S.)
10 745 H. M. Dudgeon and T. C. E. Rowland. Current collectors for electric tramway vehicles, etc.
10 786 F. G. Dyer. Tuning inductances.
10 762 General Electric Co., Ltd., and J. J. Gracie. Incandescent lamps.
10 874 Gramophone Co., Ltd. Thermionic valve circuits.
10 733 A. B. G. and E. H. Horstmann and Horstmann Gear Co., Ltd. Electric winding mechanism for clockwork devices.
10 821 F. Krupp Grusonwerke A.-G. Electromagnets for magnetic separators. (18/4/28, Germany.)
10 871 E. C. Moore and C. A. Smith. Electric switches, etc.
10 823 N. V. Philips' Gloeilampenfabrieken. X-ray installations. (19/4/28, Holland.)
10 839 National Carbon Co., Inc. Electric hand lamps. (22/5/28, U.S.)
10 868 R. E. Ollerenshaw. Speed control devices for electric motors.
10 869 R. E. Ollerenshaw. Electric switches.
10 788 M. Paul and P. Wangemann. Switching electric currents.
10 769 W. J. Pritchett. Electric plugs and sockets.
10 840 F. A. Schroeder. Electrostatic telephones.
10 783 D. S. Steuart. Transmitting apparatus for telephones, etc.
10 747 A. M. Taylor. Electric power transmission.
10 874 A. Whitaker. Thermionic valve circuits.
10 768 A. Williamson. Contacts for electric fuses, etc.

April 9th.

10 995 I. Ainstein and W. I. Einstein. Electrolytically covering organic articles with metallic layers.
10 957 L. Alaphilippe. Apparatus for wiring casings, etc.
10 924 J. Anderson. Protection of electric circuits, etc.
10 952 British Thomson-Houston Co., Ltd. Thermionic devices. (10/4/28, U.S.)
10 964 T. K. Cordes, Johnson and Phillips, Ltd., and W. J. P. Orton. Electric switches.
10 920 Graham Amplion, Ltd. Indicating scales for wireless apparatus.
10 919 R. M. Hamilton. Electric signs.
10 899 B. G. E. Haywood. Electrical speech reproducers, etc.
10 916 I. G. Farbenindustrie A.G. Partitions for use in electrolysis of chlorides. (23/12/27, Germany.)
10 986 Kolster-Brandes, Ltd., and P. A. Tiller. Electrical connectors.
10 988 Kolster-Brandes, Ltd. (Kolster Radio Corporation). Signal receiving systems.
10 954 M.-O. Valve Co., Ltd., and W. H. Peter. Electric discharge tubes.
10 925 J. H. Runbaken. Electric testing appliances.
11 021 J. S. C. Salmond, A. A. Symonds and A. Wilkinson. Resonance indicators for wireless transmitters, etc.
10 984 Siemens-Schuckertwerke A.G. Safety connections for relays, etc. (18/8/28, Germany.)
10 930 C. Stille. Reproducing magnets for telephones (26/9/28, Germany.)
10 931 C. Stille. Electromagnetically recording, etc., acoustic vibrations. (26/9/28, Germany.)
10 934 C. Stille. Transmission of signals.
10 935 C. Stille. Sound carriers for electromagnetic recording apparatus. (7/12/28, Germany.)
10 906 A. M. Taylor. Electric power transmission.
10 945 A. M. Vargas. Hygienic attachments for telephone mouthpieces, etc.
10 928 K. W. Wagner. Carrier wave signalling systems. (19/4/28, Germany.)
10 889 R. Weaver. Burglar alarms.
10 912 J. Williamson. Means for supporting cables in sea.

COMING EVENTS.

Saturday, June 22nd.

Sheffield Illumination Society.—Annual outing to York.

Monday, June 24th.

Electrical Contractors' Association (Ealing Sub-Branch).—Ordinary meeting.

Tuesday, June 25th.

Electrical Contractors' Association (Chesterfield Sub-Branch.)—Falcon Café. Ordinary meeting.

Wednesday, June 26th.

Electrical Contractors' Association (Croydon Sub-Branch).—Ordinary meeting.

Electrical Contractors' Association (Belfast Branch).—5, Bedford Street. Ordinary meeting. 3.30 *p.m.*

Royal Society of Arts.—John Street, Adelphi, London. Annual general meeting. 4 *p.m.*

Polytechnic School of Electrical Engineering.—307-311, Regent Street, London. Lecture VI (Course of six lectures) by Mr. W. H. Date on "Thermionic Valves." 6.30 *p.m.*

Wednesday, June 26th—Friday, June 28th.

Electrical Contractors' Association.—Bournemouth. Annual Conference.

Thursday, June 27th.

Electrical Contractors' Association.—Bournemouth. Annual Conference. Presidential address by Mr. W. H. Walton, 11.30 *a.m.*; paper by Mr. A. G. Bruty on "The Mutual Responsibility of Contractors, Manufacturers and Supply Undertakings (*a*) to the Electrical Industry and (*b*) to the Public."

Friday, June 28th.

Electrical Contractors' Association.—Bournemouth. Annual Conference. Paper by Mr. H. R. Taunton on "Possibilities for Contractors in Rural Electrification"; 9.30 *a.m.* Short address by the new President, Mr. Willoughby Ellis, 12 noon.

Physical Society.—Imperial College of Science, Imperial Institute Road, South Kensington. Demonstration of an Apparatus for the Measurement of Electrical Resistance at High Temperatures, by J. L. Haughton; Papers on "The Relation between Hydrogen Pressure and Filament Resistance in a Tube containing Glowing Tungsten," by Teresa J. Dillon; "The Band Systems of Titanium Oxide," by Frances Lowater; and "The Absolute Measurement of Sound Intensity," by F. D. Smith, 5 *p.m.*

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THE ELECTRICIAN

Established 1861. The Oldest Weekly Illustrated Journal of

Electrical Engineering, Industry, Science and Finance.

Bouverie House, 154, Fleet Street, London, E.C.4. Telegrams: "Benbrotric, Fleet, London."
Telephone: City 0244 (Ten lines).

[Closed on Saturdays in accordance with the "Five-Day Week" plan adopted by Benn Brothers, Ltd., and its associated organisations.]

No. 2663. [No. 24. Vol. CII.] Friday, June 14, 1929. Annual Subscription, 25s. Overseas, 30s.

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Current Topics.

A Successful Convention.

Now that the Torquay meeting of the Incorporated Municipal Electrical Association is a thing of the past, it is easier to assess its success from various points of view. So far, the number of delegates attending last week's Convention easily beat all previous gatherings, but, as the Association continues to grow at a very steady rate, it is unlikely that this record will long remain unbroken. We have already noted that most of the papers presented for discussion were of special interest to committee members, and it was interesting to see that the innovation caused many of the Committee members to take a more intimate part in the discussions than is usual. This is, of course, all to the good, so long as the engineer members are not left out of the picture. Fears that this might be so at the Torquay meetings were proved to be unfounded, for the whole programme was of distinct interest to the engineers, even though, with one exception, the subjects discussed bore no direct relation to the engineering side. These papers and discussions must have been very useful in bringing home to many of the engineers present the realisation that their work does not end with buying coal and plant, keeping the station going and laying mains. "Watching the wheels go round" is a job which can now be left to subordinates; the supply engineer of to-day must think of other things. We were glad to note the welcome given to the suggestions that were made for the re-codification of electrical legislation. A reform of this kind would be most helpful, and we hope that the I.M.E.A. will continue to press for the simplification that is so needed. The insight which engineers were able to gain into the general position as regards wages and conditions of work on the workmen's side of the industry, and of the great amount of good that has been done by the Whitley Council movement in the industry under the able guidance of Ald. W. WALKER, was another useful feature of the business sessions. Socially, the Convention was, if anything, more successful than ever, and, although the garden party was literally washed out, the other activities were enjoyed to the full. The recent changes in the secretariat naturally threw a considerable amount of extra work on the ever-willing shoulders of Mr. A. C. CRAMB, the honorary secretary, to whose personal efforts the success of the Torquay Convention was so largely due.

The Speed Boat Menace.

AT one time it was commonly thought in the industry that electricity was an agent for reducing labour in home or factory, and few of us envisaged its use in the entertainment world. To-day there is hardly a form of public entertainment or sport which does not rely upon or at least make extensive use of electricity. The showmen talk of "electrical entertainment" in a matter of fact way, and the public is seeing at first hand something of the ubiquitous nature of the universal servant. With such a wonderful ready-made public interest in being, we are sorry to see that the new "speed boat" craze is associated with the use of an internal-combustion engine. Users of our delightful rivers and seaside resorts are daily deafened with the roar of these evil-smelling contraptions, and with only one or two exceptions—notably Brighton—local authorities have made no attempt to restrain this constantly growing nuisance. The remedy is at hand in the electric battery driven boat. Who, we wonder, will have the courage and the foresight to develop electric propulsion for pleasure craft?

Progressing Backwards.

REFERENCE to missed opportunities for employing electric batteries for driving small boats suggests that serious consideration should also be given to a similar and even more inexplicable lack of progress in the use of passenger electric vehicles. As we recall in our "Looking Backward" feature this week, it is exactly 15 years since an electric battery driven passenger car successfully made the 360 odd miles run from Dumfries to London, and, after calling at THE ELECTRICIAN offices, went on to take part in a parade of "electrics" at the I.M.E.A. Convention at Kingston-on-Thames. Though the factors which held up this promising development at a crucial stage are well recognised, there seems little doubt that since that time progress in this field has been backward rather than forward. There are now evident, we are pleased to see, signs that this period of stagnation may soon be brought to an end, and that an era of quieter, cleaner motoring will not long be withheld from users of the crowded streets of our big cities and towns. Some of us may even live long enough to see the electric taxi-cab reappear on the London streets after its long period of hibernation. Be this as it may, we would seriously suggest that every central station engineer should go his rounds in an electric, thereby acting as a genuine advertisement for his undertaking, rather than for the

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ignition department of a petrol-engined vehicle. Let him ask his wife about it, or any member of the Electrical Association for Women.

The B.B.C. and Its Staff.

DURING the last week there have appeared in the daily Press many comments with respect to the recent resignations tendered by officials of the British Broadcasting Corporation, and one is almost led to believe that that the B.B.C. is likely to find it difficult to maintain its high standard of efficiency. The reason for these resignations do not concern us save that whereas two or three years ago knowledge acquired in the broadcasting service had little market value, the development of the talking film has created a demand for such experience as men in the B.B.C. have acquired. When it is remembered that the staff of the B.B.C. runs into some hundreds, it would indeed be strange were there no changes, and though some of the daily newspapers would have us believe that such changes are of recent occurrence, we have in mind similar resignations in earlier days, commencing with Mr. ARTHUR BURROWS. Another point which seems to have been overlooked is that it is probably to the good of the broadcasting service that there should be changes in the staff of the Corporation, for the more new men brought in, the more likely is it that new enthusiasm and new ideas will be introduced. The resignation of CAPT. P. P. ECKERSLEY is to be regretted but not lamented, for though he was extremely popular as a result of his Writtle performances and is now even more so as chief engineer of the B.B.C., his technical knowledge is not by any means irreplaceable, and is furthermore, we understand, still to be available to the Corporation when desired.

Electrical Development in France.

IT is of interest to the supply engineer and others connected with the industry to know that the hydro-electric development plans for France are perhaps more ambitious than those of any other country. In the construction programme now being realised the complete electrification of the country, with the exception of Normandy and Brittany, will be brought about, chiefly through the development of hydro-electric resources, the total energy available being no less than 7 500 000 kW. The completion of the work will make available 900 000 kW in the Alps alone, and this together with that in the remaining areas will be interconnected in the form of a grid. Some idea of the vastness of the scheme may be appreciated from the fact that along a distance of 100 km of the upper Rhine eight separate and distinct plants will be erected at regular intervals of about 12 km, each with its own dam and lateral canal. Locks will be built at each dam to permit the passage of vessels, while power in excess of that required in the immediate vicinity will be transmitted to Paris. In view of our own electricity schemes it will be appreciated that the adoption by the French of an even more elaborate system of interconnection is deserving of careful watching, for even though the form of generation is different, many of the transmission problems may yield something of interest which may benefit ourselves, while the development of rural areas penetrated by the general scheme also offers possible enlightenment.

The Window with a Voice.

THOUGH we have long looked upon the shop window as a "silent salesman," it seems that our views in this respect must be modified. In one of London's leading stores, window space has been devoted to demonstrations of cleaning pots and pans by means of a new polish, and in order that the demonstrator may "get the story across" a microphone has been fitted on the inside of the window, with a loud speaker on the outside. By means of these two instruments the demonstration of pan-polishing is accompanied by a series of vocal explanations, thus holding the attention of both ear and eye of the audience. This form of window selling, it is claimed, has never been used before in this country, but whether this be so or not, its advantages in a street where congestion is not likely to cause police interference seem worthy of consideration. Demonstrations, which have hitherto been confined to exhibitions or other special arrangements, could be given in the shop window, whereupon spectators could enter the shop for further particulars. In any case, the human element in a window display is always a source of attraction, but with the possibility of contact by speech its interest is greatly enhanced.

"Light's Golden Jubilee."

THIS week we are able further to support the British claim to the first discovery of the incandescent electric lamp by a statement made by Mr. KENNETH R. SWAN, a son of the late SIR JOSEPH SWAN. The facts, as set out on a later page of this issue, are perfectly clear, and there can be no suspicion of a doubt as to the priority of the SWAN invention. It being obvious that the Americans who are sponsoring large-scale celebrations of this discovery, but attributing the honour to Mr. EDISON, would not take such action without believing themselves to be right, we have sought to discover the precise grounds upon which their claim is based. So far we have been unable to reconcile any of the views put forward by our friends across the Atlantic, but in order to give readers an opportunity to see both sides of an interesting discussion we have arranged to print a statement of the American viewpoint as expressed by a colleague on our contemporary, the "Electrical World" of New York. This statement will be found elsewhere in this issue, and though we do not propose to comment on it in detail, we may say that it is a fair representation of the American attitude in this matter. Taking a general view of the controversy we feel it is a pity that the Americans insist on confining their tribute to one who, eminent as he is in many spheres, was anticipated in the incandescent lamp field by one who is no longer here to defend his own title. Apart from this point, their plan to conduct an international celebration of the jubilee of electric lighting is an extremely good one, and one in which not only this, but many other countries, would have been glad to participate. Perhaps it is not too late, even now, for the necessary steps to be taken to allow electrical people in this country to co-operate without reserve in a commemoration which so closely affects the memory of one of its many great inventors.

Suction Cleaner Markets.

THE separation of electric suction cleaners from other electrical products in the U.S. trade statistics will enable interesting comparisons to be made in future as to the development of export business in a line which is becoming increasingly important with many manufacturers over there. How important it is may be judged from the fact that the Electrical Equipment Division of the U.S. Department of Commerce has started a survey of world markets for vacuum cleaners. Last year's exports exceeded 1¼ million dollars. Britain's imports from the U.S.A. were well over half a million dollars, and there were big shipments to Canada, Australia and New Zealand. Sweden is America's chief competitor, according to the first published results of the survey work, having increased production greatly and pushed out with its exports to such purpose that the latest export figure is 111% in advance of the previously recorded yearly figure. In four or five years, Swedish manufacturers have increased their output of suction cleaners by 660%. America and Sweden, however, do not hold all the plums in the vacuum cleaner industry. Production in British works is forging ahead, and at a rate probably no less spectacular than that of America and Sweden. The question of "saturation point" does not arise, nor is it likely to disturb anyone in the trade for ages.

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ELECTRICAL PRESSBOARDS.

Characteristics Under Various Conditions of the Different Grades with Particular Reference to High Grade Varieties—Remarkable Capacity for Long Service—Applications for Thicker Boards in "Grid" Transformers.

By A. R. DUNTON, A.M.I.E.E. and A. W. MUIR, D.S.O., M.C., B.Sc.

(*Concluded from page* 551.)

IN the first part of this article some account was given of the development of pressboard as now used for electrical purposes. To that account it may be added, for the credit of pressboard manufacturers, that the manufacture in this country of the original material for use in the textile industry can be traced to about the middle of the eighteenth century, and for the credit of British enterprise it may be repeated that it is largely due to British research work that the material has attained its present position as one of the most important high grade insulators.

The remainder of this article deals mainly with the characteristics, under various conditions, of the different grades, and particularly the high grade varieties of pressboard now available.

The physical properties of the four grades covered by B.E.S.A. specification 231 are set out in Table I, which is taken from "Electrical Insulating Materials," by Allan Monkhouse. The values in the table correspond closely with those adopted in the B.E.S.A. specification.

Electrical Properties.

Of the electrical properties not the least important is the low specific inductive capacity which can be obtained. The values for this property of some varieties of pressboard approach very nearly to those of insulating oil (B.E.S.A. Spec. 148), a fact which renders the material of very great value in obtaining the most uniform possible distribution of high-voltage stresses. There are instances on record of high voltage transformers insulated with other materials which have failed to give the required performance, and which it has been possible to make serviceable only by drastic stripping and re-insulation with selected grades of pressboard.

The superiority of pressboard over the best alternative materials in this respect is very marked at high service temperatures, as is indicated by the comparative test results shown in Table II. That a range of values is shown for bakelite is due to the difference in properties of various grades,

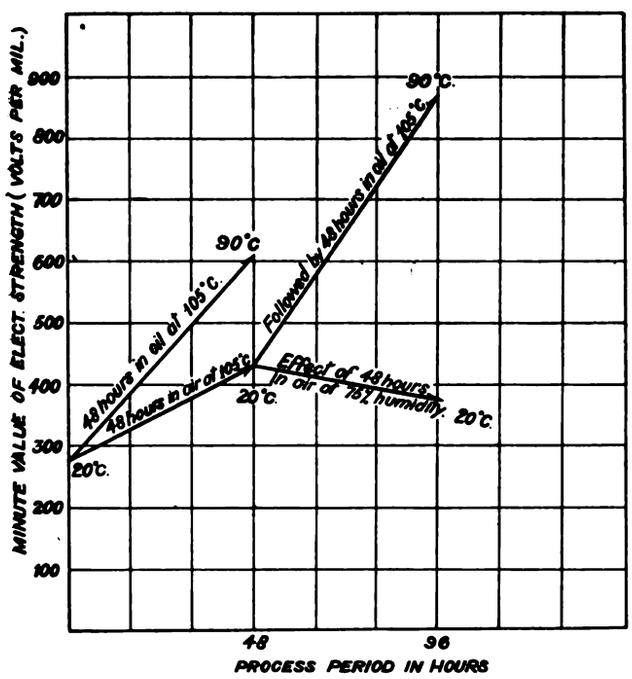

Fig. 6.—Star-graph showing electric strength/minute values for pressboard after definite periods of treatment.

and serves to emphasise the need for B.E.S.A. specifications for synthetic resin varnished paper products. Even allowing for the ranges of values, it will be noted that with rising temperature the synthetic resin products show a rapid increase in power factor and permittivity, and therefore in energy loss, since this is proportional to the product of power factor and permittivity. On the other hand, the power factor and permittivity of oil saturated absorbent pressboard, and hence its energy loss, hardly show any increase even up to 90 deg. C. Confirmation of this is given by Table III, which shows actual

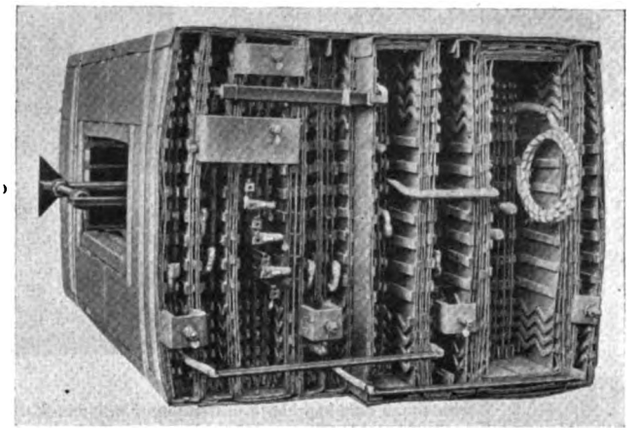

Fig. 7.—132 000 V shell-type transformer winding showing extensive use of pressboard insulation.

test values observed for watt loss in the materials in oil when stressed at 100 V per mil. at a frequency of 50 cycles. It will be noted that while at normal temperature the values for pressboard are at least as good as those of the alternative material, the values at 60 to 90 deg. C., which are of greater importance as representing the actual service temperatures of most oil-immersed apparatus, show in the case of pressboard an increase in energy loss which is very small indeed.

These characteristics have a further bearing on insulating properties in connection with the sustained electrical strength, which for any dielectric is directly influenced by the energy loss and the rate of increase of energy loss with temperature, the effects of these two influences being interacting and cumulative. The low value of energy loss in oil saturated absorbent pressboard and the low rate of its increase with temperature are thus extremely favourable to obtaining high maximum sustained voltages. Some actual test values for these voltages have already been given in Fig. 3.

It will be observed that most of the above remarks refer to oil-saturated absorbent pressboard, but it is important tc note that the electrical strength of pressboard is largely governed by the treatment to which the material has been subjected. This is illustrated in Fig. 6—a "star-graph" which shows the electric strength/minute values obtained after definite periods of various treatments. This diagram indicates again the high value of moisture-free oil-saturated pressboard.

Valuable Properties Explained.

The explanation of some of the valuable properties of pressboard may be in the fact that the material has to a considerable degree the characteristics of the oil with which it is saturated. For reasons at present unexplained, however, the electrical strength of oil-saturated dry pressboard is higher than that of either the dry pressboard or the oil alone. The best (Grade IV) B.E.S.A. pressboards $\frac{1}{8}$ in. thick when tested at 90 deg. C., are credited with a breakdown value of approximately 33 kV, and a high grade transformer oil tested under the conditions laid down in B.E.S.A. Spec. 148 is considered good if it gives a breakdown value of 30 kV between $\frac{1}{2}$ in. spheres separated by a gap of 0·156 in. With oil saturated pressboard of $\frac{1}{8}$ in. thickness, however, a minute electrical breakdown value of at least 50 deg. C. at 90 deg. C. should be obtained. A possible explanation may be found in the improved heat conductivity produced by the oil saturation and the consequent reduction of hot spot effects by the dissipation of heat through the medium of the oil.

When pressboard is used in insulating oil free from impurities very high failure values can be obtained, but even a

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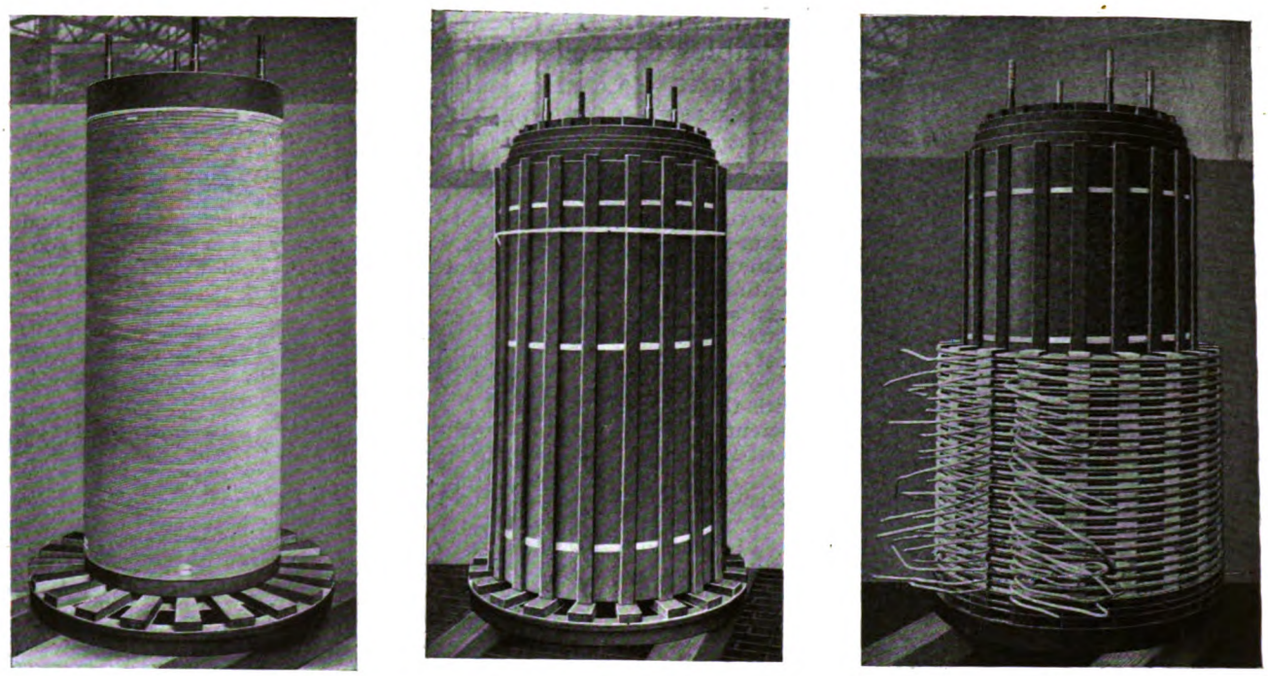

Fig. 8—Windings for a 132 000 V core-type transformer with pressboard insulation. The pictures show (left to right): The l.t. winding completed; the pressboard cylinders and spacing strips between the l.t. and h.t. winding; and finally, the h.t. winding, partly assembled.

slight trace of impurity causes a considerable reduction in electric strength, due no doubt to the impurities lining up in series along the stress paths. The ageing properties of pressboard are greatly dependent upon the class of fibre utilised in its manufacture, and for this reason every care should be exercised in the selection of pressboard for ultimate use; there are many inferior grades the appearance of which is very pleasing but the performance of which is very disappointing. A high grade board should withstand years of service even at higher temperatures than are usually accepted as good transformer practice.

A Striking Example.

A striking example may be cited in the case of a large power transformer which had been subjected to excessive temperature for apparently a number of years, and in which certain high grade pressboards were found to be still flexible and perfectly good, whereas other items of insulation had deteriorated both electrically and mechanically to such an extent that their further use was impossible. In this instance certain insulation items which originally were credited with a value of 250 V per mil. had fallen as low as 30 V per mil, but the pressboard items showed no decrease in electrical value and only a very slight deterioration in mechanical properties as indicated by reduction in flexibility.

The excellent insulating qualities of pressboard and its consequent application to large transformer units has created a demand for boards of large size and thickness, with the result that it is now possible to obtain boards up to 12 ft. long by 5 ft. wide and of practically any thickness required. The chief use of these large boards is for the washers, wave pieces and spacing strips employed in assembling the coils of large shell type transformers. Fig. 7 is an illustration of this application, showing a variety of pressboard pieces embodied in the assembly of the winding of a 132 000 V transformer for the British grid.

The thicker pressboard sheets, which are usually composed of several bonded boards of $\frac{1}{8}$ or $\frac{1}{4}$ in. thickness, are extensively used for barrier pieces between phases, for spacing blocks between coils, and where increased surface creepage paths to earth are required. Some applications of this kind are seen in Fig. 8, which shows one phase of a large core-type high-voltage transformer winding in different stages of construction.

The thicker boards are also finding extensive application for terminal boards, tapping switch bases, etc., due to a large

TABLE I.

PHYSICAL PROPERTIES OF VARIOUS CLASSES OF PRESSBOARDS.

Variety. (B.E.S.A. Grade).	Thickness usually Obtainable.	Specific Gravity.	Tensile Strength, Long. and Trans. Min. either Direction. lb./sq. in.	Tearing Strength Double Tear. lbs.	Oil Absorption, 105° C. %	Water Absorption, 20° C. %	Flexibility—Minimum Bend. Dry Condition.	After 24 hrs. Air 105° C.	After 24 hrs. Oil, 115° C.
Hard (Grade I.)	$\frac{1}{32}$″	1·25	6 500	2	15	100	$\frac{3}{16}$″	$\frac{3}{4}$″	$\frac{1}{2}$″
	$\frac{1}{16}$″	1·20	,,	4	,,	,,	$\frac{3}{4}$″	2″	3″
	$\frac{1}{8}$″	1·15	,,	9	,,	,,	$\frac{1}{2}$″	1½″	2½″
Soft Absorbent (Grade II.) ..	$\frac{1}{32}$″	1·15	5 000	1·75	20	150	Flat	$\frac{3}{8}$″	$\frac{1}{2}$″
	$\frac{1}{16}$″	1·0	,,	4·0	,,	,,	$\frac{3}{8}$″	1″	1½″
	$\frac{1}{8}$″	0·9	,,	8·5	,,	,,	$\frac{1}{4}$″	$\frac{3}{4}$″	1¼″
Extra Dense (Grade IV.) ...	$\frac{1}{32}$″	1·3	6 000	3	2·0	70	$\frac{3}{16}$″	$\frac{1}{2}$″	1″
	$\frac{1}{16}$″	1·3	,,	6	,,	80	1″	2½″	3″
	$\frac{1}{8}$″	1·3	,,	10	,,	90	$\frac{7}{8}$″	2″	2¾″
Slot Lining (Grade V.)	$\frac{1}{32}$″	1·2	6 500	2	15	60	Flat	$\frac{1}{8}$″	$\frac{1}{16}$″
	$\frac{1}{16}$″	1·15	,,	4	,,	,,	,,	,,	,,

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extent to the excellent surface flash-over values which can be obtained between contacts. A typical curve for these values as shown by test results is reproduced in Fig. 9. In respect of this service an outstanding feature of value is the fact

TABLE II.

COMPARATIVE TEST RESULTS SHOWING VARIATION OF POWER FACTOR AND PERMITIVITY WITH TEMPERATURE.

(Tests carried out at 5 000 V 50 cycles).

Temperature.	Power Factor.		Permittivity.	
	Pressboard.	Bakelite.	Pressboard.	Bakelite.
18° C.	0·031	0·025–0·087	4·6	5·9–8·0
35° C.	0·031		4·7	
50° C.	0·036	0·42 –0·50	4·74	8·4–19·0
70° C.	0·036		4·74	
90° C.	0·037	0·55 –0·65	4·82	22–41

that repeated flash-over produces very little carbonisation, a characteristic in which pressboard has again great superiority over bakelite. A typical test on pressboard with stud contacts spaced 7¾ in. apart actually gave the following consecutive flash-over values: 185 kV, 260 kV, 245 kV, 170 kV, 190 kV, the last flash-over value of this series being actually higher than the first. The increased values in the second and third tests were possibly due to elimination of surface moisture by the first flash, and the later decrease was possibly due to deterioration of the oil.

The rapidly increasing and extending use of pressboard has also resulted in considerable recent developments in connection

TABLE III.

COMPARATIVE TEST RESULTS SHOWING VARIATION OF WATT LOSS WITH TEMPERATURE.

(Tests carried out at 100 volts/mil at 50 cycles).

Temperature.	Watt Loss per C.C.	
	Pressboard.	Bakelite.
20° C.	0·00885	0·0089–0·023
60° C.	0·0108	0·02 –0·48
90° C.	0·0129	0·87 –1·2

with moulded pieces and it is now possible to obtain these in many varieties, including moulded cover pieces, channels, flanged creepage rings and tubes. These parts are made directly from the wet pulp and exhibit all the desirable characteristics of the corresponding board materials. Some of these special parts, by no means covering the whole range but showing an interesting variety, are included in the group of pressboard parts in Fig. 10.

Demand for Special Grades.

There is at the present time a marked demand for certain special grades of pressboard and mainly for varieties as follows:—

(*a*) Strong porous material for oil-immersed work.
(*b*) Hard unshrinkable materials for spacing blocks.
(*c*) Low moisture absorption sheets for use in air.
(*d*) Thin hard flexible sheets for slot linings.

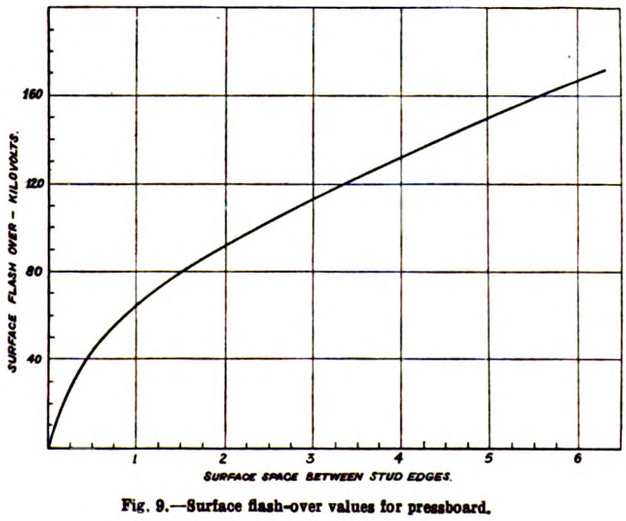

Fig. 9.—Surface flash-over values for pressboard.

Consideration has been directed in this article chiefly to the present position with regard to the first of these varieties, but it should be added that valuable developments have also been made with regard to the manufacture and application of the others. That pressboards are firmly established and recognised as high grade insulating material is indicated by the fact that in transformer applications alone there is a total of over twenty million kVA of apparatus in operation to-day

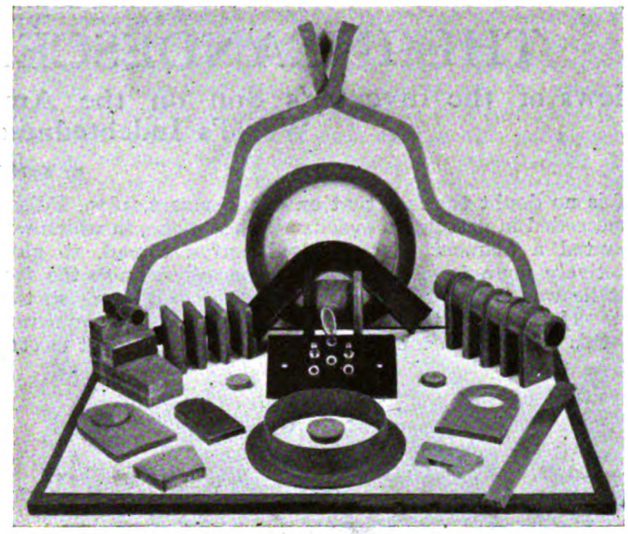

Fig. 10.—Group of pressboard insulating parts, including moulded pieces.

in which pressboard is employed as the principal insulating material.

Since the first part of this article appeared the final draft has been published* of a proposed V.D.E. specification for presspahn, and the values, particularly with regard to the standards for electrical strength, make interesting comparison with those of B.E.S.A. Spec. 231. The table from the draft V.D.E. specification is reproduced in Table IV, in which the

TABLE IV.

BREAKDOWN VOLTAGES IN KV (EFFECTIVE) FOR PRESSPAHN IN FINAL DRAFT OF PROPOSED V.D.E. SPECIFICATION.

Nominal Thickness.	Presspahn Board.			High Quality Presspahn Board.	
mm.	Dry.	Dry and bent.	In Oil at 75°	Dry.	Dry and bent.
0·20	1·8	0·9	9	2·3	1·1
0·25	2·2	1·2	11	3·0	1·5
0·30	2·7	1·4	14	3·5	1·8
0·40	4·0	2·0	19	4·7	2·4
0·50	5·0	2·5	23	6·6	3·3
0·60	6·0	3·0	26	8·0	4·0
0·70	7·0	3·5	29	9·0	4·6
0·80	8·0	4·0	32	10	5·2
1·0	10·0	5·0	37	13	6·5
1·5	12	—	48	17	—
2·0	16	—	56	23	—
2·5	20	—	—	—	—
3·0	24	—	—	—	—
3·5	28	—	—	—	—
4·0	32	—	—	—	—
4·5	36	—	—	—	—
5·0	40	—	—	—	—

ordinary grade may be taken as corresponding with the British grade I and the high quality grade with the British grade IV. An examination of the values shows in the first place a straight line relation between breakdown voltage and thickness over considerable parts of the range. This, however, does not conform with the usually accepted relation of these values, which is that the B.D.V. per mil falls with increasing thickness.

Apart from this slight difference the values in the V.D.E. draft are similar to those in the B.E.S.A. specification. They do

"E.T.Z." May 16th.

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not, however, represent by any means a similar standard of product, for whereas the proposed German standard tests are to be taken on dried material and presumably, for lack of statement to the contrary, at atmospheric temperatures, the B.E.S.A. tests are to be made at 90 deg. C. on material which has been subjected for 18 hours to an atmosphere of 75% humidity. The proposed German standard tests thus involve much more favourable conditions, and the fact that the minimum permissible values are of the same order indicates that the material covered by the continental specification is of considerably lower quality than the standard British pressboards.

In conclusion, the author's acknowledgments are due to Messrs. B. S. and W. Whiteley, Ltd., and the Metropolitan-Vickers Electrical Co., Ltd., for the use of illustrations and information.

THE INCANDESCENT ELECTRIC LAMP.

Views of the Inventor's Son on the American Claim for Important Discovery—The World's Indebtedness to a British Inventor.

By KENNETH R. SWAN.

IT is no doubt the fact that on October 21st, 1879, Edison succeeded in getting an evacuated glass globe, in which was mounted a filament of carbonised cotton thread, to glow effectively for a few hours, and it is no doubt also the fact that he was the first *in the United States* to accomplish this feat. If, therefore, the American nation choose to commemorate this occasion as the birthday of the incandescent electric lamp in the United States, they can no doubt find ample justification for doing so.

The late Sir Joseph Swan, inventor of the incandescent electric lamp.

But, if a broader claim than this is made, as it appears to be made in certain American articles on "Light's Golden Jubilee," then the following facts should be brought to the notice of those who are responsible for the wide and sweeping assertions made.

Early Demonstrations.

In December, 1878, and in January and February, 1879, Joseph Wilson Swan (who had commenced to study the problem of incandescent electric lighting in 1848) publicly exhibited his incandescent carbon lamp, and demonstrated the practicability of electric lighting by this means to large numbers of people in Newcastle-on-Tyne, Gateshead, and Sunderland.

The earliest date of these demonstrations was December 18th, 1878. So far as absolute priority is concerned, therefore, Swan was 10 months before the date claimed by the Americans for Edison's first demonstration. The 50th anniversary of this occasion (i.e., December 18th, 1878) has already been commemorated by the Institution of Electrical Engineers as the veritable birthday of the incandescent electric lamp.

It is further to be observed that neither Swan's lamp as exhibited in 1878, nor Edison's as exhibited in 1879, had in its initial form all the necessary qualities of a *commercially* successful lamp.

The first serviceable lamps made by Edison had filaments of bamboo. A few of these lamps were first seen in England in the spring of 1880. But even this form of filament, elegant and ingenious as it was, was not destined to achieve more than an ephemeral success.

Early in 1880, Swan, who had been working during the past months to improve the filament, devised a means of producing carbon filaments of the required strength and uniformity. These filaments were known as parchmentised cotton filaments, and the first commercial manufacture of lamps in Great Britain, commenced in 1880, was based upon this improved filament.

Edison quickly discarded his bamboo filament and adopted the parchmentised cotton filament of Swan's invention.

This form of filament held the field in America, no less than in Europe, and for several years all incandescent electric lamps, all the world over, were made with Swan's parchmentised filament.

The Squirted Filament.

In 1883 Swan devised a further improvement in the filament, namely, what was known as the squirted filament. Cellulose in the form of nitro-cellulose or (according to a later modification*) cellulose dissolved in chloride of zinc, was squirted through a small orifice, in the form of an endless thread. This was subsequently reduced to pure cellulose, then cut and shaped and carbonised.

This form of carbon filament, which immensely improved the efficiency of the lamp, superseded the parchmentised cotton filament, and resulted in the greatly extended use of incandescent electric lighting. Edison had nothing to do with this innovation in the principle of filament manufacture, but it was adopted in the so-called Edison lamp, as it was everywhere else throughout the world.

It is only necessary to add this. Though America no doubt owes much to Edison's initiative in connection with the evolution of the incandescent carbon filament lamp, it also owes much to Swan. On the other hand, the British manufacture of the incandescent carbon filament lamp in this country owes nothing whatever to the work of Edison, which the United States are now so loudly acclaiming as an event of world-wide importance.

The British manufacture of the incandescent carbon filament lamp in its practically commercial form is based wholly upon the work of Swan and his collaborators; and the same is true of the manufacture of the lamp on the European Continent.

America's claim, therefore, that the incandescent electric lamp is an American invention, is not only incorrect in its historical foundation, but shows an utter and most ungenerous disregard of the debt she undoubtedly owes in this matter to England.

The publicity which has already been given in our columns to the American celebration of "Light's Golden Jubilee" has given rise to comment in the U.S.A. The American viewpoint on this matter is expressed in the "American Letter," by Mr. F. C. Wells, news editor of the "Electrical World," on page 726 of this issue. The British point of view is summarised in the "Electrical World" of June 1st, page 1 118.

* Jointly developed by Leigh Powell and Swan.

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INDUSTRIAL MOTOR CONTROL GEAR.

Novel Applications of Machinery in Manufacturing—Milling by Index Table Method—Drilling Drum Controller Segments—Ingenious Grid-forming Machines.

THE design and manufacture of control gear inherently calls for a wider general knowledge and experience of electrical machines and their applications in industry than any other branch of electrical engineering. This will be readily acknowledged if one contemplates for a moment the important and onerous functions which control gear has to perform. Not only has it to control and protect the electric motor, generator or transformer, as the case may be, but it must essentially also protect the operator and protect and control the plant with which it is used.

The British Thomson-Houston Co., Ltd., Rugby, has for many years specialised in the manufacture of control gear, and the continued advance of electricity into fresh fields, and the improvements in the machinery which other branches of engineering are continually making as a result of such application, daily brings forth new problems and requirements.

The building shown in Fig. 2 forms a part of the main works at Rugby, and is entirely devoted to control gear. The tinsmiths', press shop, foundry, and the sections dealing with resistances, insulation and coil winding, are situated in other buildings. In the factory shown, the machine shop occupies the whole of the second floor, with an area of 22 500 sq. ft. It is thus situated between the two floors on which the majority of the assembly work is done, the parts for the smaller apparatus being sent up to the top floor, while parts for the larger types of apparatus go down to the first and ground floors. The latter floor is used for the assembly of contactor panels, automatic sub-station panels, transformer tap-changing "on load" and ship propulsion equipments. In the busbar section of this floor are special tools for the edgewise bending, drilling, forming, cutting and sweating of busbars. This equipment enables busbars and heavy current back connections to be made neatly and with less joints. The first floor is devoted to smaller contactor panels and to traction equipments, etc., and the second is the machine shop. This floor has been laid out with a view to keeping the material flowing continually in one direction. Raw material enters by a lift at the north end, and the finished part is finally delivered to the inspection department at the south end, where a second lift carries it to the assembly section, where the material flows in the reverse direction—i.e., south to north—thus giving the material a uni-direction flow through the building.

The arrangement shown in Fig. 5 illustrates the milling of operating arms for railway contactors on an automatic milling machine, by the index table method. These operating

Fig. 1 A.—Assembly of controllers, hand-operated and pillar-type startors and the winding of resistance tubes at the B.T.-H. control gear factory at Rugby.

arms are of malleable cast iron and the six bosses have to be machined outside and the pairs at each end are machined inside as well. The arbor carries a gang of cutters to machine two castings side by side. By using the index table, no time is wasted, as the operator is loading one jig while the cutters are working on the other one. The machine table is automatically controlled by dogs, so that the operator has only to raise the starting lever each time, the motion of the table being quick forward, feed, quick return, and stop. This particular operation has one or two special features. It is impossible, due to the shape of the centre of the casting, to machine right through at one operation, but the jigs have been so designed that four bosses are machined outside and one pair inside in a jig at one end of the table, the remaining pair of bosses being machined inside and out in a jig at the opposite end of the table, the two jigs being so aligned that the two operations are "complementary" to one another.

This arrangement made it possible to use the index table with only one jig of each kind instead of a pair of each, as is the usual practice, so that each casting only pays one visit to the machine before being finished. If two pairs of jigs had been used it would have meant machining one end of all the castings first, and then going over them all again to machine the second end.

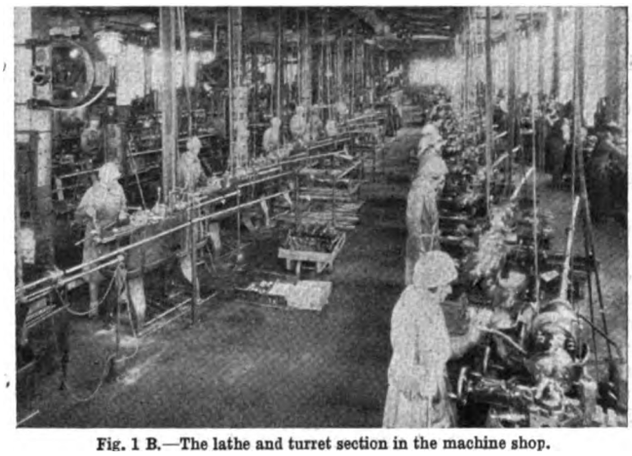

Fig. 1 B.—The lathe and turret section in the machine shop.

Owing to the fact that the large cutters have passed the outside of the end bosses before the small cutters reach there, it was found that springing took place. To overcome this the large cutters were made with large diameter bosses which were slightly greater in diameter than the small cutters. These bosses reach the outside and the bosses, which have already been machined before the small cutters, start to cut on the interior and so hold the whole job perfectly steady. Production for the complete cycle of two operations is about 30 per hour with girl operators.

Fig. 6 illustrates a device for the rapid drilling of parts with a single hole, such as contactor tips, etc. The main principle is that the downward movement of the spindle as the drill approaches the work is used to clamp the work in position. The general housing is common to a number of parts, interchangeable blocks being inserted for each separate article. The barrel attached to the spindle contains a spring plunger, to which are pinned two pairs of links pivoted on the top of the fixture. On these links is an adjustable block carrying a further spring plunger which bears against the work as the drill descends. This second plunger engages with the work and thereafter the further downward movement of the drill is taken up by the spring in the barrel. The machine is foot operated so that the operator has both hands free.

A very large variety of drum controller segments have to be drilled, and the machine shown in Fig. 4 was designed in the controller factory to take care of all these parts. The two spindles can be set at any angle between 18 and 180 deg., the angle being plainly marked on the sector on which they are mounted. Adaptors of various sizes can be inserted at the centre of the circle to accommodate segments of varying widths and diameters. These segments are mounted on their respective adaptors by means of two arms, which are also set to a scale of degrees. The drive is taken from the motor by a belt passing over the two pulleys and transmitted to the spindles through two pairs of mitre wheels. The tool used is a combined drill and counter-sinking tool, so that only the one operation is necessary to drill and counter-sink both holes in their correct positions.

The top floor, a general idea of which can be obtained from Fig. 1A, is devoted to the assembly of controllers, hand-startors and pillar type startors, and the winding of resistance tubes. Vitreous enamelled units are wound on porcelain tubes and then enamelled in an electrically-heated oven. (Seen in

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Fig. 1.) The temperature is continuously recorded on a chart by a Leeds and Northrup recorder, seen on the right in the illustration. This plant is capable of turning out 9 000 resistance tubes per week. The units are enamelled at red heat and on completion will withstand overloading to similar temperatures for comparatively long periods without permanent injury. An important product of this floor is pillar type startors, both a.c. and d.c., both faceplate and drum type starting pillars being manufactured. D.c. pillars, comprising drum type startor with step-by-step ratchet motion are supplied, up to 1 200 A capacity. A.c. pillars, equipped with a similar drum type startor for the rotor circuit, and a triple pole contactor with overload relay in the stator circuit are supplied up to 500 A per phase. D.c. faceplate startors, owing to the greater quantities required, necessitate special handling by a straight assembly line method, starting with the switch base at one end and finishing with the complete startor at the other. The number of operations to be performed by each worker is planned to occupy the same time, so that there is no accumulation of work between the operators. The necessary parts required for each operator are stored in suitable receptacles, so that they may be reached with a minimum effort. At the end of the line the complete startor is tested and is ready for packing and despatch.

Cast grid and unbreakable resistances for crane controllers, trolley 'buses, tramcars, traction, neutral earthing, etc., are made in a separate building, and machines for producing and assembling these unbreakable resistances are shown in Fig. 7. These are completed by fitting terminals and assembling in frames as shown in Fig. 3, final testing taking place in the enclosure seen in the background. The unbreakable resistance is composed of a continuous wire unit, formed into grids on the machines seen in the background of Fig. 7. The wire, or strip, comes into the works in a continuous coil. It is first cleaned and then electro-plated, to render it proof against corrosion. Then it is fed to the grid-forming machine, from which it emerges as a continuous series of grids, which are coiled directly on to drums seen in the foreground of the same illustration. The next operation is that of building the grids into resistance banks, mounting on mica insulated tie rods with the necessary spacing and insulating washers, and then passing the product to the section shown in Fig. 3, where terminals and covers are fitted. If necessary a number of boxes are bolted together to form a complete unit. They are finally tested for resistance and insulation.

AMERICAN LETTER.

Why Americans Regard Edison as Hero of Semi-Centennial of Incandescent Electric Light.

By FRANK C. WELLS, News Editor "Electrical World."

NEW YORK, May 25th, 1929.

AMERICANS are accustomed to think of Thomas A. Edison as having undisputed title to the invention of the incandescent electric lamp, which they naturally regard as by far the greatest of his achievements. The phonograph, which is certainly all his, and the motion picture, in the genesis of which he had so large a part, have added greatly to the pleasure of the world and have been of business utility besides; but they have borne a relatively small part in the industrial and social revolution in which electricity has far outweighed every other factor.

Serene in their faith, various electrical organisations and societies are about to stage a vast celebration, to be known as "Light's Golden Jubilee," and spread all over North America. This celebration, for which the Edison Pioneers have selected a sponsoring committee of eminent citizens headed by President Hoover as honorary chairman, and which is backed by the National Electric Light Association, will signalise the semi-centennial of incandescent electric light, and will glorify Mr. Edison as the Jupiter from whose brain it sprang, and as the one who may rightly look at all that has followed because of it as derived from his early exertions.

Mr. Edison, those who know him well tell us, is not the man to whom such a pose appeals, and he is likely to view his own apotheosis at the age of eighty-two with an air of detachment, depreciation, and, possibly, slight impatience. The work-bench, not the limelight, has been Edison's lifelong habit. He would undoubtedly have rested amply content with the laurels heaped upon him in the past and foregone the coming culmination. But the celebration must have its hero, and by universal consent of his fellow-countrymen—Edison is he.

It is a little disconcerting that, right at this point, there should float across the Atlantic drawn-out echoes of the British celebration last year of the fiftieth anniversary of the Swan lamp. These echoes do not quite harmonise with the opening strains of America's 1929 electrical orchestra. Many English electrical men, it has been made apparent, are of the opinion that because Swan demonstrated his invention ten months before Edison's was ready, the priority is, and the tributes and popular fame in this particular connection should be, his.

Without any attempt to compare technically the two lamps, each developed with no knowledge of the other—a comparison to make which the writer has no qualifications whatever—may it not be contended that, while Swan's lamp is an interesting historical fact, Edison's is an ever-present reality? In the United States students of the history of lighting are, of course, familiar with Swan's name, but it would be safe to say that not one other citizen in a hundred thousand ever heard of him. Yet there is not in this country a school child, a Chinese laundryman or a Syrian peddler who does not associate electric light with Edison. This is because, with a practical grasp and a business sense unusual in inventors, Edison developed along with his lamp the system of electric generation, transmission and distribution that, with no fundamental change, is used to-day.

Three years after his lamp was shown to be a practical device, the famous Pearl Street power house was energising the first incandescent electric lighting system of the world—the system that illuminated downtown New York. This system Edison and his agents rapidly spread, not only over America, but over Europe as well. When England, France, Germany and Italy swang into line with the United States as pioneers in electrical development, it was Edison to whom they turned for inspiration.

While according high honour to Swan and any other inventors who worked successfully at the problem also solved by Edison, but who failed to win the last heat of the contest—with which the telegrapher from Michigan ran away—there will be few on this side of the Atlantic who will admit that the hero of the jubilee has been wrongly chosen. If in the discovery of the new world of electric light Swan was an authentic Leif Ericson, Edison is an equally authentic Columbus. The rôle of Amerigo Vespucci can never be made to fit him.

The Trade Commission Investigation.

The investigation which the Federal Trade Commission is conducting into the utility companies, their financing and their methods of propaganda goes on more or less merrily. A new feature has been bestowed upon it by the discovery that the International Paper Co., now a subsidiary of the International Paper and Power Co., recently purchased stock in thirteen to fourteen daily newspapers in various states, and permitted offers backed by it to be made for many others. The position taken by the International Paper and Power Co. is that, just as it was organised to take care of an enormous pulp and paper-mill business by adding to exclusively industrial water-power plants the control of utility operating companies whose primary purpose and duty are to furnish power to all applicants alike, so it acquired an interest in daily newspapers to assure a market for its newsprint. With apparent complete sincerity, the International company protests that it never dreamed of trying the editorial policy of the newspapers into which its subsidiary bought. As a matter of fact, one of these—in Chicago—attacked the local utility companies and supported the Federal Trade Commission's investigation. None the less, the paper company incident has not made a good impression on the public, and the electrical industry is probably nearly unanimous in regretting that it arose.

Does it not all seem part of the tremendously complicated fabric of modern business, with its ramifying and interlocked antennæ and its substitution of credit for cash? Where it will end no man knows. But if, for instance, editors are ever to be as immune from suspicion as the wife of Cæsar, they will have to own the papers for which they write, eschew advertisements and cry in the wilderness for enough subscribers at a greatly enhanced price to insure them a living from sheets greatly diminished in size. In other words, the wheels of journalism must turn backward. It is a safe prophecy that they won't. The waterwheels, too, will continue to revolve in the normal direction; electric light and power will grow more nearly universal and more nearly an absolute essential to human life, and somehow or other consumers and producers, big businesses and small, lawmakers and law breakers, reactionaries, reformers and ordinary mortals will muddle along to an adjustment or, at any rate, a *modus vivendi*.

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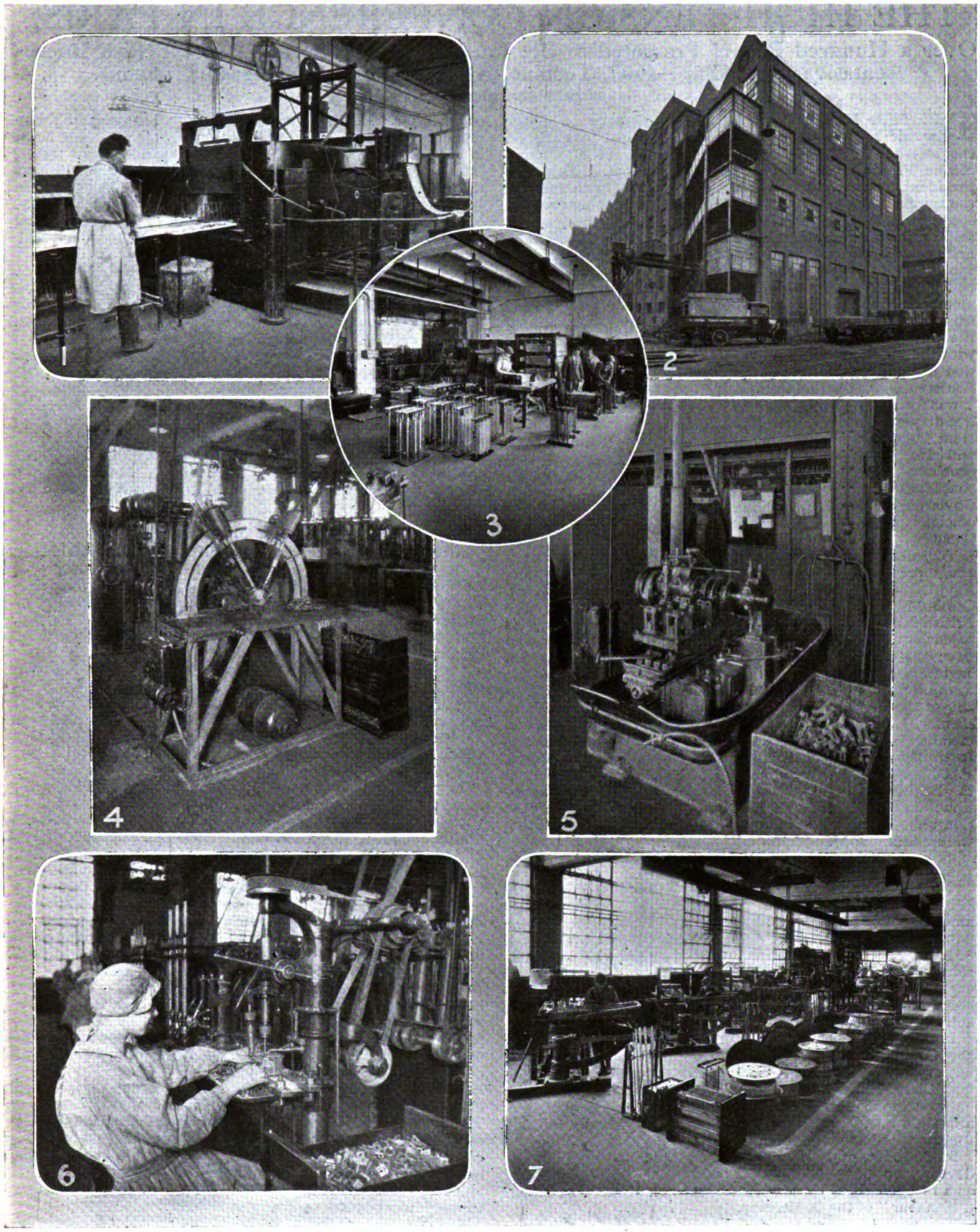

INDUSTRIAL ELECTRIC MOTOR CONTROL GEAR.

THESE pictures, taken in the British Thomson-Houston Co.'s control gear factory at Rugby, are referred to in detail in the accompanying article. They illustrate :—(1) *Electric oven, with automatic temperature control, for vitreous enamelling of resistance units;* (2) *Exterior view of the building devoted to control gear ;* (3) *Final operations and testing of unbreakable resistances ;* (4) *Two-spindle machine for drilling drum controller segments ;* (5) *Milling operating arms for railway contactors on a 24 in. automatic milling machine by the index table method ;* (6) *Self-clamping jig for drilling contact tips, etc. ; and* (7) *Machines for winding and assembling unbreakable resistances.*

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THE HIGH TENSION CONFERENCE IN PARIS.

Over a Hundred Papers Presented to Big International Gathering—More British Representatives Attending—Fuel, Turbine, Alternator and Switchgear Problems.

By THEODORE RICH, A.M.I.E.E.

THE Fifth Biennial International Conference on Large Electric High Tension Systems was opened in Paris on the afternoon of June 6th, in the presence of M. Colson, of the French Ministry of Public Works. M. Ulrich, the President of the Conference, who is connected with some of the largest power undertakings in France, in opening the proceedings, pointed out that beginning in March, 1921, as the result of proposals made at a meeting of several engineers, the first congress was held in November of the same year, in which 150 French and 51 foreign engineers took part. The Congress had grown so rapidly that at present there were about 700 members belonging to 32 countries. The Conference was from the start under the patronage of the International Electrotechnical Commission; it worked in close co-operation with the latter organisation, preparing in many cases information regarding matters suitable for standardisation. The Conference was continuing to carry out the objects for which it was formed, namely, the interchange of information and the free discussion of matters of technical interest between government, municipal, consulting and manufacturing engineers, and also professors and others interested in the very varied problems relating to high tension systems. The official character of the Congress was recognised by the French Government, and Dr. Mailloux, of New York, was the official representative of the American Government at the Congress.

The ministries of Public Works of Belgium and Denmark sent representatives, as did also the Governments of Canada, Egypt, Italy, Norway, Holland, Poland, Roumania, Sweden, Czechoslovakia and Tunis. It is a pity, therefore, that the British Electricity Commissioners, whose primary duty it is to encourage the development of electrical power, and who have the right to a material extent to dictate to British engineers as to how their work shall or shall not be carried out, have been too busy to send one of their number to this or to any of the preceding high tension congresses. Messrs. P. V. Hunter, J. R. Beard and Johnstone Wright, the last of these a member of the Central Electricity Board, represented the Institution of Electrical Engineers, and Messrs. J. E. Cogle, P. D. Morgan, B. Whitney, and E. B. Wedmore represented the British Electrical and Allied Industries Research Association; 42 British members in all were registered for the Congress, a great improvement on the numbers supporting the session in 1927.

Britain's Contribution.

The presentation of 15 papers at the Congress from Great Britain, dealing *inter alia* with insulating oils and other materials and with circuit breakers and transformers, some papers being the results of detailed experimental work taken in hand by well-known British firms or engineering organisations, will go far to give back to British electrical power engineering that place which, despite numerous political and social obstacles in the past, it should take relative to kindred activities which are taking place in other countries.

It might be noted that the number of papers prepared for the Congress reached the figure of 108. Some of these, however, of a mathematical or purely descriptive character, lend themselves more to careful study, with utility for reference purposes, than to active discussion in the time available, although many papers on what might be termed burning topical questions have given rise to much useful debate.

M. Legouez, of Paris, who had so much to do with the development of the Congress, is retiring from active work, but as a recognition of his services he was nominated "President d'Honneur" of the Conference.

The proceedings of the first day, Friday, June 7th, were related to fuel, steam turbines, alternators parallel operation and switchgear.

Dr. Mailloux in his paper on the rational utilisation of fuels, which dealt in the main with conditions in the U.S.A., stressed the increased capacity of steam raising plant per unit of space, owing to the almost instantaneous combustion obtained with pulverisers as compared with various forms of stokers, in which the combustion per square foot of grate area must be limited by the thickness of the fuel and the difficulty of getting air into contact with it. M. Dubertret, in his paper on French High Pressure and High Temperature steam turbines, pointed out that while great progress was being made in this direction the usual conditions regarding load factor, etc., in France did not seem to warrant the capital charges necessary when going to such high limits as are being used in some other countries. Messrs. Bakker and Van Staveren, of Holland, pleaded for a higher standard of slot and end coil insulation, giving tests and notes on the means by which such improvements could be obtained.

M. G. Darreus, in his paper on the Evolution of Alternators, pointed out that unwarranted demands for a high degree of inherent self regulation were still tending to hold back alternator design. Automatic regulators and specially arranged compound excited exciters made such requirements unnecessary; a power station should be called upon to supply active power to a network, the reactive power being supplied by synchronous condensers or by other means. M. Puppikofer of Switzerland described the automatic starting and paralleling from a distance of unattended generating plant. This is of interest in countries when water power is available in quantities to feed networks which would not warrant the use of the continuous employment of attendants; there must be some places at home where such arrangements could be adopted.

Exchange of Energy.

A paper by J. Reznicek dealt with exchanges of energy between stations operating in parallel. The importance of frequency maintenance, of the supply of inter-station requirements from the most economical source, the necessity for efficient means of communication with the central bureau, and the necessity for ample powers in the hands of the despatching department were urged.

In the discussion it was pointed out that the effective capacity of a transmission line rapidly decreases with its length; that synchronous condensers have an important influence on the amount of power which can be handled in a network and that the limiting factor on the amount of power which can be operated in parallel to a material extent depends on the breaking capacity of oil switches.

In the afternoon of June 7th, switchgear was dealt with. A report was presented by the Swiss Committee charged at the end of the 1927 Congress to look into various important matters relating to oil switches. Although researches have been made and certain rules formulated in Germany, England, America, France, and Switzerland it is desirable to find some common ground by which such switchgear can be compared and rated. A questionnaire was drawn up, the answers have been tabulated and certain recommendations are made.

Messrs. Wedmore, Whitney and Bruce presented a detailed report on researches carried out with the aid of a 5 000 kW turbine at Carville covering 3 000 tests.

M. J. Kopeliowitch presented a report on oil switches, giving a number of motion pictures made with the aid of a switch in oil in a glass cylinder, illuminated by 200 000 c.p., the apparatus taking 300 images a second. Owing to the formation of carbon the large bubble of gas formed comes out black in the photographic images.

This was followed by a report with cinema films of a testing station recently inaugurated by the Ateliers de Constructions Electriques de Delle for the testing of oil switches and research regarding switch operation. The generator is of 50 000 kVA. capacity at 15 000 revs. It was pointed out that the shock on an oil switch on short circuit could be exceedingly violent, and there was a tendency to blame surges for difficulties due to mechanical causes regarding switchgear.

The electro-dynamic forces on busbar insulators could be very great, the shocks being of a very sudden character. The increased height in busbar supports asked for by some power companies simply increased the bending moments on them, porcelain not being elastic. With 200 000 A busbars 18 in. apart should stand 2 tons at the beam.

Films were given showing the effect of a short on section links and busbar supports. During the discussion on the group of papers Mr. Wedmore said that the design of commercial circuit breakers would not get down to real economy or efficiency until all factors had been separated out and examined

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quantitatively and qualitatively. 'The point was, what were the conditions under which the arc was quenched. If we waited until the current came to zero and then broke, no energy was broken; if broken while current was still on there must be a large liberation of power owing to the proportion of the wave cycle that remained. One wanted a balance sheet to see where the power came from and went to.

Dr. WHITNEY said that arcs do go out sometimes when still inside the bubble of the gas produced in the oil, and one sometimes got an increase of pressure even after the gas bubble had disappeared. It was stated that as voltage increases the less the variation in results, apparently due to the fact that with medium or low voltage the current is cut off within 2 or 3 half cycles, whereas with high voltage 20 to 23 half cycles may be required.

M. SAINT GERMAIN said that laboratory results were never quite the same as in practical operation; constructors should guarantee a minimum time in which to cut off current.

When reading the reports and listening to the discussions on oil switches it seems to be a pity that the Central Electricity Board at home should be rushing into contracts relating to the supply of scores of thousands of pounds' worth of circuit breaking gear at a time when there is no urgency whatsoever and a reasonable amount of money put up to aid research work might well yield dividends running into hundreds per cent. The work on switchgear initiated two years ago is undoubtedly yielding fruit and the electrical community owes a debt of gratitude to those who are carrying out valuable research work with the expenditure of much time and money.

Below are given short abstracts of some of the papers read, together with a concise account of the discussions :—

THE STARTING UP AND PARALLELING OF ALTERNATORS IN AUTOMATICALLY OPERATED CENTRAL STATIONS. By H. PUPPIKOFER.—There is to-day a movement towards the suppression of nonproductive labour and the utilisation of all forces which may contribute towards production. A great deal of the service of the tending of plant and apparatus can be termed non-productive, the cost of labour has been largely increased, and a movement which was initiated to a large extent in America is tending towards the development not merely of automatically operated sub-stations but also of auxiliary power stations operated automatically, the principal rôle being that connected with water power.

Where synchronous generators are concerned the problem is to find a means by which a generator can be run up and put into parallel.

There are three general methods.

Three Methods.

(I) Coupling by means of reactance coils. With the aid of these in circuit if an incoming generator is run up to approximately synchronous speed and, the coupling switch closed, the current flowing is limited, the machines are run into phase, and the reactance is automatically cut out.

(II) By auto-synchronising (pull-in) methods, which have been used in America for units up to 10 000 kVA. The alternator has amortising bars, and it is run up by the hydraulic turbine to a speed near that of the synchronous circuit to which the generator is to be coupled. The incoming generator is switched in without excitation, the current running up, in some cases, to 8 times normal. By raising the excitation one can reduce the rush of current, but, for some seconds at least, it remains at double full load. Such means, which must affect local voltages, can only be used on large networks.

A third method is to run up the speed to the exact synchronism and parallel-in automatically. One means is to run a synchronous motor from the circuit in operation and connect it to the incoming machine by means of a differential gear box which can actuate the hydraulic regulation movement until synchronism is obtained. Another method is to use two modified dynamo-tacheometers cross connected.

A system is described by which a station containing two 700 kVA low tension units can be run up to speed and coupled up by the closing of a main switch which connects the feeder from the station to the main network.

In the discussion it was pointed out that as automatic power stations are usually actuated by turbines in positions difficult of access, the use of an asynchronous type of generator (which would not require paralleling) is not usually advisable, as its operation would mean the supply through the branch in question to the generating point of quantities of reactive current.

INFLUENCE OF OPERATING CONDITIONS UPON THE DEVELOPMENT OF ALTERNATORS. By M. DARREUS (Engineer of the Compagnie Electromecanique (formerly Brown Boveri of Paris).—This paper presents in a comparatively small space a comprehensive analysis of the factors influencing modern alternator design.

At one time the limited extension of networks, their low diversity factors, the absence of efficient automatic regulators or compounding devices, caused purchasers to lay undue stress on the inherent regulation of alternators. Armature reaction was held in check by large air gaps and saturation, so that no load excitation formed the major part of that required for full load. Such limitations naturally influenced short-circuit currents.

Diminished Exciting Current.

The coming of the high-speed turbo-alternator led to the abandonment of such restrictions in order to increase the output per unit of material, leakage reactance with transient short circuit phenomena being of more importance now than armature reaction. The proportion of no load to full load excitation has now reached 3 or over, but diversity factors have materially stabilised station loads, and separate excitation and automatic regulators have made such alternators satisfactory in operation. At normal excitation the permanent short circuit current has come down a great deal, and for both turbo-alternators and large slower speed alternators. The primary duty of the excitation is to balance the demagnetising ampere turns of the armature, only a small proportion of the excitation being required for no load conditions. The increase in speed and pole pitch and of the ampere turns per centimetre has led to a diminution of exciting current.

The limits of output factors at present are about 150 metres per second peripheral speed air gap induction B. 10 000 and 700 ampere turns per centimetre, which gives about 7 000 kW per square metre of air gap area. The saturation limits the air gap induction, the state of metallurgy limits the peripheral velocity, but the ampere turns per centimetre length could be still further increased by increasing the depth of slots to 30 cm., and the ampere turns from 700 to 1 800 without excessive eddy current losses in the slots, the main problem in such cases being the reduction of losses in coil ends.

Core losses have been kept down, and the relative reduction of the iron losses which do not vary with the load as compared with those which do so, will tend towards the improvement of synchronous compensators at light loads.

The continuous increase in ampere turns is often limited by special factors. For example, alternators required to feed long high voltage lines at low loads may have to supply a leading capacity current which, reacting on the flux and voltage, may reduce the necessary excitation to such an extent as to reduce the synchronising couple. There has been, therefore, a tendency to increase the air gaps, though it is doubtful whether such modifications are worth while, as more than one machine can usually be run in parallel, and absorbers of reactive power such as transformers and synchronous motors may be connected into the circuit.

Distributing networks tend to absorb excessive capacity currents and the tendency is to reserve to the generators the supply of active power, leaving to synchronous or asynchronous compensators the duty of the supply of reactive power. Asynchronous compensators, excited by polyphase commutator machines in cascade, in which the compensator-rotor ampere-turns oppose those in the stator are coming into vogue.

Problems regarding the stability of power transmission systems form a material influence as tending to limit the ampere turns, but such an influence often assumes a constant field current, which to-day ceases to be such a material factor now that reliable automatic voltage regulators are available.

For excitation the normal shunt system is not desirable, the compound system being but little better, as the demagnetising influence of the stator on short circuit has so much influence. A separately excited exciter would give an improvement in this direction. The author of the paper, however, prefers the use of a series exciter with an entirely laminated field arranged to operate on the straight line part of the no load curve. This type of exciter can be arranged with an auxiliary coil fed by a storage battery or extra exciter which can add or subtract ampere turns to an extent settled by an automatic regulator connected up on the potentiometer principle. The prejudicial effects often imputed to an excessive armature reaction are often due to insufficient study of accessory problems.

Capacity is not as troublesome as is often imputed; in fact its effect can be considered as opportune and favourable.

(*To be continued*).

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THE I.M.E.A. CONVENTION.

Sir John Snell on the Simplification of Distribution Systems—The President and the Promised Land—Wider Scope for Municipal Engineers—Mr. Cramb's Services.

ALTHOUGH our special illustrated report of the 34th annual convention of the Incorporated Municipal Electrical Association at Torquay last week occupied no fewer than twenty-three pages, and included reports of all the papers and of all the discussions, considerations of time and space compelled us to hold over the report of the annual dinner and of the annual meeting on Friday, now presented below.

At the annual dinner, held at the Pavilion on June 6th, SIR JOHN SNELL (Chief Electricity Commissioner) proposed "The Incorporated Municipal Electrical Association," and said that for ten strenuous years the Electricity Commissioners had been trying to bring some orderly simplicity into the electrical industry out of the tangle of numerous frequencies and pressures and systems which they found confronting them.

In his opinion, economic generation was now adequately provided for, and when it was remembered that the output of electricity—low as it had been—had doubled in the last five or five-and-a-half years, and that the average rate of increase of growth was one thousand million units per annum during the last two years, he had no reason to doubt that the large output of electricity which he had advised the Weir Committee in 1924 would probably be realised within 15 or 16 years, was in a fair way to being realised, or even exceeded.

He agreed with the President that provision for the cheap production of electricity and its main transmission was only half the story, and whether it fell to himself or to someone with fresher vigour to head the Commission in the work which lay before it, there could be no doubt that the next task which would obviously fall to the Commissioners was to bring about co-ordination in the distribution of electricity throughout the country. He did not, however, wish to be misunderstood. For years past the Commissioners had been steadily encouraging—and had been greatly assisted by many of the distributors—the gradual standardisation of their systems and the gradual supplanting of d.c. by a.c. distribution, without which, he ventured to suggest, the increasing density of load in urban areas for domestic purposes in particular can never adequately be met. That quiet preparation was, in the aggregate, going to be quite a substantial contribution to the gradual simplification and improvement of distribution systems, and was quietly paving the way for the larger step yet to be taken.

He specially hoped that the Committees of Corporations who were authorised distributors would seriously consider that it was to their own advantage that the contribution of a reasonable amount in some proportion to their revenues should be made to the funds of the Electrical Research Association.

The PRESIDENT (Mr. A. Nichols Moore), replying to the toast, said that undoubtedly the Association was making amazing progress. There were 1 020 delegates and visitors to the Convention this year, and the Association could be proud of the fact that it now had considerable influence and was playing an important part in the development of electricity supply in the country. The Association was all out, with the Commissioners and the Central Electricity Board, to make the new schemes a success, and he believed that would be done. But it was necessary to have the help and guidance of the Commissioners to take full advantage of the legislative machinery at their disposal.

At one of the meetings of the Convention an eminent consulting engineer made some reference to Biblical law and drew certain analogies. Whilst that gentleman was speaking he could not help thinking of another analogy. Sir John Snell had referred to the momentous date of 1940 and had indicated the development that might then be expected. This year 1940 reminded him that there was an experience in Biblical history of another period of 40 years when the Children of Israel wandered in the wilderness for 40 years looking for the Promised land. The electrical supply industry was looking for the Promised land, and it was perhaps possible to carry the analogy a little farther. The Children of Israel wandered 40 years in the wilderness and in that period they sent spies into the Promised land to see what it was like. These spies came back with their report and pronounced the Promised land to be very beautiful.

All this rather struck him as being like the gentlemen who prepared the Weir Report. There were in the Biblical history to which he had referred, false spies who came back with reports which did not tell the truth. He could only hope that those gentlemen who came back with the Weir Report had not done the same thing, because the false spies met with a sticky end.

Ald. E. HUNTSMAN (chairman, Nottingham Electricity Committee) proposed "The County Borough of Newport and the Borough of Torquay" which was replied to by the Mayor of Newport and the Mayor of Torquay.

The final toast, that of "Our Guests and the Ladies," was proposed by Mr. R. A. Chattock (Past President), who coupled with it the name of Mr. Frank Hodges.

Mr. Frank HODGES, in the course of his reply, said that although the members of the Central Electricity Board dealt with the problems they had to face in a strictly impartial manner, he foresaw the day when private enterprise in matters electrical would offer no more in scope, no more in ambition and no more in salary than municipal work. He believed that we should become more municipal as time went on, but municipalities would never survive or thrive on small men. Neither would they survive or thrive on too limited territorial definitions. When municipalities had the courage to look forward and operate on the basis of wider areas, when they co-operated in large industrial populations and geographical areas, then the scope for the municipal engineer would widen far beyond the possibilities of the scope provided for him by the inevitably delimited territory of private enterprise.

The Annual Meeting.

The annual general meeting was held on June 7th, in the Pavilion, and was, as usual, private.

The result of the election of officers and Council for 1929-30 was as follows:—

PRESIDENT.—Mr. J. K. Brydges (Borough Electrical Engineer, Eastbourne).

VICE-PRESIDENT.—Mr. A. J. Fuller (Borough Electrical Engineer, Fulham).

HON. SOLICITOR.—Mr. J. H. Rothwell (Brighton).

HON. TREASURER.—Mr. H. Faraday Proctor (Bristol).

HON. SECRETARY.—Mr. A. C. Cramb (Croydon).

The following were elected to fill vacancies on the Council:—LARGE UNDERTAKINGS: Major E. A. Barker (Barnsley); Mr. A. W. Barham (Watford). (To fill the vacancy caused by the election of Mr. Fuller as Vice-President, Mr. J. W. Burr (Swansea) was elected for one year). SMALL UNDERTAKINGS: Mr. C. J. Wood (Sale). LOCAL AUTHORITY REPRESENTATIVES: Ald. E. Huntsman (Nottingham); Ald. T. Shires (Huddersfield).

The report and accounts were adopted, and the meeting closed with cordial votes of thanks to the retiring President.

The PRESIDENT, in acknowledging the vote of thanks, spoke of the services of Mr. Cramb as Hon. Secretary and of the special difficulties which he had to face in organising the Convention this year. The fact that everything in connection with the Convention had passed off with comparative smoothness and had been carried out according to plan was due entirely to Mr. Cramb, and he proposed a hearty vote of thanks to him. The vote was carried with acclamation.

Mr. CRAMB, acknowledging the vote of thanks, said it was always a pleasure to him to do anything he possibly could for the Association. The development in the last ten years, however—during which time he had been Hon. Secretary—had been such as to render it impossible for him to give as much time to the affairs of the Association as he had in the past. The Association was now getting so big that he sometimes felt a little bit afraid for the future, because it had reached such a position of importance that it was necessary to live up to it. His own duties to his Corporation were increasing rapidly, and the fact that he would be able to devote less time to the affairs of the Association in the future was a matter to which the Council would have to give careful consideration.

Cordial votes of thanks were also passed to the Mayors of Newport and Torquay, to the Chairmen of the Electricity Committees of those towns, and to the officials of the Torquay Corporation in connection with the arrangements made for the Convention.

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MORE I.M.E.A. CONVENTION SNAPSHOTS.

THE above snapshots, supplementing our special pictorial record of the I.M.E.A. Convention at Torquay last week, show: (1) *A group of visitors alongside the "Henley" demonstration van.* (2) *Mr. Barnes Kay (Haslingden) and Mr. F. G. Nesbitt (Credenda) in the sun-porch before breakfast.* (3) *Mr. H. F. G. Woods, of Torquay, filling up outside the Pavilion.* (4) *Mr. C. W. Marshall as the snapper snapped.* (5) *A view of Beacon Cove taken by the special coloured floodlighting at night.* (6) *The good ship "Magicoal" in dock; she attracted many visitors.* (7) *A group of engineers, all of whom graduated at Croydon. They are: Back row (left to right)—C. W. Salt (Carlisle), W. C. Bexon (Ayrshire Electricity Board), J. H. Parker (West Hartlepool), H. Wilson (Ashford); front row (left to right)—J. W. Burr (Swansea), A. C. Cramb (Croydon) and A. P. MacAlister (Islington).*

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CORRESPONDENCE.

The Editor welcomes the free expression in these columns of genuine opinion on matters of public interest, although he disclaims responsibility alike for the opinions themselves and the manner of their expression.

Trade Charges in the Electrical Installation Industry.

[To the Editor.]

Sir,—The writer of the article under the above heading in your issue of May 17th is to be congratulated, and it is to be hoped that those contractors who do not make a careful analysis of their trading figures and balance sheets will do so.

The remarks on the Cost of Ignorance ought to be brought before every contractor to-day, but the difficulty is that thousands of the " small men " do not even invest in the trade journals that publish such valuable information, with the result that they never know any better. I feel sure that it is this appalling ignorance that is one of the chief causes of price-cutting and the ruinous cut-throat competition to-day, because the culprits have very little idea of what overhead expenses should be taken into consideration in basing their prices for work, or in the costing of jobs done.

There is bound to be a considerable difference in percentage of total P.C. in connection with various items, for the simple reason that the business done by contractors varies so much. Take several businesses, each doing, say, £20 000 per annum, one firm with premises in a back street of a provincial town, paying a low rent and specialising in power work. The bulk of this work may be done on four or five jobs in the year, with the result that the percentage of many items on the prime cost would be far less than those of another business doing the same turnover, with showrooms in a front street, more elaborate offices, showroom attendants, etc., and the total turnover accounted for by many small house and shop lighting jobs, sales of fittings, radiators, etc., from the showroom, and a large number of jobbing repairs.

These percentages for rent, advertising, management, postage, and nearly all other items mentioned in the analysis will vary in accordance with the class of business.

This does not, however, minimise the fact that contractors should be alert and have a very careful check each year on the percentage of the items mentioned by your writer, because it enables the proprietor to see at a glance the true proportions of the ingredients that go to making up his overhead expenses, also, incidentally, often enables him to put his finger on the item or items which ought to be reduced.

For the benefit of the writer of your article, and also any of your readers who are interested, I am enclosing a table of percentages extracted from my firm's last two years' balance sheets and which may be useful as a comparison for others who desire to make a detailed analysis of their own accounts.

For obvious reasons I cannot give the actual figures of the business or the name.

Percentage Table.

	1929. Per cent.	1928. Per cent.
Wages paid to employees	26·10	24·90
Carriage charges	0·95	0·94
Rent, rates, lighting and insurance	2·85	2·82
Printing and stationery	0·71	0·61
Advertising	1·47	1·15
Telephones	0·44	0·41
Postages	0·75	0·70
Travelling expenses (exclusive of workmen's expenses)	1·31	0·90
Sundry trade and petty cash expenses	0·74	0·64
Bad debts	0·08	0·81

I am, etc.,

Analysis.

Mains Operated Wireless Sets.

[To the Editor.]

Sir,—Having recently installed for a customer an expensive mains operated wireless receiver of well-known make, considerable inconvenience is being experienced as a result of " clicks " being heard in the loud speaker whenever anyone switches on the electric light. These clicks occur, apparently, irrespective of whether the light switched on is next door or 30 yards down the road, and at times when neighbours retire for the night the noise from the loud speaker is appalling.

I have tried screening the set, altering the direction of the aerial and various other means, but without success.

Should any of your readers know of a remedy then I shall be glad if they will communicate with me through your correspondence columns.—I am, etc.,

" Electrician."

Frinton-on-Sea.

[Correspondence on this subject is invited.—Ed.]

" The Boiling Plate of To-day."

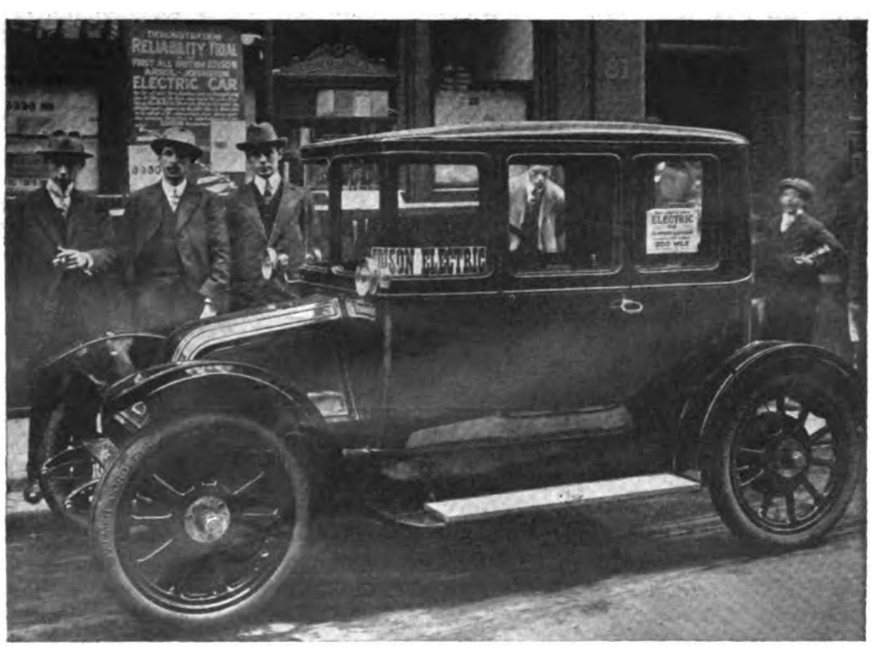
[To the Editor.]

Sir,—We have read with interest the article by Mr. S. Bickell on boiling plates, and whilst we agree with all he says, we think that in all fairness to the enclosed-type boiling plates the comparative test figures for 2, 3 and 4 pints should have been given. Perhaps Mr. Bickell will oblige ?—I am, etc.,

L. P. Haussauer,
Managing Director,
Sadia, Ltd.

London, W.1.

CAN THE PASSENGER ELECTRIC BE REVIVED ?



THIS question is appropriate in view of the reference, on the opposite page, to the exploits fifteen years ago. The car in question is seen in the accompanying photograph outside The Electrician *offices at the finish of its run from Dumfries. Although this was not the first long-distance trial made with an electric vehicle in this country, it was the first time that a distance of nearly 400 miles was covered by such a vehicle in a total time for running and charging of 58 hours. The run incidentally demonstrated that a town-type vehicle could be used for touring purposes over the roughest roads and under the worst possible conditions. In the group alongside the car are seen Mr. M. E. Fox (left), who drove the car, and Mr. W. E. Warrilow (right), who acted as observer on behalf of* The Electrician. *A 60-cell battery, weighing 900 lb. requiring a normal charging current of 30 A for 7 hours was used, but owing to the circumstances of the run the average charge actually given was about 100 A. On a total mileage of 362 the car averaged 12·3 m.p.h. at an average cost of 0·67d. per mile run.*

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NEWS IN BRIEF.

Electrical Wages—I.E.E. Students' Summer Tour—Manchester and Electrical Contractors—Poplar and Its Canal—Peterborough Has a Fire.

A THROUGH telephone circuit between London and Milan has now been put into operation.

A fire occurred at the Peterborough electricity works station on June 3rd, involving the coal-handling plant.

The time for the receipt of applications for the position of borough electrical engineer and manager at Torquay is extended to June 27th.

Cheltenham Electricity Committee has authorised the Borough Electrical Engineer to obtain tenders for the supply of meters, transformers and cable.

It was announced recently that the U.S.A. Senatorial Inquiry into the radio telephone and telegraph monopolies would commence during the present week.

The Summer Tour of the Students' Section of the I.E.E. will be held in Paris and Northern France from August 3rd to August 12th.

The 4th annual sports meeting of the Hackbridge Electric Construction Co., Ltd., will be held on June 22nd, at Molesey Road, Hersham, Walton-on-Thames.

A large portion of a wall in St. Leonard's Road, Poplar, collapsed, on Tuesday, as a result of disturbance by work carried out by a contractor in connection with the widening of the canal which runs alongside the road. The broken wall, in slipping down on to the canal bank, carried about 40 ft. of the Borough Council's cable with it, but, fortunately the cable is not damaged, and the supply of current is not affected.

Mansfield Electricity Committee recently recommended that all future work under the assisted wiring scheme be placed with the Corporation electricity department. Five tenders had been received from contractors for certain work, and the department's estimate was 35 per cent. higher than the lowest tender. Although an amendment to accept the lowest tender was defeated, the Council ultimately agreed to refer the matter back to the Committee.

The Preston District of the St. John Ambulance Association suggests that employees of the tramways and omnibus departments should receive special instruction in first aid work, and be supplied with first aid equipment.

The staff of Greenock municipal electricity department had their annual outing recently. Ex-Bailie Lemmon, convener of the Electricity Committee, Mr. D. McDougall, engineer and manager, and Mrs. McDougall were included in the party, which travelled to the Isle of Bute.

The School of Foreign Travel, New York, is sending for the second season a group of engineering students and young engineers to Europe to study the problems of industrial administration and labour management. The party, which will consist of about 17 persons and will be under the direction of Prof. N. C. Miller, chairman of the University Extension Division of Rutgers University, the State College of New Jersey, will have an interview with Sir Ernest Benn, Bart., in London on July 16th.

In reference to the fire which occurred in a cable subway on the Victoria Embankment, London, on June 6th, the Post Office has issued a statement that some 630 telephone subscribers' lines on the Central Exchange, and 280 on the City exchange and more than 1 000 junction lines were put of service. A number of temporary junction circuits have been brought into operation, and arrangements have been made for alternative means of routing to and from affected exchanges.

Shipley Electricity Committee has decided that the electricity required for an exhibition house established by builders, furnishers and electrical contractors shall be provided free of cost.

At last week's meeting of Manchester City Council a motion was submitted by a labour member that the electricity department should be permitted to carry out the work of wiring municipal houses for electric lighting in competition with private firms of electrical contractors. Ald. Dagnall, chairman of the Electricity Committee, said that if the proposition were accepted, it would be necessary to take on a special staff, and it could not be certain that it would be busy all the time. The Council rejected the proposition.

A sub-committee of the London Traffic Advisory Committee is considering a proposal to adopt automatic traffic control signals for road traffic in Oxford Street.

Mr. E. Allsopp lectured, at the Bradford electricity offices on June 4th, on "The Development of the Electric Cooker." He said Franklin demonstrated in 1749 that electricity could be applied to cooking. It was only recently that the invention of nickel-chromium had made it possible to deal with the high temperatures. British cookers were greatly in advance of any others. The lecture was arranged by the British Electrical Development Association.

Trials have been made recently at Canterbury of a system of road traffic signals supplied by Switchgear and Cowans, Ltd. In St. Lawrence Road, the approach of a car to the main (New Dover) road depresses "pedals" which connect with mechanism showing an amber light, and, after a certain time, a red light, to the main road. In the side road (the St. Lawrence Road) a red light, succeeded by an amber light, is shown. As an additional warning to the main road traffic, an electric gong and an electric siren are also used.

The number of telephones in operation in the United Kingdom at March 31st, 1929, was 1 754 641, an increase of 123 450 or 7·6% during the year ending on that date. The number of public call offices (including kiosks) working at March 31st last was 25 864, of which 5 599 were connected with London exchanges and 20 265 with provincial exchanges.

The Sub-Committee appointed by the National Federated Electrical Association and Electrical Trades Union in conformity with the National Wages Agreement of September 22nd, 1921, to give effect to the agreements of August 7th, 1920, and September 22nd, 1921, by ascertaining and declaring at four-monthly intervals the variations due (if any) and the net rates of wages payable under the terms of the agreements to each grade for the ensuing period of four months, has declared that the variation in cost of living justifies a 28% reduction in the basic rates of wages (April, 1921) and that the net rates of pay applicable to the respective grades of the agreements are as follows: Grade A, 1s. 10½d. (decrease ½d.); grade B, 1s. 7½d., and grade C, 1s. 6d. (no change); grade D, 1s. 4½d. (decrease ½d.). These rates will come into effect on the second pay day in June, 1929, and will remain current up to and including the period covered by the first pay day in October, 1929.

LOOKING BACKWARD.

FIFTY years ago THE ELECTRICIAN, *dated June 14th, 1879, recorded that:—*

The Edgware Road Station of the Metropolitan Railway was electrically illuminated for the first time. There were two Serrin lights, placed 240 ft. apart.

Experiments were being carried out in France with a system of ploughing by electricity.

The International Telegraph Conference was meeting in London.

* * *

Twenty-five years ago it was recorded in THE ELECTRICIAN, *of June 17th, 1904, that:—*

The I.E.E. Council attended the unveiling at Colchester of a picture of Dr. Gilbert (1544–1603), *author of the famous book "De Magnete," and "founder of the science of electricity and the discoverer of terrestrial magnetism." The picture was presented by the Institution.*

The Postmaster-General said it would not be in the public interest to exercise its powers for the compulsory purchase of the National Telephone Co.'s system.

* * *

Fifteen years ago, according to THE ELECTRICIAN, *of June 14th, 1914:—*

A feature of the I.M.E.A. Convention, held in London, was that a paper on Heating and Cooking was discussed in camera.

A passenger electric vehicle completed, without any breakdown, the 362 *miles run from Dumfries to London.*

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NEW ELECTRIC TRUCK.

NO more apt example of the utility of electric plant for cargo handling can be found than at West Toxteth Dock Sheds, Liverpool, where Elder, Dempster and Co., Ltd., have their berths. For about ten years they have been using

An electric truck at the West Toxteth Docks, Liverpool, with attachment for loading and stacking cotton bales, etc.

various types of electric trucks for specialised transport operations in the dock sheds. The latest addition to the resources is an electric truck with an attachment for transporting, elevating and stacking various classes of import cargoes. Twenty-two electric trucks, comprising Lansings, Greenbats and Walkers, are in service here, and six of these are in process of conversion to elevating trucks. These can be employed to pick up a load from a dock scale, transport it and dump it on a pile 6 ft. 6 in. high without the use of any manual labour excepting, of course, that of the driver of the truck. The whole of the operations are mechanical.

The load carrying platform of the truck is made up of arms in a fork formation elevated in channel guides carried at the driving end of the chassis. It is possible for the vertical guides to be hinged down from a height of 6 ft. 6 in. in order to allow the truck to pass through a doorway of normal dimensions, but in this case the hinged portion is counterbalanced.

The lifting motor of ¾ H.P. at 48 V, complete with solenoid operated brake, worm reduction gear and lifting barrel, is fitted on the guides. An important feature of the elevating gear is that it is counterbalanced in such a manner that the return springs for resetting are quite small and the energy absorbed in elevating only the platform is just sufficient to overcome the normal frictional losses in the worm gear, pulleys and working parts.

FARADAY HOUSE OLD STUDENTS.

THE Faraday House Old Students' Association have elected Dr. Alexander Russell, F.R.S., their President for this year to commemorate the fortieth anniversary of his appointment on the staff of the College. The number of students who have joined the College during this time is about 2 050, and the number of members of the O.S.A. is 920. The Council hope that as many qualified Faradians as possible will join this year, as they are anxious to make the numbers exceed the thousand mark during Dr. Russell's Presidency. Mr. Robert G. Burton, of A. Reyrolle and Co., has presented an oil painting of the Principal to the Governors of the College, in commemoration of Dr. Russell's forty years' connection with the College.

PERSONAL.

SIR Hugo Hirst was amongst those received by the Duke of York on Monday.

Mr. Owen Young, chairman of the Reparations Committee, left Paris for Cherbourg on Monday, on his way to America.

Mr. Nicholas G. Gedye has been elected chairman of the Committee of the Association of Consulting Engineers for the ensuing year.

Bristol Salaries Committee recommends increasing the salary of Mr. T. H. Gait, the chief electrical engineer, from £500 to £600 per annum.

Stockport Town Council has confirmed the appointment of Mr. G. H. Oldroyd, as deputy electrical engineer, at a salary of £700 per annum.

Mr. S. Hooper, electrical engineer and manager of Alexander's Electric Light Works, Carlow, has accepted a new appointment in Dublin.

Mr. J. H. Ward, electrical engineer at Chatham Dockyard, was the recipient of a parting gift on the occasion of his retirement at the end of May.

Mr. D. Williams, of Leicester Corporation Electricity Department, has been appointed consumers' engineer at the Rugby Electricity Works.

Mr. Alan Kirk has relinquished his appointment with Engineering Works (Electrical and General), Ltd., and joined the staff of Troughton and Young, Ltd.

Mr. D. G. Petrie, of Young, Osmond, and Young, Ltd., has been appointed a member of the Provisional Council of a Chamber of Commerce formed for Welwyn Garden City.

It is understood that Mr. Noel Ashbridge will be appointed to succeed Capt. P. P. Eckersley as chief engineer to the British Broadcasting Corporation as from September 30th.

After serving 50 years with the firm of J. Smith and Son (Brighton), Ltd., Mr. Harry Crowther has been presented with a silver plated tea service, armchair and illuminated address.

Mr. W. H. Speedy is vacating the position of junior assistant engineer with the Newport (Mon.) Electricity Department, to take up an appointment as shift engineer at Darwen Electricity Works.

Stepney (London) General Purposes, Staff and Education Committee recommends that to the present designation of Mr. W. C. P. Tapper, of borough electrical engineer and manager, be added that of consulting electrical engineer.

Torquay Electricity Committee has decided that the borough electrical engineer, Mr. H. F. G. Woods, be paid 500 guineas in respect of the special services which he has rendered as consulting engineer for the extension of the generating station, and the installation of additional plant.

We are fortunately able, without suspicion of political bias, to give full expression to our family pride in the appointment of Mr. Wedgwood Benn as the Secretary of State for India. It is now nearly 25 years since Mr. Benn was associated in any active capacity with Benn Brothers, Ltd. In the early 'nineties, after a scholastic career culminating in B.A. (Lond.) with first place in Honours, and later a Fellowship of University College, he joined the staff of "The Cabinet Maker," and later acted for a time as editor of that paper. In 1897 he edited and managed a magazine of home decoration, "The House." He was appointed a director in 1906, and remained a member of the Board after he entered Parliament in that year. In 1910, however, in obedience to the self-denying ordinance which Mr. Asquith imposed upon his ministers, Mr. Benn resigned his position as a director of the company, and thus ended his work in connection with it. He is a large shareholder. Mr. Benn's appointment to the highest Cabinet rank is a fitting recognition of his long experience of public and political work. He represented St. George's Division of the Tower Hamlets as Liberal from 1906-1918, when, owing to his refusal to accept the Lloyd George coupon, he left St. George's and accepted an invitation to fight Leith, also in the Liberal interests. For the following nine years he was the member for Leith, until in 1927 he joined the Socialist party and resigned his seat. A few months later he successfully contested North Aberdeen and re-entered Parliament as a Labour member. He has enjoyed a wide experience in matters of government, having served in every Parliamentary grade from Private Secretary upwards. He was a Junior Lord of the Treasury from 1910 to 1915; he acted as Representative of H.M. Office of Works in the House of Commons from 1912 to 1914, and of the Insurance Commission in 1914. On the outbreak of war Mr. Benn was appointed first Chairman of the National Relief Fund, but after a few months joined the Middlesex Yeomanry.

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THE I.M.E.A. EXHIBITION.

A Further Review of the Exhibits at Torquay—Many New Equipments for Domestic Use—Variety in Electric Cookers.

(*Concluded from page* 689.)

THE exhibit of the BRITISH THOMSON-HOUSTON CO., LTD., included lighting fittings and equipment, amongst which were the "Hermetica" lantern with double well-glass for industrial use, the "Glassteel" diffuser and the gas-tight dispersive reflector.

In the floodlighting section was shown the type 599 projector in its latest form, and the new spherical projector lantern as installed throughout the North-East Coast Exhibition. Examples of the "Luxor" dining-room pendant and "Eye Restolite" floor standard were also on view. Other lighting equipment shown included street lighting fittings such as the "Zona," the "Rugby" and "Manchester" pole top units. Tungar rectifiers were exhibited, a new type being the high and low tension model. On the d.c. side the output is, for low tension batteries 0·8 A at 2, 4 or 6 V, and for high tension batteries 0·1 A at 60, 90 and 120 V. Another exhibit was the new electric refrigerator. Other items were fractional H.P. motors for various purposes and a selection of radio apparatus.

YOUNG, OSMOND AND YOUNG, LTD., The Broadway, Bexley Heath, included on their stand "Unity" tubular electric heaters for the heating of schools, churches, offices, factories, cinemas, houses, etc., thermostats, towel airers, car heaters, linen cupboard heaters, four-bar radiators with or without 3-heat control, gas-tight and water-tight heaters for petrol depots, cellulose paint shops, powder factories, etc., window heaters to prevent condensation on shop windows, and heaters for traction work available up to 1 500 V.

A New Kettle.

The BRITISH ELECTRIC TRANSFORMER CO., LTD., Wellington House, Strand, London, W.C., showed a new "Tricity" table type cooker suitable for twelve persons. Another exhibit was a kitchen kettle, recently patented, embodying double automatic safety devices. The makers state that, so far as they are aware, this is the first kettle of its kind, inasmuch that protection is ensured against boiling dry, in addition to switching off when the appliance is lifted. Cookers in alternative vitreously enamelled and black and nickel finishes were shown fitted with enclosed and open boiling plates, while in the "Sunray Parlour" a new model was introduced which incorporates hot wire bars on the "Sunray" principle.

FERRANTI, LTD., Hollinwood, Lancs, exhibited electric thermal storage water heating equipment, thermostats, load levelling relays and accessory control equipment, as well as a small scale working model of a household water heating installation. A new range of "Ferranti" parabolic reflecting fires of improved design was included on the stand, and these are available in a variety of finishes, 2½ kW loading. With the exception of the household water heating equipment shown, the other exhibits have been described in earlier issues.

Water is stored at 185 deg. to 195 deg. F., and control of the heat is automatic. The heating elements may be removed without interference with the water system, and provision is made for emptying the tank for cleaning.

Water Heating.

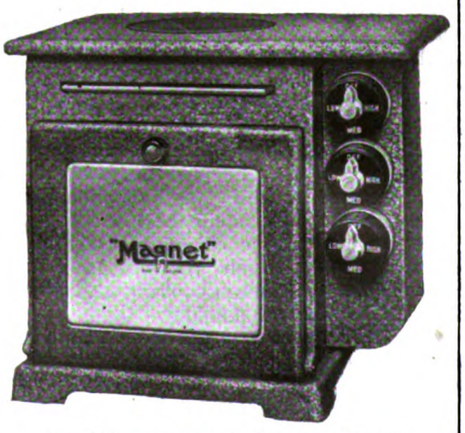
DRAKE AND GORHAM (WHOLESALE), LTD., 67, Long Acre, London, W.C.2, displayed 1½ gallon "push through" type hot water cisterns, 4½ to 55 gallon gravity feed type cisterns; and the new "Inventum" barber's cistern, fitted with a new "mixing tap," giving a wide range of temperature control. A new bed warmer was seen, and this was of the accumulator type. The makers state that there is no solder incorporated in this device, the whole job being pressed metal. The appliance is so made that it cannot be placed in the bed while the current is on. Other new items were bathroom heaters, with "pull cord" pattern switches, a cooking plate, window and ceiling heaters. A working model of the "Parmotor" relay operated by a thermo-switch and pilot wire from the supply station or other point selected for remote control was shown, the model exhibited being designed to show control of street lighting on one side of the relay, and night tariff water heating on the other. Other exhibits were e.h.t. ring main controllers, and e.h.t. oil switch fuses.

On the stand of the CREDENDA CONDUITS CO., LTD., Oldbury, Birmingham, were shown examples of the latest models of "Creda" electric cookers. Various detail improvements have been incorporated since these were shown last year at Bath, chief among these being improvements in the wiring arrangement for the boiling plates and an improved type of grill pan. Oven temperature indicators are now fitted which are easier to read than the ordinary mercury oven thermometers, and much cheaper. Samples were also exhibited of two new wash boilers, models C23 and C24, which have been designed to meet the need for cheap and efficient appliances of this nature. The exhibit was completed with models of automatic water storage heaters and "Credalux" street lighting fittings.

"Burco" electric wash boilers was featured by BURNLEY COMPONENTS, LTD., Rose Grove, Burnley, one of the special exhibits being a boiler fitted with an automatic safety cutout, which opens the circuit immediately the boiler is dry. This cutout is of robust design, and the switch contacts are large enough to cope with 20 A at 250 V. The device is clamped to the pan bottom, and two parallel contact fingers close a circuit between two pairs of contact pillows. The cable and element connections are completed to the contacts. The contact is maintained against the pressure of a coil spring by means of a stud, which is made in two portions soldered together. When the pan of the boiler is dry the solder melts,

The new electric washer which was shown by Entwistle and Kenyon, Ltd.

The "Ferranti" fire in an attractive setting.



One of the many cookers which were shown on the stand of the General Electric Co., Ltd.

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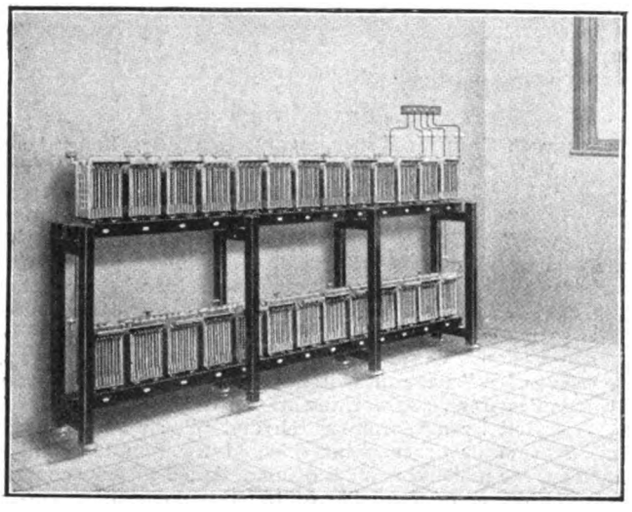
thus allowing the stem of the stud to telescope into the head, the coil spring forcing the contacts apart. The switch can be reset by inserting a new fuse plug or resoldering the used one. Another exhibit was a combination boiler, designed for sterilising milk or for heating milk for cafés, etc.



One of the many types of batteries shown by the Edison Swan Electric Co., Ltd.

THE BRITISH QUAIN SUNLIGHT, LTD., exhibited artificial sunlight apparatus for tonic treatment at home, without medical supervision, an outstanding feature of which is that when not in use as sun bath it may be used as an electric fire. Another exhibit was a twin-arc model "Ideal" sun bath suitably mounted on a telescopic stand giving a 20-A radiation at half this current. This model works from either a.c. or d.c., and is recommended for nursing homes, clinics, etc., and for home treatment under medical supervision. The balancing resistance which is connected to the reflector may be used separately as an electric fire when the apparatus is not required for therapeutic purposes. Other items shown were the "B.Q." ozoniser and an electric fan primarily intended for use with the ozoniser. Together, they form an efficient ventilation device.

The "Ewbank" electric washer, shown by ENTWISTLE AND KENYON, LTD., of Accrington, was another new machine. The appliance, driven by a ¼ H.P. B.T.H. motor, is of the rotary type fitted with an electrically-operated wringer equipped with rubber rollers 2 in. in diameter and 16 in. long. Risk of injury is reduced by the adoption of a spring assisted release to the wringer control, which allows the rollers to be under the operator's instant command. Protection to the user, machine, or motor, is afforded by the fitting of automatic friction drive to the clothes container and wringer rollers, while the driving mechanism and motor are under lock and key, encased away from water or dirt. The gear box is claimed to be of special design, and allows the drive to run in oil. When not in use the machine can be folded into a useful kitchen table.

MOORWOODS, LTD., Harleston Iron Works, of Sheffield, featured electric cooking equipment, including three models of the "family type" and two cookerettes. Electric fires were another exhibit, and though no new items were included on the stand, there was still much to interest the visitor.

SADIA, LTD., 22, Newman Street, London, W.1, showed a wide selection of wall type water heaters, stand type 66 gallon water heaters, a full range of self-winding time switches, a new universal mercury thermostat, a full range of boiling plates, a wide range of enamelled table stoves, aluminium utensils, motor-driven thermostatic controls, and drying stands. The aluminium cooking utensils have been especially designed for electric cooking.

On the stand of BELLING AND CO., Bridge Works, Southbury Road, Enfield, Mx., was shown a new series of electric cookers with all-metal boiling plates and a new boiler-griller plate with all-metal top. The "Baby Belling" cooker was also on show. There was a display of electric immersion heaters suitable for fitting into existing tanks or cylinders and for use in conjunction with the ordinary domestic hot water system. New sizes have been introduced, so that the range now offered covers all capacities of tanks or cylinders and the loadings range from 250W to 3 kW. Practical demonstrations were given of the new "Parmotor" relay for automatically controlling electrical circuits.

The exhibits of SIEMENS ELECTRIC LAMPS AND SUPPLIES, LTD., 38-39, Upper Thames Street, London, E.C.4, consisted of "Xcel" cookers of various types fitted with totally enclosed boiling plates, and "Imperial" type cookers as supplied to colonial undertakings. Another feature was a representative range of "Cosyglo" fires with moving flame and smoke effect, fitted with the new improved rotor. The remainder of the exhibits consisted of safety kettles, immersion heaters, tube heaters, and towel rails. There was also shown, for the first time, a sample of the "Xcel Minor" cooker. This has a small oven with a new design of dual grill boiling plate. It can be supplied for table use or with a stand to form a complete cooker.

The EDISON SWAN ELECTRIC CO., LTD., 123/5, Queen Victoria Street, London, E.C.4,. made a special show of stationary batteries, house wiring systems, washing machines, and ironing and cleaning appliances. A specimen of one of the batteries exhibited is shown in the previous column.

The exhibit of the TORQUAY ELECTRICITY DEPARTMENT was confined to types of apparatus let on hire to consumers, and literature concerning prices, hire rates, etc.

A. REYROLLE AND CO., LTD., Hebburn-on-Tyne, featured an electric steam raiser, for use where a small quantity of steam is required, and a domestic water-heater. The steam raiser has a total capacity of 18 kW and will raise steam in 10 to 15 minutes, the pressure being 80 lbs. per sq. in. The heating elements are built up of three 6 kW units and the required selection is made by means of a standard Reyrolle earthed plug. Three sockets are provided, so arranged that either one, two, or three units are in circuit, giving 6, 12, or 18 kW respectively. The domestic water-heater shown was one of the smaller type, holding about three gallons of water; the 500-W heating element is controlled by means of a thermostatic switch. In addition, a representative collection of small metal-clad air-break switches, for domestic and other purposes, was shown. Another interesting exhibit was a metal-clad, flame-proof, horizontal, draw-out switch panel, suitable for working in mines, etc.

VENNER TIME SWITCHES, LTD., 45, Horseferry Road, London, S.W.1, exhibited time switches, both hand and electrically wound, for the control of electric water heating off peak, street lighting for individual post and group control, with examples controlled by solar dial; models for the control of maximum demand indicators and two-rate meter operation; types for renting for the control of late shop window lighting, and stop watches reading to 1/10th of a second. Amongst other exhibits may be mentioned the new thermostat, an improved model easily convertible for use either in horizontal or vertical position; new models of time switches for poultry farms; a new solar dial controlled electrically wound time switch, as used by the G.P.O. in telephone kiosks; a new type of domestic water heating control switch giving three on and three off operations per day, and a 5 A 15-day run time switch with selective devices controlling earlier hour and/or Sunday operation.

Further Domestic Items.

The exhibits of ELECTRIC FIRES, LTD., Heatrae Works, Norwich, included a 5-gallon thermal storage water heater mounted on a framework complete with ball valve tank, basin for the draw-off water and sump, and pump for the return of water to the high level, the whole being a portable and self-contained unit for demonstration purposes. A 2-gallon thermal water heater was arranged on a trunnion for easy inspection of all working parts, while a 10-gallon open-type ball valve tank with low loading was also included. Another exhibit was a small tank, type R.T.B., suitable for direct connection to water supply and for delivery of hot water at one point only. A few samples of electric fires were shown, these being chosen to demonstrate the three standard types of fire bars used by the firm to suit varying conditions. A small combined cooker-radiator was also included. Samples of various terminal ends fitted to "Heatrae" hot pipes, as required by the various types of tubular heating installations, were shown, together with floor and wall pattern towel rails. Five different warming plates, a spray boiler, whistling kettles, low temperature radiators, and a 4 kW geyser were also exhibited. A 9 kW oil heater was another feature, and although these are made for loadings up to 60 kW as standard, the example on the stand showed the general design and the method of construction.

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BUSINESS ITEMS.

THE transmission of pictures of the Derby to an express train was successfully attempted on the day of the race. The apparatus used was a " Fultograph " picture receiver coupled to a " McMichael " portable set.

A special record of the chimes of Big Ben is being made by the Gramophone Co. (H.M.V.) and this will be electrically reproduced through an installation of " Marconiphones " at the Aldershot Tattoo on June 18th to 23rd.

One of the chief attractions at the Theatrical Garden Party on Tuesday was the B.B.C. marquee, where artistes performed for the benefit of the charity. " Marconiphone " loud speaking equipment was installed for relaying the performances.

A French agent in Paris desires to secure for France and the French Colonies the representation of British manufacturers of plant and equipment for metallurgical works, electrical power stations, etc. The Department of Overseas Trade will supply further particulars. (Reference 488.)

The ENGLISH ELECTRIC Co., Ltd., has received an order from Darlington Corporation for six complete four-wheel single-deck railless 'buses. Each 'bus will seat 32 passengers, and the equipment will consist of a 60 H.P. motor, and foot-operated controller, and rheostatic braking is provided.

The business of KIRK, WILSON, LTD., electrical engineers and contractors, Wragby Road, Lincoln, has been acquired by WM. WRIGHT AND SONS (LINCOLN), LTD., Park Street, Lincoln. The business will now be known as KIRK WRIGHT AND CO., and the services of Mr. J. P. Kirk have been retained in the capacity of general manager. Kirk, Wright and Co. have recently taken up the agency for the DAKOL ELECTRIC CO., LTD., Newcastle-on-Tyne.

The METROPOLITAN-VICKERS ELECTRICAL CO., LTD., announces that as from June 17th the Newcastle branch will be moving into new premises, which will afford greater warehouse and office accommodation. The trade counter will be open from 8 to 6 p.m., but due to the severity of the winter, the new showroom will not be complete, and the present address in Saville Row will be continued for showroom purposes until the end of August. The new address both for Metropolitan-Vickers Electrical Co., Ltd., and Metro-Vick Supplies will be :— Metro-Vick House, Northumberland Road, Newcastle-on-Tyne.

The MIDLAND ELECTRIC MANUFACTURING CO., LTD., attained their majority during the current year, the company being incorporated in 1908. The occasion was celebrated by several functions. There was a dinner at the Midland Hotel, at which all the executive staff and outside representatives were present, followed by a musical evening, at which there were present five of the small band who helped to found the company. There were also present about fifty who had been employed by the firm for ten years and over, to whom commemorative presentations were made.

PATENT LAW REFORM.

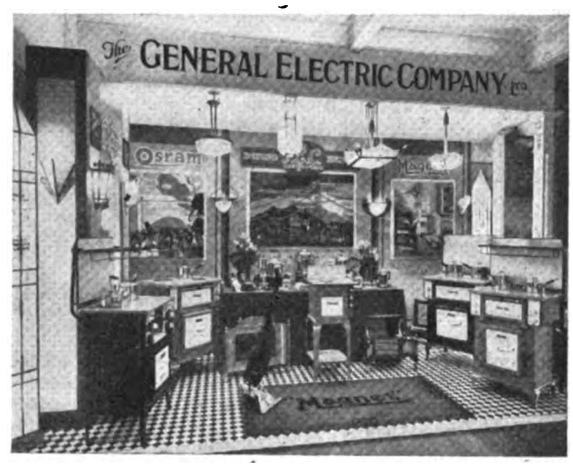
Bar Council Approves Report of British Science Guild as to Improvements.

THE proposals for reform of the British Patent System recently put forward by the British Science Guild have been reviewed by a Committee of the Bar Council, the members of which included, amongst others, Sir Duncan Kerly, K.C. (Chairman), Mr. James Whitehead, K.C., the Hon. Stafford Cripps, K.C., and Mr. Trevor Watson. The Bar Council warmly commends the report of the British Science Guild, which was the work of a committee whose chairman was Dr. W. H. Eccles, F.R.S. ; they consider that most of the proposals of the report are reasonable and likely to be useful. The Council expressed the view that a patent ought not to be invalidated by mere Paper anticipations—that is, by the publication many years ago of ideas which were stillborn and have never become known to the trade. They agree that there should be stronger remedies against unwarranted threats by persons wrongly claiming to possess patent rights, and they also support the proposal that appeals from the decisions of the Comptroller of the Patent Office should be heard by a special judge in chambers instead of by the Attorney-General or Solicitor-General. They do not agree that the Comptroller of Patents should be empowered to act as a Court of first instance for the trial of infringement actions ; but they propose (*a*) arbitration by consent of the parties, and (*b*) agreement between the parties whereby the issues to be tried in court should be restricted.

TRADE PUBLICATIONS.

A NEW booklet dealing with the " Alfilt " CO_2 system of fire protection has been sent to us by FOAMITE FIREFOAM, LTD., 55/57, Gt. Marlborough Street, London, W.1.

A special fan folder, publication No. 1070, has been published by VERITYS, LTD., 31, King Street, London, W.C., space being provided for printing contractors' names, etc.



THE stand of the General Electric Co., Ltd., at the I.M.E.A. Exhibition. The exhibits shown here were described last week.

" Facts and Figures Concerning the Firm You Deal With " is the title given to a new publication by the LANCASHIRE DYNAMO AND MOTOR CO., LTD., of Trafford Park, Manchester.

A circular letter giving particulars of the new " Henley " pavement frames and covers has been sent to us by the W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Holborn Viaduct, London, E.C.1.

A new booklet relating to the A.T.M. Doignon Baudot multiplex printing telegraph system has been published by the AUTOMATIC TELEGRAPH MANUFACTURING CO., LTD., Strowger Works, Liverpool.

The WHOLESALE FITTINGS CO., LTD., 23/37, Commercial Street, London, E.1, has issued a new electrical accessories catalogue of some 70 odd pages. A comprehensive index, arranged in alphabetical order, is included.

RADIO INSTRUMENTS, LTD., 12, Hyde Street, London, W.C.1, have sent us a folder dealing with the new " Hypermu " transformer, while a forty-page catalogue describing the range of " R. I." components has also been issued.

Amongst the recent publications of PHILIPS LAMPS, LTD., of 145, Charing Cross Road, London, W.C.2, are leaflet No. 403 dealing with " Philiray " shop window reflectors, and list No. 181, giving details and prices of " Argenta " lamps.

The ZENITH ELECTRIC CO., LTD., Villiers Road, London, N.W.2, has sent us a new list of regulating resistances of interest to schools, colleges and research laboratories, as well as to the test rooms of all electrical and allied manufacturers.

The MULLARD WIRELESS SERVICE CO., LTD., Denmark Street, London, W.C., has published Volume 3, No. 1 of " Radio for the Million " in which is described the " S.G.P. Master Three " receiver incorporating screen-grid and pentone valves.

The GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, has published a number of revision sheets for inclusion in the blue bound catalogue. The sheets are gummed and a list indicating the positions of the new sheets is available.

The WARDLE ENGINEERING CO., LTD., Elsinore Road, Old Trafford, Manchester, has issued folders dealing with " Wardelytes " and " Inverlytes," and street lighting equipment. A leaflet on factory lighting equipment has also been published.

The works and manufactures of ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria St., London, S.W.1, are described in a new issue just received. The booklet comprises nearly 100 pages and contains a large number of illustrations.

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BUSINESS OPENINGS.

Latest Particulars of Electrical Engineering and Wiring Installation Contracts for which Tenders are being Invited at Home and Abroad.

WE give below the latest particulars of contracts for which tenders are invited. The closing date is given, where available.

BRISTOL CORPORATION.—Wiring of 15 houses on Fishponds' Knowle, St. John's Lane, and Sea Mills estates. Specifications from the Housing Department, 1, St. Stephen's Street, Bristol.

MACCLESFIELD EDUCATION COMMITTEE, June 14th.—Electrical installation at Technical School Annexe. Specification from the Education Office.

BRIDLINGTON SCHOOL, June 15th.—Re-wiring certain buildings at Bridlington School and Avenue Boarding House. Specification, etc., from Mr. J. Edwin Storr, 14, Park Row, Leeds, until June 15th; deposit £1 1s.

Lancashire Cable Contract.

FARNWORTH URBAN DISTRICT COUNCIL, June 15th.—Supply of l.t. cables. Specifications, etc., from Mr. A. J. Hutchinson, engineer and manager, Electricity Department, Albert Road, Farnworth, Lancs.

BELFAST CORPORATION, June 17th.—Manufacture and supply of (a) h.t. combined cubicle and truck-type switchgear (Specification W. 85); and (b) transformer kiosks (W. 88); and manufacture, supply, and erection of (c) 1 000 kW rotary convertor (W. 86); (d) 500 kW rotary convertor (W. 87); (e) c.c. switchgear for sub-stations (W. 89); (f) h.t. armour-clad switchgear for sub-stations (W.90); and (g) h.t. truck-type switchgear for sub-stations (W. 91). Specifications from Mr. F. H. Whysall, city electrical engineer and manager, East Bridge Street, Belfast; deposit £2 2s. for each.

EAST GRINSTEAD URBAN DISTRICT COUNCIL, June 17th.—Supply, laying and jointing of l.t. cables. Specification, etc., from the Clerk, Council Offices, London Road, East Grinstead; deposit £1 1s.

EDINBURGH EDUCATION AUTHORITY, June 17th.—Electrical installation at Colinton, Davidson's Mains, Gilmerton, Granton, Juniper Green, Willowbrae, and Milton House Schools. Specifications from Executive Officer, Education Offices, Castle Terrace, Edinburgh.

GLASGOW CORPORATION, June 17th.—Electric lighting installations at Allan Street and Braidfaulds Street, No. 2 housing schemes. Specifications from the General Manager, Electricity Department, 75, Waterloo Street, Glasgow, C.2.

GRANGE-OVER-SANDS URBAN DISTRICT COUNCIL, June 17th.—Supply and laying of underground and erection of overhead lines. Specifications from Mr. J. Sims, Electricity Works, Grange-over-Sands.

LEEDS EDUCATION COMMITTEE, June 17th.—Electric lighting of schools. Particulars from Education Offices (Architects' Section), Calverley Street, Leeds.

SWANSEA CORPORATION, June 17th.—Electrical requirements of Municipal Secondary Schools, Dynevor Place, and De la Beche Street, Swansea. Schedule, etc., from the Borough Architect, 3, Prospect Place, Swansea.

WEST HAM EUDCATION COMMITTEE, June 17th.—Electric light installation at Fyfield Open Air School Extension, near Ongar, Essex.

NORTHERN IRELAND GOVERNMENT, June 18th.—Electric light installation at Criminal Lunatic Asylum, Londonderry. Form of tender from Londonderry Employment Exchange, or from the Ministry of Finance, 15, Donegall Square West, Belfast.

TRURO RURAL DISTRICT COUNCIL, June 18th.—Three separate installations of ejectors, or high lift centrifugal pumping plant, electrically driven and controlled. Specification (£5) from Mr. J. D. Haworth, 3, Central Buildings, Westminster, S.W.1.

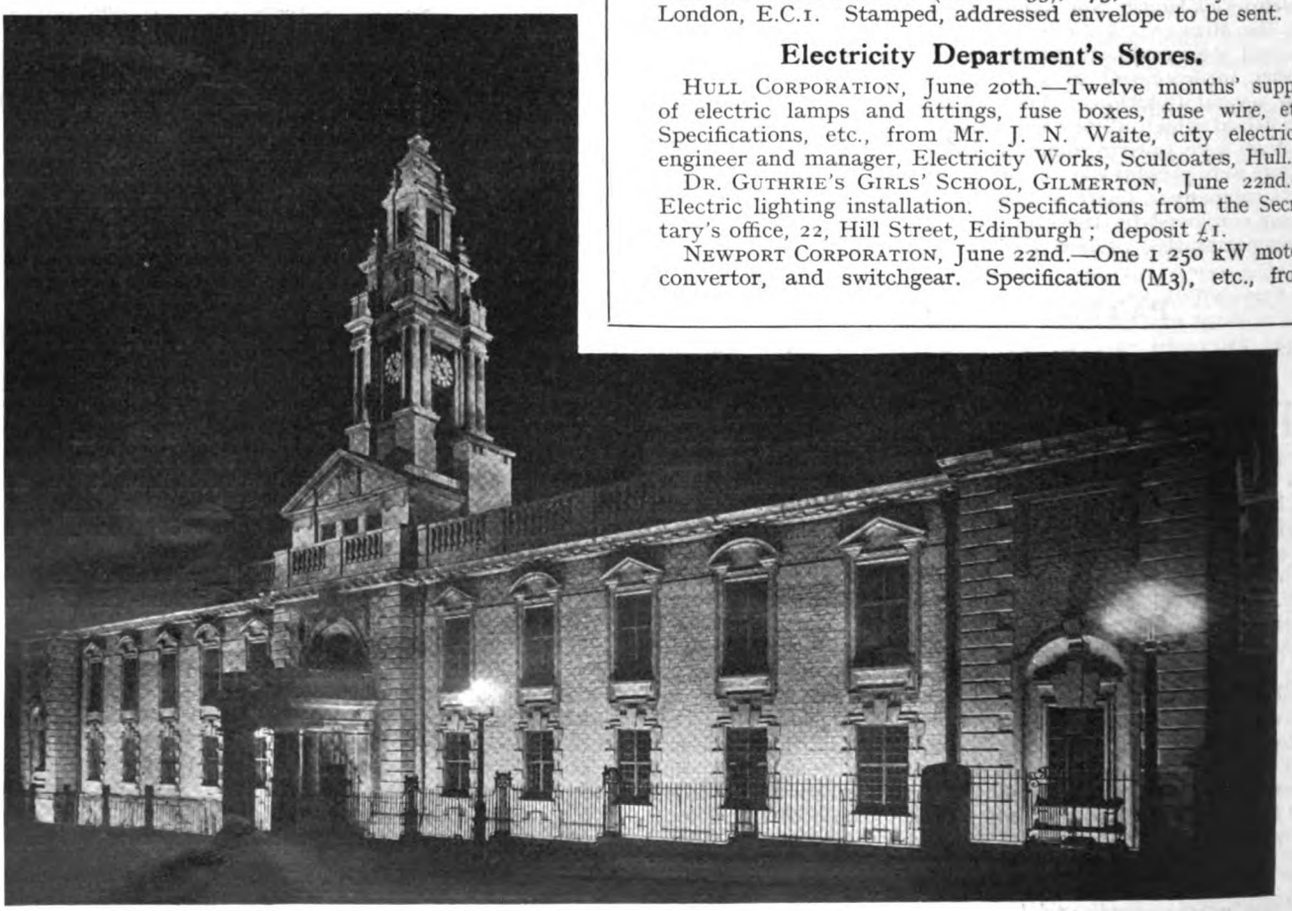
METROPOLITAN WATER BOARD, June 19th.—Supply of electric lamps for six or 12 months. Tender form (No. 24) from the Board's Offices (Room 155), 173, Rosebery Avenue, London, E.C.1. Stamped, addressed envelope to be sent.

Electricity Department's Stores.

HULL CORPORATION, June 20th.—Twelve months' supply of electric lamps and fittings, fuse boxes, fuse wire, etc. Specifications, etc., from Mr. J. N. Waite, city electrical engineer and manager, Electricity Works, Sculcoates, Hull.

DR. GUTHRIE'S GIRLS' SCHOOL, GILMERTON, June 22nd.—Electric lighting installation. Specifications from the Secretary's office, 22, Hill Street, Edinburgh; deposit £1.

NEWPORT CORPORATION, June 22nd.—One 1 250 kW motor convertor, and switchgear. Specification (M3), etc., from



THE Town Hall, at Torquay, which was illuminated by G.E.C. floodlight projectors during the period of the I.M.E.A. Convention. Further reference to the Convention and details of the exhibition are given on pages 730 and 735.

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Mr. A. Nichols Moore, Town Hall, Newport, Mon.; deposit £3 3s.

STOKE-ON-TRENT CORPORATION AND STAFFORD COUNTY COUNCIL, June 22nd.—Electric light and power installation in new buildings at North Staffordshire Technical College, Stoke-on-Trent. Further particulars from the Clerk to the Governors, Town Hall, Hanley; deposit £5 5s.

HARROGATE CORPORATION, June 24th.—Wiring, etc., of 58 houses, included in Devonshire Place housing scheme, No. 7. Specifications from the Borough Engineer.

NOTTINGHAM CORPORATION, June 25th.—Supply of general stores to electricity department for 12 months. Forms of tender from the Engineer, Electricity Works, Talbot Street, Nottingham; deposit 5s.

REIGATE CORPORATION, June 25th.—Construction of refuse disposal works, including electricity generating plant. Forms of tender, etc., from Borough Engineer, Municipal Buildings, Reigate; deposit £5 5s.

ACTON EDUCATION COMMITTEE, June 27th.—Electric lighting installations in schools. Specifications from the Borough Engineer, Municipal Offices, Acton, London, W.3; deposit £1 1s.

STAFFORDSHIRE EDUCATION COMMITTEE, July 2nd.—Electric light installation in Kingswinford Brockmoor Council School and in new buildings on the adjoining site. Specification, etc., from Messrs. Moffett, Rosher and Mann, consulting engineers, Union Chambers, Temple Row, Birmingham; deposit £5 5s. Only registered electrical contractors are invited to tender.

LONDON COUNTY COUNCIL, July 8th.—Manufacture, supply and maintenance of (*a*) 150 electric tramcar bodies; (*b*) 150 sets of swing bolster bogie trucks; (*c*) 150 sets of electrical equipment for tramcars, with assembly of bodies, trucks, electrical equipment, etc., into complete tramcars; and (*d*) 150 sets of magnetic track and wheel brake equipments. Specifications, etc., from the Clerk, County Hall, Westminster Bridge, S.E.1; deposit £2 for each section or £7 for the four.

SUNDERLAND CORPORATION, July 8th.—Manufacture and supply of 12 months' requirements of (*a*) paper insulated, lead sheathed cable, (*b*) rubber insulated wire, (*c*) consumers' meters, and (*d*) gas-filled and vacuum lamps. Specifications from the General Manager, Electricity Offices, Dunning Street, Sunderland; 10s. deposit for each section. Applications must state the classes of goods for which specifications are desired.

WEST MIDLANDS JOINT ELECTRICITY AUTHORITY, July 10th.—Supply and erection at Ironbridge power station of three boilers, each having normal rating of 225 000 lb. of steam per hour, with economisers, air heaters, fans, ironwork, pipework, coal pulverising plant, ash handling plant, etc. Specification (No. 3), etc., from Mr. E. F. Hetherington, chief engineer and manager, Phœnix Buildings, Dudley Road, Wolverhampton; deposit £2 2s.

CENTRAL ELECTRICITY BOARD, July 22nd.—Supply and erection of central indicators and telephones in connection with the Central Scotland Electricity Scheme. Specification (C.S.-S.S. 15) and form of tender from Mr. R. H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

Overseas.

UNLESS otherwise stated, particulars of overseas contracts are to be had from the Department of Overseas Trade (Room 52), 35, Old Queen Street, Westminster, London, S.W.1. *Note.—An asterisk denotes that local representation is, in practice, essential.*

CAPE TOWN MUNICIPALITY, June 17th.—Supply of three-phase motors. (Reference B.X. 5 366.)

VICTORIAN RAILWAY COMMISSIONERS, June 19th.—Supply of 550 miles of insulated copper wire. (Reference B.X. 5 335.)

COPENHAGEN MUNICIPALITY, June 21st.—Supply of switchgear in connection with extensions to Faelledvej sub-station. (Reference B.X. 5 367.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, June 25th.—Supply of hard drawn copper wire, tinned soft copper wire, and cadmium copper wire. (Reference A.X. 8 040.)

TURKISH ADMINISTRATION OF RAILWAYS AND PORTS, July 4th.—Supply of electric wire and cables and general lighting accessories. (Reference B.X. 5 368.)

INDIAN STORES DEPARTMENT, July 8th.—Supply of 30 kW oil-engine-driven generating set for Military Engineering Services, St. Thomas Mount, Madras. (Reference B.X. 5 364.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, July 23rd.—Telegraph instruments (schedule C. 436). (Reference B.X. 5 323.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, July 25th.—Supply of two 2-ton electrically-driven hoist blocks (tender No. 1 471). (Reference A.X. 8 072.)

SOUTH AFRICAN POSTS AND TELEGRAPHS, August 1st.—Supply of telephone cable (tender No. 160). (Reference B.X. 5 345.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, August 6th.—Supply of 120-ton, four-motor, overhead travelling crane and runway (specification No. S.M. 358). (Reference A.X. 7 810.)

NEW ZEALAND POSTS AND TELEGRAPHS, August 7th. Enamelled and silk covered resistance wire (No. P. and T. 151/1497). (Reference B.X. 5 322.)

NEW SOUTH WALES PUBLIC WORKS DEPARTMENT, August 12th.—Supply and erection at Burrinjuck of auxiliary hydro-electric generating plant. (Reference B.X. 5 365.)

EGYPTIAN MINISTRY OF THE INTERIOR, August 13th.—Supply of electric power plant, with underground and overhead network, for the town of Maghagha, Minieh Province. (Reference B.X. 5 318.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, August 13th.—Water turbine driven generating sets and switchgear, for Waitaki power development (section 2). (Reference B.X. 5 278.)

PIETERSBURG (TRANSVAAL) MUNICIPALITY, August 13th.—Supply of h.t. and l.t. cable, lamps and sundries, in connection with extensions of the electricity undertaking. (Reference B.X. 5 312.)

PIETERSBURG (TRANSVAAL) MUNICIPALITY, August 13th.—Supply and erection of steam raising plant, engine, alternators, and switchgear (contract A). (Reference A.X. 7 983.)

AUCKLAND ELECTRIC POWER BOARD, August 19th.—Single-phase transformers. (Reference B.X. 5 324.)

NEW ZEALAND GOVERNMENT RAILWAYS, September 4th—Supply of motor generator (specification 287). (Reference B.X. 5 308.)

Tenders Accepted.

GLASGOW CORPORATION.—Siemens Electric Lamps and Supplies, Ltd., 75 electric cookers.

BEDFORD CORPORATION.—Robert M. Russell, erection of overhead line to Clophill and Maulden, £2 404.

SWANSEA CORPORATION.—British-Thomson-Houston Co., Ltd., supply of 10 000/12 500 kW turbo set, £34 476.

DUMFRIES CORPORATION.—Brush Electrical Engineering Co., Ltd., turbo-alternator plant, £7 913, plus £870 for extras.

NEWTON ABBOT URBAN DISTRICT COUNCIL.—Tangyes, Ltd., centrifugal pumps, pipes and valves, electric motors, control panels, etc., £795.

DUMFRIES CORPORATION.—British Thomson-Houston Co., Ltd., supply and erection of 1 500 kW, 3 000 r.p.m. turbo-alternator; Premier Cooler and Engineering Co., Ltd., erection of cooling tower.

LIVERPOOL CORPORATION.—Metropolitan-Vickers Electrical Co., Ltd., supply and erection at Clarence Dock power station of one 50 000 kW maximum continuous rating, turbo-alternator, with accessories, £193 370.

SALFORD CORPORATION.—Saunders and Taylor, Ltd., provision of electric thermal storage system in extension of offices at Frederick Road power station, £995; Hackbridge Electric Construction Co., Ltd., supply of three-phase oil-immersed power transformers for 12 months; Metropolitan-Vickers Electrical Co., Ltd., supply of e.h.t. switchgear at Cromwell Road sub-station, £536; W. T. Glover and Co., Ltd., supply of 1 170 yd. single core cables, £626 13s. (All recommended).

HORNSEY CORPORATION.—A. E. Sandilands, further electrical installation at Highgate school, £356 8s. 6d.; A. Reyrolle and Co., Ltd., h.t. switch panel, £317; Bruce Peebles and Co., Ltd., supply of 300 kW motor convertor, £1 887; A. Reyrolle and Co., Ltd., supply of h.t. switchgear, £1 404 19s. 6d. Hewittic Electric Co., Ltd., supply of 300 kW rectifier set, £2 460; Bertram Thomas, supply of l.t. switchgear, £1 073; Standard Telephones and Cables, Ltd., h.t. and control cables, £2 711 14s. 4d. (All recommended).

CARLISLE CORPORATION.—English Electric Co., Ltd., two 8 000 kVA transformers, £5 370; G. and J. Weir, Ltd., supply of turbo-feed pump of 200 000 lbs. capacity, £575; British-Thomson-Houston Co., Ltd., 3 300 V switchgear equipment, £3 451, and switchgear for auxiliary turbine, £810; Bertram Thomas, supply of switchgear for rotary convertor, £312; Worthington-Simpson, Ltd., circulating pump equipment and oil catchers, £933; Harland Engineering Co., Ltd., supply of 1 000 kW rotary convertor, £1 876 12s. 6d.; Blakeborough and Sons, Ltd., supply of circulating water screens, £2 892 15s.

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ELECTRICITY SUPPLY.

Assisted Wiring at Stone and Gillingham—Lincoln's Electric Houses—Extension of Sheffield Electric Street Lighting—Worksop Extension Proposals—Bulk Supplies for London Boroughs—Extension of Plymouth Wiring Scheme.

STONE U.D.C. has adopted an assisted wiring scheme and will instal slot meters when required.

Gillingham (Kent) T.C. has decided to prepare a scheme for the installation of fittings and wiring.

Epsom U.D.C. has applied for a loan of £1 000 for assisted wiring, and for £1 200 for a new switchboard.

Oswestry has refused to consent to the erection of overhead lines in the borough by the North Wales Power Co.

Salford Electricity Committee seeks sanction to borrow £5 230 for the erection and equipment of sub-stations.

Croydon Electricity Committee has decided to arrange for an increased supply to Messrs. Creeds, at a cost of £1 150.

It is proposed to convert the bulk supply from Rawtenstall to Bacup from 3 000 to 6 000 V, to avoid stoppages at the mills.

Marazion Parish Council has accepted the terms of the West Cornwall Electric Light and Power Co. for electric street lighting.

Leek U.D.C. has applied for loans of £2 500 for cables, etc., in connection with a supply to Longsdon, and £2 490 for laying a new feeder cable.

Blackburn T.C. has approved agreements for a supply to Messrs. J. Fish and Co., of Cardwell Mill, Livesey, and Messrs. James Livesey's Mill.

Burnley Electricity Committee has approved an extension of an existing main from Holmby Street sub-station to the Cold Stores, at a cost of £4 602.

At the meeting of Haslingden T.C. on June 6th the Housing Committee's decision that electricity only should be installed in the houses at Stonefold was confirmed.

Electricity for all purposes is to be installed in 12 non-parlour, four-bedroom type houses which are to be erected on the St. Giles estate for Lincoln City Council.

Gainsborough U.D.C. has rejected an offer by the Yorkshire Electric Power Co. to take over the Council's undertaking. The Council takes a bulk supply from the company.

Birkenhead Electricity Committee seeks sanction to borrow £25 000 for mains and services.—The Committee has received sanction to borrow £5 000 for sub-station equipment.

Walsall Electricity Committee is to lay electricity mains in the Ring Road at a cost of £400 and to carry out a scheme for the electric lighting of central streets at a cost of £600.

Sheffield Watch Committee has authorised the fixing of 280 electric lamps at a cost of £1 269.—The electricity department is to extend mains at an estimated cost of £24 891.

The Newcastle and District Electric Lighting Co. has consented to supply electricity to 280 houses in section C of the Two Ball housing estate, subject to a satisfactory agreement with the Corporation.

Peterborough T.C. recently considered in committee an offer for the acquisition of the city electricity undertaking from a group of financiers. It is understood that the offer made is approximately a million sterling.

It is stated that landowners in Sefton rural district are urging Liverpool Corporation to expedite the supply of electricity in the district, as they desire to supply farms and cottages on their estates with electricity before the winter months.

Mr. H. A. Nevill, borough electrical engineer and manager, Peterborough, recommends the installation of an additional boiler, an economiser, a chimney and pipework at the electricity station, at a cost of about £65 000. The proposals are to be placed before the Central Electricity Board.

An agreement has been reached between Wallasey and Birkenhead Corporations in regard to the future electricity supply for Moreton. Hitherto the supply has been through Birkenhead, but Wallasey has now agreed to pay £15 000 for the electricity plant at Moreton, including standards, cables, etc.

It has been resolved at a conference of representatives of the Isle of Wight local authorities to support the application by the Isle of Wight Electric Light and Power Co. for a Special Order to cover that portion of the Isle of Wight where existing local Orders now apply. Under the company's proposal ten existing Orders would be replaced by one Order for the whole island.

Worksop U.D.C. has applied for a Special Order to include Whitwell in the area of supply. There are about 40 prospective consumers, and the cost of the scheme will be £8 689. The Council has applied for a loan of £13 652, part of which is for a main transmission line linking Manton Colliery with Rhodesia, and passing close to Whitwell.

Islington (London) B.C. has received an offer from the London and Home Counties Joint Electricity Authority for a bulk supply and, as other local authority undertakers in London are in a position similar to Islington as regards obtaining additional supplies, the Town Clerk has sent a letter inquiring whether such authorities will attend a conference to discuss the subject generally.

Hull Electricity Committee has approved a scheme to improve the coal handling facilities at the Sculcoates power station. A new bridge over the Beverley and Barmston Drain, and another siding are to be constructed. The provision of an additional cooling tower, pumping plant, piping, etc., at a cost of £22 000, has also been authorised.—Electric lighting is to be adopted at the Central Public Library.

The Holderness Trust is erecting lines in its area, and is under contract to commence supply Withernsea in November. Hull electricity department is to give a bulk supply at the boundary of the Corporation area of supply.—The Electricity Committee has rejected the proposal of the Holderness Trust that the Corporation should hand over the Order authorising supply in the Beverley area to the company.

Chorley Markets Committee has considered a proposal submitted by Mr. A. Gaskell, to install electricity on a number of stalls in the general market, and the Committee recommends that the application be not entertained. The Markets Superintendent has been instructed to ascertain the demand for electricity for lighting purposes, and to report on arrangements already made with regard to wiring, etc.

Leeds Corporation has decided that the portion of the undertaking of the Yorkshire Electric Power Co. which is situate in parts of the Hunslet, Tadcaster and Wharfedale rural district be purchased from the company for £44 500, and that so much of the undertaking of Electrical Distribution of Yorkshire, Ltd., as relates to the former township of Eccup be purchased from the company for £500.

Glasgow Tramways Committee has now agreed to recommend that arrangements be made for giving the Clyde Valley Co. the temporary supply of d.c. current required by the George Bennie Railplane Trust, Ltd., on condition that the firm pays to the department the cost incurred in respect of plant, etc., in connection with the supply, and on such other terms and conditions as the manager may consider necessary.

Plymouth Electricity Committee has decided that the scheme for free wiring be extended to consumers using ordinary meters, a deposit of 10s. without interest being made, and in case of transfer from prepayment meter to ordinary meter, the cost of the transfer being borne by the consumer. The scheme is also to be extended to the hire purchase of radiators for private houses, the quarterly payment to be at the rate of 1d. per 1s. or fraction of 1s. of the cost of the installation.

Hornsey Corporation has received an offer of a supply of electricity in bulk from the London and Home Counties Joint Electricity Authority, and the Council has been recommended to accept it. The Authority's offer is to give to the Council a supply of energy sufficient to meet the total requirements of the borough during the next seven years, at a price less than the estimated cost of generation by the Council during that period. The Authority will take all the energy actually produced at the Council's generating station and will repay to the Council the actual cost of generation.

Torquay Electricity Committee recommends that the Corporation oppose an application by Mr. W. G. Heath for a Special Order to supply electricity in Ivybridge urban district and in several parishes in the Kingsbridge and Totnes rural district, in so far as the Order affects the rural district of Totnes, and that application be made for an Order authorising the Corporation to supply electricity in several parishes in the rural district of Totnes. The Committee recommends the Corporation to offer £10 500 to the Teignmouth Electric Lighting Co. for the Buckfastleigh electricity undertaking.

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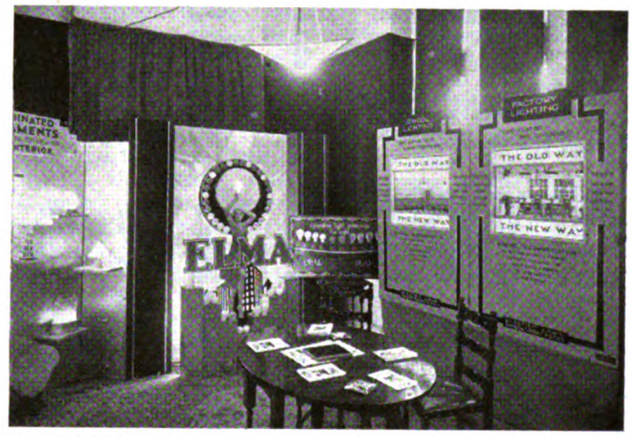
ELECTRICAL NEWS OF THE WEEK IN PICTURES.

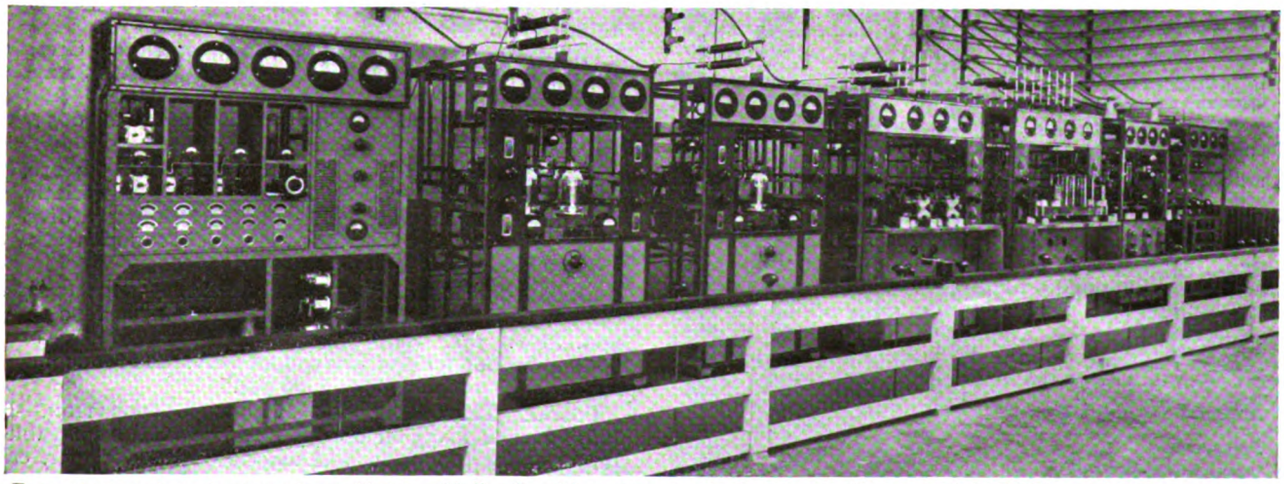
Mr. R. B. Renwick, son of Sir Harry Renwick, and his bride, Miss Dorothy Parkes, daughter of Major Harold Parkes, of Alveston, Stratford-on-Avon, leaving St. Margaret's, Westminster, after their wedding, on Monday.

The cable-ship "Faraday" last week marked the course of 63 miles from Norbreck, near Blackpool, to Port Grenaugh before laying the submarine telephone cable to the Isle of Man, and on Saturday last the first telephone communication between that island and this country was established. One of the ends of the cable may be seen here being hauled ashore.

The modified design of Broadcasting House, the future home of 2 LO, contracts for the building of which have now been placed. The new design makes fuller and more practical use of the space afforded by the site, while still retaining the super-studio included in the former design. A feature of the building will be a retaining wall enclosing the site.



The exhibits in the E.L.M.A. Lighting Room at the I.M.E.A. Exhibition. The exhibit was described in our last issue, and it is interesting to note that in connection with the model street and showroom window displays which attracted so much attention, two special booklets dealing with these subjects have now been published by the Bureau.



Recently tests have been made at Huizen (Holland) with a new short-wave transmitting station (PHI), working on a wave-length of 16·88 m. The new station is intended for working the Dutch Indies, the service being under the control of the "Philips Omroep Holland Indie," abbreviated to "Phohi." The transmitter, which consists of seven groups, is by reason of its maximum anode output of 60 kW, the most powerful short-wave station in existence. Signals from the new station have been heard with outstanding clearness in many countries. This is the second broadcasting station erected by Philips, the first being the well-known station PCJ.

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COMPANY NEWS.

Appreciation of Siemens and Henley's Shares—Arrangement between Siemens Bros. and Co. and Siemens and Halske—Callender's Prosperous Condition—Directors' Reports and Dividends—New Companies Registered.

THE principal feature disclosed by the week's dealings in electrical shares has been the buying of Siemens and W. T. Henley's ordinary shares, the quotations for which have, as a consequence, risen. Siemens shares have advanced from £1 7s. 6d. to £1 12s. 6d., and Henley's from £6 2s. 6d. to £6 6s. 3d. English Electric preference have weakened from 8s. 9d. to nearly 8s. In the electricity supply section, Newcastle issues have improved somewhat, Newcastle and District ordinary touching 30s.; Yorkshire Power ordinary shares are 1s. up at 36s. Underground Electric Railways ordinary shares are 6d. down at 23s. Eastern Telegraph Stock has lost 5 points, and Marconi's Wireless are 3s. 9d. lower at 75.

Last Annl. Divd.	Description	This Week.	Last Week.	1926 to 1928. Highest.	Lowest
%	**Electricity Supply.**				
(*d*)	Brompton & Kensington Ord. ..	26/–	26/–	35/6	23/9
4	Central Elec. Sup. 4% Deb. ..	94½	93	95½	88½
(*a*)	Charing Cross Elec. Ord. (£1) ..	26/–	26/–	51/–	24/3
4½	,, ,, ,, 4½% C.P. (£1)	17/6	17/6	18/3	16/6
(*b*) 8	Chelsea Elec. Sup. Ord.	26/6	26/6	45/3	24/–
10	City of Lond. Elec. L'ting Ord. ..	33/1½	33/1½	52/10½	26/–
6	,, ,, ,, ,, 6% C.P.	23/–	23/–	24/3	21/6
10	County Lon. Elec. Sup. Ord. ..	55/6	55/–	68/6	25/9
6	,, ,, ,, ,, 6% C.P.	23/–	23/–	24/–	21/3
(*c*)	Kensington & K'bridge Ord. (£1)	26/6	26/6	27/6	23/9
1/9⅜	Lon. Elec. Sup. Ord. (£1) ..	28/–	27/6	37/6	23/–
1/9⅜	Metro. Elec. Sup. Ord.	47/6	47/6	53/–	24/9
4½	,, ,, ,, 4½% C.P.	17/6	17/6	18/3	16/3
7½	N'castle & Dis. Elec. Ltg. Ord. ..	30/–	28/9	31/9	17/6
1/2⅝	N'castle-upon-Tyne Elec. Sup. Ord.	26/10½	26/3	30/3	19/3
6	N Metro. Elec. 6% C.P.	23/–	23/–	23/9	20/10
6	Notting Hill 6% C.P. (£10) ..	11	11	11½	9½
(*c*)	St. James & P.M. Ord (£1) ..	27/6	27/6	28/6	23/6
6	Shrops. Worcs. & Staffs. Power Pref.	22/6	—	—	—
1/9½	W'minster Elec. Sup. Ord. (£1) ..	26/–	26/–	52/9	24/–
4½	,, ,, ,, 4½% C.P. (£1)	17/6	17/6	17/10½	16/7½
8	Yorks. Elec. Power Ord.	36/6	35/6	38/9	24/6
6	,, ,, ,, 6% C.P. ..	24/–	24/–	26/9	20/7
	Railways and Tramways.				
8	Brit. Elec. Trac. Pfd. Ord. Stk. ..	130½	130½	152	117
6	,, ,, ,, 6% Pf. Stk.	127½	127½	133	103½
4	Cent. Lon. Ry. Ord. Stk. (asstd.)	72	72	72	54
4	,, ,, ,, 4% Deb.	80	80	83	77½
4	City & S. Lon. 4% Perp. Deb. ..	78½	78½	81	76½
5	Lon. Elec. Rly. Cons. Ord. Stk. ..	73½	73½	75½	42½
4	,, ,, ,, ,, 4% Pf. Stk.	73	73	77	68
4	,, ,, ,, ,, 4% Deb. ..	80	80	83	76½
5	Lon. & Sub. Trac. A. Deb. ..	95½	95½	97½	74
4	Lon. Un. Trams. 1st Deb.	64	64	63	39
4½	Met. Elec. Trams, 4½% Deb. ..	72	72	73½	62
5	,, ,, ,, 5% Deb. ..	67½	67½	70½	65½
3½	Met. Rly. Cons. Ord. Stk.	60½	61	81	54½
3½	,, ,, ,, 3½% Pf. Stk. ..	63	63	67	60½
3½	,, ,, ,, 3½% Deb. ..	70	70	73½	67½
5	Met. Dis. Rly. Ord. Stk.	76½	76½	77½	52½
4½	,, ,, ,, 4½% 1st Pref. ..	81½	81½	84	74½
6	,, ,, ,, 6% Perp. Deb. ..	116½	116½	118½	110
4	S. Met. Elec. Trams, 4% Deb. ..	70	70	70	64½
7	Underground Electric Rlys. Ord.	23/–	23/6	28/2	11/–
—	Yorks. (W.R.) Trams, Ord. ..	5/–	5/–	16/–	3/–
4½	,, ,, ,, 1st Deb. ..	59	59	78	60
	Electrical Manufacturing.				
7	Brit. Elec. Transformer 7% C.P. ..	13/9	13/9	19/10	4/6
15	Brit. Insulated Cables Ord. ..	72/6	72/6	86/3	56/–
6	,, ,, ,, 6% C.P. ..	22/6	22/6	23/10	21/–
7	British Thomson-Houston Pref. ..	23/9	23/9	24/9	19/7
7	,, ,, ,, 7% Deb.	103½	103½	109½	102½
10	Brush Electrical Ord.	27/6	27/6	30/9	24/–
15	Callender's Cable Ord.	87/6	87/6	91/3	66/–
6½	,, ,, 6½% C.P. ..	25/–	25/–	25/9	22/–
7½	,, ,, 7½% B. Pref. ..	27/6	27/6	28/3	25/–
8	Crompton-Parkinson 8% Cum. Pf.	25/–	25/–	27/–	14/–
6	,, ,, 6% Cum. 2nd Pf.	17/6	17/6	19/6	9/7
7½	Edison Swan Elec. 1st Pref. ..	25/7½	25/7½	13/–	7/4½
5	,, ,, ,, 1st Deb. Stk.	86½	86½	92	81½
7½	Elec. Construction Ord.	18/9	18/9	32/6	23/6
7	,, ,, 7% C.P. ..	22/6	22/6	22/9	21/–
—	English Elec. Ord.	6/3	6/3	15/9	5/–
—	,, ,, 6% C.P. ..	8/1½	8/9	18/9	7/–
7	Ericsson Telephones 7% Pref. ..	20/–	20/–	22/7½	17/6
35	Ever Ready (Gt. Britain) Ord. ..	23/6	23/6	92/3	18/1
6	Ferranti 6% Pref.	18/–	18/–	19/4½	16/9
7	,, 7% 2nd Pref.	21/3	21/3	19/3	13/9
10	General Elec. Ord.	52/6	52/6	46/6	26/6
‡25	W. T. Henley's Ord.	126/3	122/6	120/–	69/3
10	Johnson & Phillips Ord.	36/3	36/3	67/11	34/–
7½	Lon. Elec. Wire. & Smith's Pref. ..	23/9	23/9	25/–	22/3
7½	Siemens Bros. & Co. Ord. ..	32/6	27/6	36/6	24/9
10	Telegraph Const. Ord. (£12) ..	24½	24½	30½	20
	Telegraph.				
3½	Anglo-Am. Tele. Ord. Stk. ..	61½	61½	63½	56½
10	Eastern Ord. Stk.	265	270	273	135
3½	,, 3½% Pref. Stk.	67½	67½	70½	59
4	,, 4% Deb.	78½	78½	81½	74
10	Eastern Extension Ord. (£10) ..	26½	27	27½	14
22	Gt. Northern Telegraph (£10) ..	31½	33	43½	26
10	Indo-European (£25)	50½	50½	48½	30
20	Marconi's Wireless T. Ord. ..	75/–	78/9	84/4	12/–
15	,, Int. Mar.	62/6	62/6	90/–	16/6
10	Western Tel. Ord. (£1)	26½	27	27½	12½

(*a*) 19¼d. per share. (*b*) 1s. 9·3d. per share. (*c*) 1s. 6·949d. per share.
(*d*) 1s. 8·706d. per share. (*e*) 1s. 7·181d. per share. ‡ Including 1s. bonus.

PENNSYLVANIA WATER AND POWER CO.—Div. on common shs. $⅝ p. sh. for qrtr. ending June 30.

ELECTRIC SUPPLY CORPORATION, LTD.—Fin. div. of 7% on ord. shs., makg. 11% for year; fwd. £17 013.

VICTORIA FALLS AND TRANSVAAL POWER CO., LTD.—Net earngs. for year ended March 31, 1929, £294 609.

BRITISH COLUMBIA POWER CO.—Qrtrly. div. of 50 cents p. sh. on class "A" shs., less tax, is announced.

SHAWINIGAN WATER AND POWER CO.—Div. of $1½ p. sh. on common shs. for qrtr. endg. June 30 is announced.

HYDRO-ELECTRIC SECURITIES CORPORATION.—Initial qrtrly. div. of 25 cents p. sh. on common shs. will be payable on June 14.

LEATHERHEAD AND DISTRICT ELECTRICITY CO., LTD.—An issue of £20 000 5½% 1st mtge. debs., at par, was announced last week.

CANADIAN GENERAL ELECTRIC CO., LTD.—Qrtrly. div. of 1¾% for three months ending June 30, 1929, on pref. stk. will be payable on July 1.

RICHARD JOHNSON AND NEPHEW, LTD.—Rpt. for period from May 24, 1928, to March 31, 1929, shows gross pft. £37 057, Ord. div. at rate of 8% p.a. Fwd. £10 833.

PARA TELEPHONE CO.—Net pft. for 1928, £7 442, agst. £6 833. To depreciatn., etc., £5 296; div. 5% agst. 4%; fwd. £1 963, agst. £3 318.

GENERAL ELECTRIC CO. OF NEW YORK.—Extra div. of $1 p. sh. on common stk. has been declared, plus reg. div. of $1 on common stk. and 15% on the special stk.

ELECTRIC AND GENERAL INVESTMENT CO., LTD.—Divs. for year ended May 31, 1929, at full rate of 2s. p. sh. (10%) on ord. and 1s. p. sh. on dfd. shs. are recommended.

POLISH TELEPHONE CO.—An issue of £550 000 of 6% debs. at par was made at Stockholm on June 7. The issue was guaranteed by the Telefonaktiebolaget Ericsson.

CALCUTTA TRAMWAYS CO., LTD.—Rev. for 1928, £180 989, agst. £163 350. Div. on ord. shs. 10d. p. sh., tax free, makg. 1s. 2½d., agst. 1s., tax free, for 1927. Fwd. £11 020, agst. £7 758.

BARCELONA TRACTION, LIGHT AND POWER CO., LTD.—Net rev., $2 759 674, plus $208 148 brt. in. Divs.: 1% on ord. shs., makg. 2% for year, and 1% additional on pref. shs., makg. 9% for year. Fwd. $413 159.

AMERICAN CITIES POWER AND LIGHT CORPORATION.—Qrtrly. div. at rate of 2½% on "B" stk. payable on Aug. 1 in the form of further shs. of "B" stk. Net earnings available for "B" stk. amtd. to $2 379 000 for qrtr. ended March 31.

CONSUMERS' POWER CO.—Gross earngs. for 1928, $30 464 127, agst. $26 612 448, gross income $15 430 230, agst. $12 889 384, and net income $12 604 204, agst. $10 336 440. Divs. on pfd. cap. amtd. to $3 551 863, agst. $3 349 334.

CANADIAN HYDRO-ELECTRIC CORPORATION.—Gross rev. for 1928, $4 367 393; exes., $874 383; int., $2 272 810; disct. on funded debt, $146 708; depreciatn., $297 426; and pfd. divs., $750 000. Surplus for year $26 065; total surplus, $6 842 734.

WINNIPEG ELECTRIC CO.—Gross inc. 1928, $2 542 210, agst. $2 498 288. After provisn. for int., taxes, depreciatn., etc, blce. carried to surplus, $767 553. Regular qrtrly. divs. paid on pfd. stk. and two divs. of $1 p. sh. on common stk., and $77 500 was placed sinkg. fund res.

CANADA NORTHERN POWER CORPORATION.—Gross earngs. for 1928, $3 088 592, agst. $2 812 514; net earngs. $2 198 737, agst. $1 961 701. Surplus $1 410 218, plus $817 615 brt. in. After deduction for pref. and common divs. and for depreciatn., surplus is $1 196 460, agst. $489 994.

POSTAL TELEGRAPH AND CABLE CORPORATION.—Reg. qtrly. div. of $1·75 on the 7% pfd. stk. will be payable on July 1. Net pft. of co. and associated cos. for qrtr. ended March 31, $691 900, equal, after provision for taxes, depreciatn., int., etc., to $2·27 p. sh. of 7% pfd. stk.

CALCUTTA ELECTRIC SUPPLY CORPORATION, LTD.—Rev. for 1928, £955 129, agst. £930 291. Div. 12%, plus cash bonus of 4d. p. sh. (same as last year). Electy. sold 147 957 366 kWh, agst. 129 090 227. Sales for three months ended March 31, 1929, 38 151 824 kWh, agst. 32 504 346.

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WEST KOOTENAY POWER AND LIGHT CO.—Gross earngs. for 1928, $2 133 562, agst. $1 923 701. Exes., $536 405; bond int., $152 494; depreciatn., $507 510; written off, $209; divs., $35 000; tax adjustmts., $26 667. Surplus for year, $798 491. Previous surplus brt. fwd., $1 045 390.

HYDRO-ELECTRIC SECURITIES CORPORATION.—Rev. for 1928 $1 296 439; net inc. $1 159 134, exclusive of divs. paid in shs. of market value of $635 568. At Dec. 31, 1928, surplus was $1 021 837, compared with $498 328 at Dec. 1927. Investments at Dec. 31, 1928, stood at market value of $51 420 711.

TORPOINT ELECTRIC SUPPLY CO., LTD.—An offer has been made by Edmundson's Electricity Corporation, Ltd., to purchase whole of issued shs. of Torpoint Electric Supply Co. at 26s. 4d. for each pref. sh. and 10s. for each ord. sh., the offer being conditional upon acceptance by hldrs. of at least 80% of both classes of shs.

CAWNPORE ELECTRIC SUPPLY CORPORATION, LTD.—Surplus for 1928, £86 861, agst. £67 637. Int. on debs., £11 798; to depreciatn. and renewals, £27 500; written off sh. issue exes., £4 002; income tax, £2 000; sinkg. fund, £7 587. Pref. sh. divs. absorb £12 600 and intm. div. of 3% on ord. £6 000. Fin. div. 7%, makg. 10%. Fwd. £3 824.

LA PLATA ELECTRIC TRAMWAYS CO., LTD.—Gross recpts., 1928, £114 686, agst. £110 058; net recpts., £29 748, agst. £31 463. Int. on debs., £4 547; to deb. stk. redemptn. fund, £1 382, leavg. £23 548, plus £4 641 brt. in. To renewals fund, £8 000. Board recmmds. paymt. of div. for year on 6% pref. shs. and 1½% on acct. of arrears of div. on pref. shs.

NEW ENGLAND POWER CO.—Gross earngs. for 1928, $31 835 604, agst. $28 778 661. Available for divs., $5 441 576, agst. $4 477 934. New 60 000 H.P. Bellows Falls hydro-electric plant has been completed and connected with system. Constructn. commenced on new 300 000 H.P. hydro-electric development on Connecticut river. Contract concluded with Edison Electric Illuminating Co., of Boston, for purchase by it of 150 000 000 kWh a yr. for 20 yrs.

WESTERN UNION TELEGRAPH CO.—Gross operatg. rev. for 1928, $136 449 613; income from divs. and int., $2 93 808; operatg. exes. $120 310 256; int. on bonds $3 609 406; to surplus acct., $15 467 659. This added to surplus at Dec. 31, 1927, $78 528 582 and premium on cap. stk. issued to employees during year, $518 100, makes a total of £94 514 341. Deducting divs. paid, $8 084 634, and adjustmts. of surplus, $72 524, leaves surplus at Dec. 31, 1928, $86 357 183.

MADRAS ELECTRIC SUPPLY CORPORATION, LTD.—Net pft. for 1928, £65 934, plus £6 656 brt. in. Nine months' div. on pref. stk. required £13 000, and intm. (2½% actual) on ord. $11 830. Fin. three months' pref. div. £4 493, and fin. 5½% actual on ord., making 8% for yr., tax free, £26 026; to res., £9 855; fwd. £6 906. Tramways workg. for 1928 showed available blce. £14 402, includg. amt. brt. fwd. Pref. div. absorbed £6 699. Fwd. £1 703.

International Telephones.

INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION.—Earngs. of the Corporation and associated cos. for 1928, $81 234 824, agst. $32 645 500. Net earngs., $23 053 828, agst. $12 582 923. Int. and divs. on pfd. stk., etc., required $6 882 491 and int. on 25-year 4½% gold deb. bonds $1 575 000, leaving net income $14 596 337. Reg. divs. at rate of 6% p.a. have been distributed, and net earned surplus at end of year was increased by $5 835 659. The total earned and cap. surplus Dec. 31, 1928, amtd. to $34 709 760.

OFFICIAL QUOTATIONS.—The Stock Exchange Committee has granted official quotations to 287 250 £50, fully paid, ord shs., 251 934 £100, fully paid 7% non-cum. participatg. pref. shs., and £1 677,060 5% 1st mtge. 50-year bonds of the Barcelona Traction, Light and Power Co., Ltd.; 100 000 £1, fully paid, ord. shs. of the Enfield Cable Works, Ltd.; 140 833 £1, fully paid, ord. shs. of the Oriental Telephone and Electric Co., Ltd., and, 11 996 £1, fully paid, ord. shs. of the Underground Electric Railways Co. of London, Ltd.

ELECTRICITY IN TIN MINING.—The rpt. of the directors of the Associated Tin Mines of Nigeria states that great importance is attached to acquisitn. of a half in. in Kurra Falls Hydro-Electric undertakg. Since date of report enterprise has become vested in Nigerian Electricity Supply Corpn., in which the co. holds about half the ord. shs. A long-term contract has been entered into with the corporatn. for supply of electric. power. The utilisatn. of this power will, it is anticipated, be reflected in a very substantial reductn. of workg. costs.

UNITED RIVER PLATE TELEPHONE CO., LTD.—Rev. for 1928, £2 764 625. Deducting £2 261 508 workg. exes., £13 500 deb. stk. int. and £192 400 for div. on pref. shs. to Dec. 31, 1928, and intm. div. on ord. shs., leaves £297 217, plus £165 000 brt. in. Fin. div. of 5% on ord. shs. recommended, makg.

Sir Hugo Hirst at the G.E.C. Sports, which were held at Wembley on Saturday, June 8th. The picture also includes Mr. H. W. Roberts, on the left.

8% for year, tax free. Fwd. £158 219. Results have not enabled usual div. to be met without drawg. upon amt. brt. fwd. This is principally due to reductn. of tariffs forced upon the co. in last qrtr. of 1928. Further progress has been made with conversion of Buenos Ayres to automatic system. An offer made in Dec., 1928, by International Telephone and Telegraph Corporation of New York to purchase the ord. shs. was accepted by majority of shhldrs.

Company Meetings.

GREAT NORTHERN TELEGRAPH CO., LTD.—At the meeting on June 7th the Chairman said, in replying to an inquiry from a shareholder, that a settlement of the account outstanding with the Japanese Administration, as referred to in last year's report, had quite recently taken place through the payment to the company of approximately £143 000, by which amount the revenue for 1929 would thus extraordinarily be augmented.

COMPANIA HISPANO AMERICANA DE ELECTRICIDAD, S.A.—Mr. F. de A. Cambo, presiding at the meeting in Madrid on May 25th, said revenue had increased from 103 726 432 pesetas in 1927 to 114 670 761 pesetas in 1928, and net profit from 43 196 874 pesetas to 50 884 560. This permitted the board to propose a total dividend of 15% gold, compared with 14%. The sale of 200 000 series "E" shares at a rate much above par had provided the company with a net profit of 98 460 350 pesetas, which it was proposed to carry to the reserve fund. The conservative policy of dividend payments which had been adopted had permitted them, without any strain on their cash resources, to carry out the construction of their super-station at Buenos Ayres, which was the most perfect in the world. The report and accounts were adopted.

VENEZUELA TELEPHONE AND ELECTRICAL APPLIANCES CO., LTD.—Resolutions in regard to an increase of the capital were submitted at an extraordinary meeting on Monday. Sir Alexander Roger, who presided, said the conversion of the company's system in the Caracas area to automatic operation had been well received, which had decided the directors to introduce automatics into other sections of the system, and an investigation by experts showed that further development would be profitable. The remaining unissued capital amounted to £6 050 only, and it had therefore been decided to put proposals before the shareholders to increase the capital by £320 000, in the form of non-voting "A" ordinary shares of £1 each, with the same dividend and capital rights as the existing ordinary shares. It was proposed to offer immediately about 140 000 of the new shares.

SIEMENS BROTHERS AND CO., LTD.—At an extraordinary general meeting on Tuesday, a resolution approving alterations of the articles of association was confirmed. Sir William Bull, chairman, said it was becoming increasingly difficult to keep abreast with the developments made by the large American and Continental concerns, which, owing to their very much larger capital and turnover, could afford, and did incur, expenditure on development work and research on a scale which would mean an excessive strain on the company's resources. It was natural, therefore, that they should examine the possibilities of obtaining the advantages of the research

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and technical development undertaken by some of these powerful groups in concessions and any necessary long-term credit business rather than undertake the obligations in whole upon themselves in competition with those groups. They were able to make satisfactory arrangements without in any way affecting the British control of the company, and they succeeded in making an agreement with regard to their telephone business with Messrs. Siemens and Halske, Berlin, the biggest manufacturers of telephones on the Continent of Europe, and with a very powerful international group. They had also entered into an agreement with Siemens and Halske to arrange for a complete exchange of research, development work and factory experience in regard to all other fields that were common to both companies, and they had arranged to issue to Siemens and Halske 450 000 ordinary shares, and they were issuing to Siemens Brothers and Co. 6 557 shares (700 marks nominal value each) in Siemens and Halske.

New Companies.

ALLOM BROTHERS, LTD.—Cap., £3 000. To acquire business now carried on at 15, George Street, Hanover Square, London, W., and elsewhere, as "Allom Brothers," and to carry on business of electricians, electrical, wireless and general engineers, etc.

RAILWAY RADIO CO., LTD.—Cap., £1 000. To acquire inventions, patents and secret processes in connection with establishment of radio communication to and from railway trains or other forms of transport; to manufacture and deal in wireless apparatus and radio accessories, etc. Reg. office: 12/13, South Place, London, E.C.2.

POWELL AND HANMER, LTD.—Cap., £300 000. To acquire business of manufacturers of and dealers in lamps and accessories carried on by Powell and Hanmer, Ltd. (incorporated in 1904) and carried on in Birmingham and elsewhere, and to adopt an agreement with the said company and A. E. Phillips. Solicitors: Pinsent and Co., Birmingham. (Public co.)

METAL AND CHEMICAL PRICES.

TUESDAY, June 11th.

		Price.	Inc.	Dec.
Copper—				
Best Selected ..	per ton	£78 5 0	£3 15 0	—
Electro Wirebars	,,	£84 15 0	£0 5 0	—
H.C. Wires, basis	per lb.	11 11/16d.	1/16d.	—
Sheet	,,	11 11/16d.	—	1/16d.
Phosphor Bronze—				
Wire (Telephone) basis	per lb.	1s. 2 11/16d.	1/16d.	—
Brass 60/40—				
Rod, basis ..	per lb.	9d.	—	—
Sheet ,, ..	,,	10 1/2d.	—	—
Wire ,, ..	,,	11 1/2d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£3 12 6	—	—
Galvanised Steel Wire, basis 8.S.W.G. ..	,,	£14 15 0	—	—
Lead Pig—				
English	per ton	£25 0 0	—	—
Foreign or Colonial	,,	£23 12 6	£0 2 6	—
Tin—				
Ingot	per ton	£200 10 0	£2 15 0	—
Wire, basis ..	per lb.	2s. 8d.	1/2d.	—
Aluminium Ingots	per ton	£95 0 0	—	—
Spelter	,,	£26 7 6	—	2s. 6d.
Mercury	per bottle	£22 5 0	—	—

Sulphur—Flowers, Ton £12 0 0 *Sulphuric Acid*—
,, Roll ,, £10 10 0 (Pyrites, 168°) Ton £6 15 0
Copper Sulphate ,, £25 to £25 10 0 *Sodium Chlorate* per lb. 2 1/2d.
Boric Acid (Crystals) ,, £30 0 0 *Sodium Bichromate* per lb. 3 1/2d.
Rubber—Para fine, 11d.; plantation, 1st latex, 11 1/2d.

∴ **The metal prices are supplied by British Insulated Cables Ltd.**

CALLENDER'S CABLE AND CONSTRUCTION CO., LTD.

Orders from the London Company and for the Central Board's "Grid"—Excellent Prospects for the Coming Year.

SIR Fortescue Flannery, presiding at the thirty-third ordinary general meeting on June 6th, said he was fortunate once more to be able to present a balance-sheet and accounts which maintained the wonderful record which the Callender Co. enjoyed. The details of the "grid" were now known, and several contracts had been placed in connection therewith, one of which had been secured by their company for the southern section of England, between the Thames and the sea coast as far as Worthing, and this contract represented a value of approximately half a million of money. The effect of the "grid," when completed, would, they believed, be to increase the quantity of underground cable required for distribution and general services, especially in the towns which it served, and therefore the tendency would be to considerably enlarge business for the underground cables, which it was their company's speciality to manufacture. On the other hand, the orders obtained for the ordinary run of underground cables and for the wires and cables required inside premises represented a highly satisfactory business, which continually tended to increase and helped materially to produce the profit shown in the balance-sheet. Great progress had been made in research work to assist in producing cables for higher pressures, which had been very helpful in assisting the company to obtain the large orders for mains of 66 000 V recently placed with them to be laid in London to form the interconnecting link between the various local generating stations, thus also giving to those stations supply from the Government network. One of the three such districts in London had been entrusted to the company.

The chairman then gave particulars regarding the purchase of the business of W. T. Glover and Co., Ltd., and referred to the figures in the accounts, which were abstracted in our issue of May 31st. The board, he said, proposed a dividend of 15 %, which would be payable on the shares numbered 1 to 800 000 only. They had excellent reports as to the Okonite-Callender Cable Co., with which they were so closely identified in the United States. Mr. Watson, the technical manager and head of their research department at Erith, had just returned from a visit to America, and they were satisfied from his report that the American company was making cables of the utmost excellence, that the field in connection with their use was steadily increasing, and that good orders were being obtained. The board suggested that £186 000 be taken from the reserve funds so as to enable fully-paid ordinary shares to be distributed to the shareholders in the proportion of one bonus share to every five ordinary shares held. He concluded by moving the adoption of the report and accounts.

Sir T. O. Callender, deputy chairman and managing director, said Mr. Hunter, one of his chief assistants, was proceeding, in the position of representative of the Institution of Electrical Engineers, to the conference which was being held that week in Paris on the subject of electrical distribution as it affected, especially, high-tension mains. He would be joined by Mr. Watson, head of their research department, and those two gentlemen were responsible for a most important paper, which would be read at the meeting, on the expansion of conductors in super-tension mains. Although, during the past year, they had had some large contracts, they had not had the volume of them they would like to have had. They had laid many miles of high-tension mains for the London Company, and that had been followed by an equally important contract for the Central Electricity Board in the 66 000 V cable to which their chairman had referred. Their small trade was coming in in large amounts, and was likely to increase, and he looked upon the prospects of the company during the coming year as excellent.

In Burmah, for the Burmah Oil Co., they completed, after nearly two years' work, the power line which connected their various oilfields; later they completed a somewhat similar line for the Anglo-Persian Co. at their works at Abadan, in the Persian Gulf, and they had just finished the electrification of the island of Bahrein, the headquarters of the wonderful pearl fishery in the Persian Gulf. A big installation had been carried out at Benares by them with their cables. They had barely finished their work in Benares when they were called upon to send cables and men to Jerusalem. The work there had been practically completed. It was carried out under the auspices of Messrs. Balfour, Beatty and Co. As to the other places in India where they had done work, they owned the concessions for the island of Salsette, a new district being opened up in connection with Bombay. It would, he felt sure, prove to be a very valuable market for the supply of cable in that district. They had also done business in Santiago, in Chile, where last year they supplied quite a large amount of cable. They had also done work in Rio, in Brazil. As to South Africa, they were still doing a lot of work there, and also in all parts of the world.

The report and accounts were adopted.

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COMMERCIAL INFORMATION.

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debt. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

BINGHAM, Mr., Woodmansey, wireless dealer. £15 10s. 2d. May 1st.

CAREY, Mr. E. J., 26, Theobald Road, Cardiff, electrical engineer. £42 10s. 8d. May 6th.

CLAYTON, Aubrey V., 330, Glossop Road, Sheffield, electrical engineer. £15 15s. April 26th.

DODD, Mr. W. S., 474, Bury New Road, Kersal, magneto dealer. £13 13s. 9d. May 1st.

FINNEGAN AND POLLOCK, 47, North Bridge Street, Sunderland, electrical engineers. £11 6s. 7d. May 1st.

LOWMAN (H.) AND SON, 17, Jane Street, S.E., electrical contractors. £22 11s. 11d. April 9th.

METCALFE, Mr. J. E., Fishergate, York, wireless dealers. £26 18s. 8d. April 16th.

POPE, Mr. H. Dalton, 119, Commercial Road, Swindon, electrical engineer. £17 3s. 6d. April 18th.

REX O TONE RADIO CO., 326, High Street, Bangor, radio dealer. £10 2s. 1d. April 24th.

SCOTT AND RICE, 26, The Causeway, Teddington, radio engineers. £10 1s. 2d. April 10th.

SKIPPER (S. H.) AND CO., 35, Broad Bridge Street, Peterborough, electrical engineers. £15 18s. 4d. April 30th.

SMITH, Bolton (trading as H. WHARTON), The Crescent, Spalding, electrical engineer. £20 7s. May 3rd.

SWEET, Mr. R. C., London Radio Stores, 107A, High Street, Uckfield, wireless and electrical engineer. £19 11s. 11d. May 7th.

Deed of Arrangement.

PRICE, Albert Alex., 11, Hart Street, and 11, Marchmont Street, W.C., electrical engineer. Dated June 3rd, filed June 10th. Trustee, E. Watts, 77, Chandos House, Palmer Street, S.W., C.A. Liabilities unsecured, £222; assets, less secured claims, £75.

Mortgages.

[NOTE.—*The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—allowed by the date of the Summary, but such total may have been reduced.*]

MIDWAYS ELECTRIC, LTD., London, W.C. Registered May 16th, £400 debentures; general charge. *Nil. May 3rd, 1929.

TEE (J.) AND CO., LTD., London, W.C., electrical and radio engineers. Registered May 21st, £1 000 (not ex.) debenture, to Pettigrew and Merriman (1925), Ltd., 2, Bucknall Street, W.C.; general charge. *Nil. April 3rd, 1928.

Private Meetings, etc.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

A. AND B. HARRIS, LTD., electrical and general engineers, 47, Victoria Street, London, S.W., and at Kings Lynn. This company, following a meeting of creditors, passed resolutions for voluntary liquidation. At the statutory meeting of creditors the liquidator reported that the liabilities were £2 234, and the net assets £289, or a deficiency of £1 945. He stated that at the date of his appointment certain creditors had levied execution, and the Sheriff had advertised a sale by auction. The sale should have taken place on May 24th, and he made efforts to get it postponed, but was unable to prevent the sale taking place. The goods belonging to the company were sold the previous day by public auction at Kings Lynn, and realised £410, whilst the amount required to pay the execution creditors and costs was £415. In addition to the assets appearing in the statement of affairs, there was work in progress in connection with uncompleted contracts for machines. It was possible that if those contracts were completed a sum of something like £300 profit might be made. In answer to a question, the liquidator said that the premises at Kings Lynn were the property of the local authorities, and as the rent had not been paid the landlords had given notice terminating the lease. The latter expired in December next. The company was formed with a nominal capital of £4 000, and the accounts showed that during the year to June, 1927, there was a net loss of £1 466, whilst in the following 12 months there was a net loss of £634. It was estimated that since June last there had been a loss of £1 780, but that figure included certain depreciations written off the assets, and preliminary expenses of £102. A resolution was passed confirming the voluntary liquidation of the company.

London Gazette, etc.

Companies Winding-up Voluntarily.

BRIGHTLINGSEA ELECTRICITY SUPPLY CO., LTD. By special resolution, May 21st, confirmed June 6th. A. C. Lucas, 167, Strand, London, W.C.2, Chartered Accountant, appointed as liquidator.

SHEFFIELD WIRELESS DEPOT (1926), LTD. By reason of its liabilities, May 30th. H. Cunningham, King's Chambers, Angel Street, Sheffield, Incorporated Accountant, appointed as liquidator.

Bankruptcy Information.

LATHAM, John James, 3, Brickhouse Street, Burslem, Stoke-on-Trent, wireless dealer. Receiving order, June 4th. Debtor's petition. First meeting, June 18th, 11 a.m., Official Receiver's Office, 12, Lonsdale Street, Stoke-upon Trent. Public examination, June 20, 11 a.m., Town Hall, Hanley, Stoke-on-Trent.

WILMINGTON, Granville, 75, Railway Street, Nelson, electrical and radio engineer. Receiving order, June 6th. Debtor's petition.

Notices of Dividends.

CRUMP, Augustus Henry, lately carrying on business at 202, Walworth Road, S.E.17, as SELWYN ELECTRICAL ENGINEERING CO., electrical engineer. First and final dividend, 4s. 7d. per £, payable Bankruptcy Buildings, Carey Street, London, W.C.2.

NORMAN, George Arthur, 11, Freeman's Yard, Barnsley, electrical engineer. First and final dividend, 5s. 2d. per £, payable June 11th, Official Receiver's Office, County Chambers, King Street, Wakefield.

Notice of Intended Dividend.

BOWLER, Thomas William (separate estate), 314, Yardley Wood Road, Moseley, Birmingham, trading with another as TAYLOR AND WYNNE, at back 180, Green Lanes, Small Heath, Birmingham, electrical engineer. Last day for receiving proofs, June 17th. Trustee, Clement Hoult, 191, Corporation Street, Birmingham, Official Receiver.

Application for Discharge.

JOLIVARD, Kenneth Paul James, described in the Receiving Order as K. Jolivard and Co., 66, Victoria Street, London, S.W., electrical engineer. Hearing, June 21, 11 a.m. Bankruptcy Buildings, Carey Street, London, W.C.2.

Partnerships Dissolved.

BREWER AND BRUNT (Arthur George BREWER and William Henry BRUNT), 17, Albert Road, Hoylake, electrical engineers and electricians, by mutual consent as from September 30th, 1928. Debts received and paid by W. H. Brunt, who will continue the business.

RELIANCE ENGINEERING CO. (Edwin POBJOY and Grove Thomas BOOTE), electrical engineers, 339, Richmond Park Road, East Sheen, Surrey, by mutual consent as from May 29th. Debts received and paid by E. Pobjoy, who will continue the business.

W. H. TRACE AND SON (William Henry TRACE and Harold Greenaway TRACE), electrical engineers, 26, Upton Road, Birkenhead, by mutual consent as from January 31st, 1929. Debts received or paid by H. G. Trace. The business will be carried on in the future by H. G. Trace in conjunction with Walter Thomas Trace and George Arthur Smith Trace.

Bankruptcy Proceedings.

HUNT, Sydney Everest, 8a, Torwood Street, Torquay, electrical engineer and contractor. This debtor's statement of affairs shows liabilities amounting to £2 312 against assets of £601, less preferential claims of £102, or a deficiency of £1 813. Debtor attributes his failure to heavy overhead charges; interest and rent; bank charges, etc., preventing him earning sufficient to meet living and personal expenses; shop which cost £5 a week being inconveniently suited to attract custom; loss of £100 on largest contract; and costs, through being suddenly sued, since last June. At the statutory first meeting of creditors, Mr. E. H. Hawkins, of Poppleton, Appleby and Hawkins, 4, Charterhouse Square, London, E.C., was appointed trustee of the estate.

THE LEAD MARKET.

The market has remained steady throughout the week and according to James Forster and Co., the highest prices were paid on Wednesday, when £23 16s. 3d. was touched for June, and £23 15s. for September. Prices have since been easier with the tone steady at the close.

Closing prices on June 7th were £23 12s. 6d., for all positions, or 1s. 3d. to 2s. 6d. per ton up on the week.

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PATENT RECORD.

The following information is prepared from the Illustrated Official Journal (Patents) by permission of the Controller of H.M. Stationery Office. Printed copies of full Patent Specifications, when accepted, may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at 1s. each.

Specifications Accepted.

292 983 British Thomson-Houston Co., Ltd. Non-metallic sheathed multiple conductor cables. (28/6/27.)
296 368 Landis et Gyr Soc. Anon. Induction measuring instruments. (30/8/27.)
310 246 A. K. Croad (Automatic Lighter Corporation). Magnetic sharpeners for razor and like blades. (27/7/28.)
310 250 Rainsford and Lynes, Ltd., and R. K. Lynes. Electrical switches. (2/8/28.)
295 039 International General Electric Co., Inc. Thermo-magnetic relays. (5/8/27.)
296 087 Siemens-Schuckertwerke Akt.-Ges. Electrically-driven household machines. (25/8/27.)
296 778 Westinghouse Lamp Co. Electric discharge devices. (8/9/27.)
298 470 Associated Telephone and Telegraph Co. Electric remote control systems. (8/10/27.)
300 175 A. Huber. Electrical teaching device. (7/11/27.)
300 240 E. Morel. Magneto-electric machines. (9/11/27.)
300 614 British Thomson-Houston Co., Ltd. Electric discharge devices. (16/11/27.)
301 474 Electrical Research Products, Inc. Television and like electro-optical transmission systems. (6/4/27.)
309 851 Beatty W. E. (Bell Telephone Laboratories, Inc.). Insulating materials. (15/12/27.)
310 296 G. L. Porter and Ferranti, Ltd. Regulation of control of alternating currents. (22/11/27.)
310 297 H. Cane. Lime-supporting towers or masts. (23/11/27.)
310 383 J. Y. Johnson (I. G. Farbenindustrie Akt.-Ges.). Manufacture and production of electrodes for Edison accumulators. (25/11/27.)
310 299 P. D. Feild and T. C. Standbrook. Potential supply means suitable for use in wireless receiving-apparatus. (23/12/27.)
310 387 British Thomson-Houston Co., Ltd., M. C. I. Hunter and F. L. Fletcher. Electric switchgear. (19/1/28.)
283 937 Electrolux, Ltd. Absorption refrigerating systems. (20/1/27.)
283 938 Electrolux, Ltd. Absorption refrigerating apparatus. (20/1/27.)
310 390 Siemens Bros. and Co., Ltd., and C. R. Riber. Electricity meters. (21/1/28.)
310 304 A. U. Westfelt. Electrically operated and controlled means for operating the barriers at railway crossings. (23/1/28.)
284 193 Electrolux, Ltd. Absorption refrigerating systems. (22/1/27.)
310 451 C. S. Franklin. Wireless telegraphy and telephony, and aerial systems therefor. (26/1/28.)
284 296 Compagnie Des Telephones Thomson-Houston. Electric remote control systems. (27/1/27.)
310 570 J. W. Manley. Primary batteries. (2/2/28.)
310 574 Automatic Telephone Manufacturing Co., Ltd., and C. E. Beale. Telephone systems. (2/2/28.)
310 575 Automatic Telephone Manufacturing Co., Ltd., and O. A. Pearce. Telephone systems. (2/2/28.)
285 079 Leclanche Soc. Anon. Electrical condenser. (12/2/27.)
284 977 Soc. Industrielle Des Telephones. Amplifiers for electric circuits. (5/2/27.)
310 579 Siemens Bros. and Co., Ltd., and W. E. Goodwin. Telephone instruments. (7/2/28.)
310 581 N. Dennes and Associated Electrical Industries, Ltd. Thermal electric switches. (8/2/28.)
310 582 H. J. Buchanan-Wollaston. Means for indicating or recording, also applicable to electrical relays. (9/2/28.)
310 585 British Thomson-Houston Co., Ltd., and C. G. Garton. Mercury or the like switches. (10/2/28.)
285 379 G. Hammermann. Clamp for electric current-conducting wires. (14/2/27

Applications for Patents.

March 25th.

3 564 **F. A. L. Billerey. Electric heating.**
9 492 **O. Boden. Mounting dynamos of motor vehicles, etc.**
9 586 **British Thomson-Houston Co., Ltd. Electric circuit interrupters. (23/3/28, U.S.)**
9 627 **British Thomson-Houston Co., Ltd. Electric fuses. (23/3/28, U.S.)**
9 566 K. W. Daumann. Thermionic tubes.
9 524 Electro Medical Supplies, C. H. Greenham, and F. S. Lyle. Massaging apparatus.
9 523 Etablissements Industriels de E. C., et D. A. Grammont. Manufacture of vacuum electric tubes., etc. (24/3/28, France.)
9 590 E. Fattori. Stands for electric irons.
9 495 J. H. O. Harries. Transmission of signals by wirelese, etc.
9 555 Hart Accumulator Co., Ltd., and R. Wheatley. Anti-spilling devices for batteries.
9 587 International General Electric Co., Inc. Electric fuses. (26/3/28, Germany.)
9 569 P. A. Macchioni. Telephone apparatus. (24/3/28, Italy.)
9 620 Marconi's Wireless Telegraph Co., Ltd. Oscillation generating, etc., systems. (23/3/28, U.S.)
9 621 Marconi's Wireless Telegraph Co., Ltd. Electric circuit coupling devices. (23/3/28, U.S.)
9 546 N. V. Philips' Gloeilampenfabrieken. Microphones. (27/4/28, Holland.)
9 547 N. V. Philips' Gloeilampenfabrieken. Manufacture of Wehnelt cathodes. (13/4/28, Holland.)
9 550 F. G. L. Scott and A. W. Sharman. High frequency signalling.
9 501 W. Sefton. Electric switch.
9 600 Siemens and Halske A.G. Mechanical translator for printing telegraph systems. (5/4/28, Germany.)
9 601 Siemens and Halske A.G. System for transmission of news, etc.
9 740 Siemens and Halske A.G. Electrical transmission system. (2/4/28, Germany.)
9 487 J. Slavik. Measurement of transformation, etc., ratio of transformers. (5/4/28, Czecho-slovakia.)
9 474 W. A. Stevens. Means for controlling regeneration in electric vehicles.
9 499 P. G. A. H. Voigt. Magnets.
9 504 F. Whipp, and Whipp and Bourne, Ltd. Electrical relays.

March 26th.

9 694 A. Allan and A. Reyrolle and Co., Ltd. Circuit breakers.
9 638 C. P. Allinson. Low frequency chokes.
9 718 Associated Electrical Industries, Ltd., and E. Y. Robinson. Vacuum electric tube devices.
9 719 Associated Electrical Industries, Ltd., and E. Y. Robinson. Thermionic cathodes.
9 720 Associated Electrical Industries, Ltd., and F. E. Bancroft. Plug and socket connectors.
9 682 L. H. Austinlite, and C. B. Walker. Control of electrical machines.
9 739 M. Bertelsen. Wireless receiving circuits.
9 733 British Thomson-Houston Co., Ltd. Electrical transmission of pictures. (26/3/28, U.S.)
9 734 British Thomson-Houston Co., Ltd. Induction motors. (30/3/28, U.S.)
9 735 British Thomson-Houston Co., Ltd., and F. H. Clough. Systems for giving indications of electrical conditions at a distance.
9 662 A. W. Brooker. Electromechanical train control apparatus.
9 661 H. Bullamore. Brake operated by electromagnetism.
9 743 Constructions d'Appareillages et Specialités Electriques. Feeding arrangements for electric devices. (4/2/29, France.)
9 727 D. C. Gall, and H. Tinsley. Electric switches.
9 764 General Electric Co., Ltd., L. C. Jesty and J. T. Randall. Gasfilled electric lamps.
9 765 General Electric Co., Ltd., and H. G. McClean. Driving mechanisms for electric vehicles.
9 680 J. P. Laker. Radio receivers, etc.
9 691 N. V. Philips' Gloeilampenfabrieken. Electric discharge tubes. (13/4/28, Holland.)
9 705, 9 706 C. Peters and Siemens Bros., and Co., Ltd. Telephone systems.
9 694 A. Reyrolle and Co., Ltd. Electric circuit breakers.
8 679 V. C. Sawyer. Potentiometer.
9 471 Siemens-Schuckertwerke A.G. Vacuum switches. (11/4/28, Germany.)
9 670 H. Stefke. Production of electrolytic metal deposits.
9 749 H. Wade (Moffats, Ltd.). Electric cooking ranges.
9 656 J. Walker. Electric heating elements.

March 27th.

9 844 L. Barrett. Electric switches.
9 899 P. Beringer and English Electric Co., Ltd. Electric protective systems.
9 922 J. Bethenod. Electric musical instruments. (5/5/28, France.)
9 925 Brecknell, Willis and Co., Ltd., and C. W. Merrick. Valves for air controlled collectors for electric traction.
9 906 British Thomson-Houston Co., Ltd. Electric switches. (28/3/28, U.S.)
9 909 British Thomson-Houston Co., Ltd., F. A. Fossey, and J. H. Pollard. Distributors for magneto-electric machines.
9 804 Callender's Cable and Construction Co., Ltd., and C. W. Kay. Insulating supports for electric wires and cables.
9 918 J. J. Drumm. Electrical accumulators, etc.
9 907 International General Electric Co., Inc. Electric heating devices. (29/3/28, Germany.)
9 859 Landis et Gyr Soc. Anon. **Prepayment electricity meters.** (25/4/28, Switzerland.)
9 833 A. B. C. Licence. Enclosed etc., electrical apparatus.
9 811 H. F. L. Moon. Switching device for wireless sets.
9 781 F. H. Reeves and Revo Electric Co., Ltd. Electric lamp fittings.
9 883 Siemens-Schuckertwerke A.G. Relay connections. (5/4/28, Germany.)
2 818 Standard Telephones and Cables, Ltd. (R. Schenk). Automatic battery changing device for telephone exchanges.
9 817 A. M. Taylor. Electric power transmission.
9 882 Telefonaktiebolaget L. M. Ericsson. Intercommunication telephone systems. (31/3/28, Sweden.)
9 887 Telefonaktiebolaget L. M. Ericsson. Measuring amplification ratio of amplifiers (28/3/28, Sweden.)
9 901 Telefonaktiebolaget L. M. Ericsson. Electric signalling systems. (31/3/28. Sweden.)
9 886 A. R. Upward. Primary cells, etc.
9 851 C. E. Verdan. Telegraphic systems. (27/3/28, France.)
9 774 G. Wilkinson. Electric heat storage plant.

March 28th.

10 072 Automatic Telephone Manufacturing Co., Ltd., and L. M. Simpson. Totalising apparatus.
10 012 British Thomson-Houston Co., Ltd., F. A. Fossey, and J. H. Pollard. Magneto-electric machines.
10 016 H. C. Channon, J. N. Dean, H. J. Garnett, B. J. Habgood and W. S. Smith. Insulating materials.
10 028 J. G. Christopher, General Electric Co., Ltd., and E. L. Randall. Electric light fittings.
9 962 W. R. Edwards. Venting devices for accumulators.
10 026 Electramonic Co., Ltd., D. W. Sayers, L. N. and S. J. Tyrell. Thermionic valve holders.
10 027 Electramonic Co., Ltd., D. W. Sayers, L. N. and S. J. Tyrell. Means for turning wireless receiving cabinets.
10 061 M. Ow-Eschingen. Coating electrically non-conducting bases.
10 042 Forges et Ateliers de Constructions Electriques de Jeumont. Electric generators. (30/3/28, France.)
10 049 W. J. D. Harding and S. C. Phillips. Leading-in terminals for wireless apparatus.
10 091 Dr. M. Levy Ges. Electric starting apparatus for talking machines. (30/3/28, Germany.)
9 966 S. Loewe. Thermionic cathodes. (25/6/27, Germany.)
9 998 J. Ostermeier. Flash lamps. (28/2/29, Germany.)
9 974 Record Electrical Co., Ltd., and J. E. Speight. Maximum demand indicators.
9 994 U. Rouselle. Electric purifying devices for treating liquids, gases, etc.
10 045 Siemens and Halske A.G. Relays for amplifiers. (5/4/28, Germany.)
10 084 Sprague Specialties Co. Electrical condensers. (9/1/29, U.S.)
9 976 Standard Telephones and Cables, Ltd. (F. E. Eschrevens). Selector switches for telephone systems.
9 977 Standard Telephones and Cables, Ltd. (K. M. Sano). Measuring instruments for electromagnetic devices.
9 980 C. H. Stave. Accumulators.
9 957 M. Weisbt. High tension electric cables. (16/6/28, Germany.)

April 2nd.

10 290 M. Becavin de Thomin and G. Rys. Electric rectifiers. (2/4/28, France.)
10 226 C. S. Bleicher. Automatic contrivance for receiving written messages by telephone. (21/4/28, Austria.)
10 258 A. W. Boothroyd and A. G. Mumford, Ltd. Electrically-driven two-throw pumps.
10 115 W. E. Bruges. Method of testing transformers.
10 138 W. H. Bulpitt and Bulpitt and Sons, Ltd. Safety appliances for electrically-heated apparatus.
10 140 S. Butterworth and S. Ward. Electric condensers.
10 155 J. E. Clementson. Switches for wireless apparatus, etc.
10 109 C. L. F. Clutterbuck. Light sensitive cells.
10 273 W. Dallenbach. Introduction of current into metal vacuum discharge vessel. (2/4/28, Germany.)
10 247, 10 250 S. G. S. Dicker (N. V. Philips' Gloeilampenfabrieken). Reproduction from sound records and films.
10 251 S. G. S. Dicker (N. V. Philips' Gloeilampenfabrieken). Devices for reproducing sound recorded on films.
10 252 S. G. S. Dicker (N. V. Philips' Gloeilampenfabrieken). Winding wire coils.
10 105 Loewe-Radio Ges. and E. Romhild. Electron discharge device. (30/3/28 Germany.)
10 173 J. Lucas, Ltd., and R. L. Neill. Electric horns.

COMING EVENTS.

Wednesday, June 19th.

Electrical Contractors' Association (Sussex Branch).—Midland Bank Chambers, Brighton. Ordinary meeting.

Polytechnic School of Electrical Engineering.—Lecture V (course of six lectures) by Mr. W. H. Date on "Thermionic Valves." 6.30 p.m.

Saturday, June 22nd.

Sheffield Illumination Society.—Annual outing to York.

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THE ELECTRICIAN

Established 1861. The Oldest Weekly Illustrated Journal of

Electrical Engineering, Industry, Science and Finance.

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[Closed on Saturdays in accordance with the "Five-Day Week" plan adopted by Benn Brothers, Ltd., and its associated organisations.]

No. 2665. [No. 26. Vol. CII.] Friday, June 28, 1929. Annual Subscription, 25s. Overseas, 30s.

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Current Topics.

The I.E.E. Summer Meeting.

THE summer meeting of the Institution of Electrical Engineers which concluded in London, on Sunday, after a highly delightful time in Paris and the Pyrenees, was voted one of the most successful yet held. The hospitality of the French hosts was most marked and the social functions of the meeting were well carried out. It will be gathered from the snapshots which we published in our last issue, and still others this week, that everyone attending the meeting will look back upon the visit as well worth remembering. The party, numbering well over one hundred, saw much that was novel and instructive, as our reports of the proceedings indicate. The fact that the President of the Institution, Col. K. EDGCUMBE, was so much at home in the matter of language and that so many members of outstanding interest attended the meeting, will have had a considerable influence on the French appreciation of the visit. Appreciation which will without doubt stand us in good stead for many years to come and which will perhaps result in a reunion on similar lines at some future date. Both in Paris and in the Pyrenees the members of the Institution received welcome and hospitality from technical associations, power companies and others connected with electricity. The Orleans and the Midi Railway companies acted with the greatest generosity regarding the transport of the party by special train, and thanks are due to M. BUNET and M. GROSSELIN and to the Société Française des Electriciens. Regarding the Pyrenees, many were struck by the way in which difficulties had been got over, to enable new industries and interests to grow up, and many of the party expressed a wish to pay before long another visit to a district blessed by nature with such wonderful scenery and by man with so many places and things of historic interest.

The Incandescent Electric Lamp.

WITH reference to the gala effects which were shown at Atlantic City this month in connection with the National Electric Light Association's Convention, whereat Edison was proclaimed the inventor of the incandescent electric lamp, we publish elsewhere in this issue copies of two letters which are of interest. Both these communications emanated from the Institution of Electrical Engineers, and the more important of the two was addressed to the U.S. National Illumination Committee, drawing attention to the fact that Sir JOSEPH SWAN, and not Mr. T. A. EDISON, was the true inventor of the incandescent electric lamp. Our attitude with respect to the "jubilee" to be held in October is well known, and the fact that our views, together with the Institution's letters, have not had the desired effect of coupling the name of SWAN with the celebrations is, to say the least, disappointing. It is, of course, now too late to make as enthusiastic an acknowledgment of SWAN'S invention as we would like, while the publicity given to the EDISON claim will take a long time to lose its effect; nevertheless, we feel that even now the United States should do something to pay tribute to the name we ourselves have honoured.

N.E. England Electricity Scheme.

THE Electricity Commissioners have to date submitted six electricity schemes, of which five have already been adopted by the Central Electricity Board. The sixth relates to North-East England and has just been submitted for approval, while still other schemes to cover S.W. England (including South Wales), and East Anglia are expected to be developed before the end of the year. In the early part of next year the Commissioners hope to complete schemes to cover the outstanding parts of Wales and Scotland. With regard to the N.E. England scheme, this deals with about 5 050 square miles covering Northumberland, Durham and a part of the North Riding of Yorkshire. The area had a population at the last census of approximately 2 674 800 and embraces coal-mining, shipbuilding, iron and steel, engineering and the chemical trades. It also covers wide tracts of agricultural territory which, with a few isolated exceptions, are at present unprovided with any system of supply. At present there are 32 authorised undertakers in the area, owning between them 15 public generating stations. The consumption in 1927/28 was about 247 kWh per head of population and it is estimated that this will increase to an average of 410 in 1935/36. Under the proposals, six existing stations will be selected and operated for the Board, namely, Carville (A), Carville (B), Dunston, North Tees, Darlington and Sunderland. It is not anticipated that any new stations will be required, but the scheme provides for five further stations to be worked under temporary arrangements for a few years. There are several waste-heat and private generating stations connected up to the system of undertakers in the area, and it is assumed that these undertakers will continue the arrangements already entered into with the owners of

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these sources of supply. Broadly speaking, four of the selected stations, namely Carville (A) and (B), Dunston and North Tees, will supply the base load, while the remainder will be used for meeting the peak load in the area.

The Transmission System.

THE stations will be interconnected by high pressure main transmission lines designed in a series of ring mains. These are not necessarily completed in the present scheme, but the primary transmission system has been laid out so as to permit of later amplification under schemes for adjoining areas. The main transmission system will comprise 102 route miles of line and five transforming stations. The secondary transmission system will involve a further ten transforming stations. Incidentally, the interconnection of these stations will result in the release for revenue-earning purposes of about 80 000 kW of plant now kept as spare and representing about £1 360 000 of capital. The greater part of the electrical development in the area has been carried out on a frequency of 40 cycles, and the scheme contemplates standardisation in 25 undertakings at an estimated eventual cost of £5 963 070.

The E.C.A. Conference.

STILL another important occasion this month is the fourth annual conference of the Electrical Contractors' Association which opened at Bournemouth on Wednesday. As popular as were the Brighton, Scarborough and Cheltenham conferences, that at Bournemouth is even better attended. As is our usual custom, we shall, in our next issue publish a full report of the conference, including the discussions, and exclusive snapshots of most of the outstanding personalities and social functions. That the E.C.A. is growing in importance no one doubts; that it will grow even more is a foregone conclusion, for, in spite of many difficulties, the association has already shown its ability to protect the interests of its members in many ways; and furthermore, has raised the status of the electrical contractor above that set by many of those who have not yet joined its ranks. While it is yet too early to say that the papers and discussions at this week's conference will add still further glory to the Association, it may, however, be stated without hesitation that they will undoubtedly serve the purpose for which the Association was formed, namely to assist the electrical contracting industry as a whole.

The National Radio Exhibition.

THE applications for space at the National Radio Exhibition, which will open at Olympia in September, have exceeded all previous records, and the organisers have experienced considerable difficulty in satisfying a number of intending exhibitors with the space allotted to them. That any dissatisfaction should exist at all at this early stage is disappointing, for though the majority, if not all, of the firms who feel that they will be exhibiting with less advantage than others, are outside the membership of the R.M.A., they form nevertheless a good percentage of the total exhibitors. We agree that members of the Association should have some preference in the matter of stands, but such preference should not be held out as one of the reasons why radio traders should join the R.M.A. As it is, members of the Association are found in the best stand positions at Olympia, with non-members in the less important places, and, in our opinion, this is lacking in that co-operative spirit which the future success of the radio industry demands. Were the R.M.A. members to hold an exhibition themselves, that is to the exclusion of all non-members, the show would be considerably less attractive than is at present the case. With its membership of 100 odd the Association would make a poor show at Olympia when compared with, say, the last exhibition. The list of exhibitors for the next show indicates that the numbers of members and non-members are approximately equal, and, in view of this, surely no one exhibitor should be treated differently from his neighbour purely on the question of membership. The exhibition has become so established, and the demand for space so large, that the present method of balloting appears to have become inadequate, and we suggest, therefore, that some other arrangement, based perhaps on the priority of date of application be considered by the organisers. In any case the suggestion that the non-success of some firms to procure good space is likely to influence them into becoming members of the R.M.A. is not likely to be popular.

The Talking Film and British Apparatus.

IT is satisfactory to note that some of the largest talking film companies in America have decided to lease their pictures to exhibitors who have installed British apparatus. Prior to this decision the position was understood to be that those American film companies who are licensees of the Western Electric Company's system, placed a ban on the leasing of their talking films to exhibitors who had not installed exclusively the Western Electric apparatus. Exhibitors, therefore, who were obliged to rely to a great extent on films produced by those companies, were compelled to instal reproducing equipment of American manufacture. Since there are in Great Britain alone something like 4 500 cinemas which, but for the ban, would by now probably have been fitted with electrical reproducing equipment, the American film companies have only themselves to thank that not more "talkies" are exhibited. The British electrical engineer has already shown his superiority as a designer of loud speaking equipment, and since the success of the talking film, both in production and exhibition, is largely a matter of electrical engineering, American producers will quickly find that not only is a British-made reproducing equipment for use with American films a more popular proposition, but that British-made talking films are a serious rival to the American product. The ban on the use of British reproducing equipment has hitherto held up the film producing side in this country, but now that the ban is lifted both apparatus and films have got their chance.

A Chance for the Electric Vehicle.

THE new rules made by the Ministry of Transport regarding motor traffic as a result of complaints of undue noise are a strong argument in favour of the electric vehicle. Though much of the noise created by road traffic is due to causes other than the petrol motor, the latter is nevertheless responsible for a good deal. Acceleration, careless gear changing, an ill-designed exhaust, all tend to noise, and the number of petrol driven vehicles which do not offend in one way or another must be very few. In the case of the electric vehicle noises due to mechanical construction are completely absent. Quiet acceleration, no smell and no engine noise are obvious advantages which, if applied to, say, the London motor traffic, would result not only in giving greater comfort to travellers themselves, but also to pedestrians. The distance between, say, Charing Cross and the Bank is not far, but the number of times the driver of a motor vehicle is required to change gear in that distance must be high. When that number is multiplied by the number of such vehicles passing a given point on that particular section of the road the noise resulting from gear changing alone must surely be of considerable volume. The fact that gear changing is necessary to such an extent in so short a distance is a further argument in favour of the electric vehicle, for, from the point of view of economy, all traffic blocks and hold-ups give in this case a conservation of energy, whereas with the petrol motor, the driver who by way of saving his "juice" stops his engine and at the policeman's bidding has to restart, is, to say the least, unpopular. It seems to us that the new regulations which come into force on August 1st offer an opportunity which makers of electric vehicles should not fail to grasp. Public opinion is on the side of the authorities on the noise nuisance, let us show a way to solve the problem, if not entirely, then to a very considerable degree.

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CONCRETE POLE PROBLEMS.

Advantages of Concrete Over Wood—Methods of Overcoming Weight—Hollow Shell or Solid One-Piece Poles?—Hair-Line Cracks—Preliminary Expansion of the Steel Used.

By WILLIAM T. TAYLOR, M.Inst.C.E., M.I.E.E.

THERE are many problems that cannot be dealt with in this short article and must therefore be left over for a further period.

It would seem that the quicker we come to a conclusion respecting the best line or system, which is that one delivering a given amount of energy for the lowest cost, and includes relatively best reliability, the quicker and more definitely we shall arrive at a decision in favour of reinforced-concrete pole-line construction as against wood or steel for transmission lines in particular. For conditions in general, the margin of profit between the manufacturing and selling prices of energy can quickly be consumed in the wood-pole line when we account fully for the annual costs resulting from relative life, maintenance, pole changes, interruptions, etc.

Some of the advantages of reinforced-concrete over wood or steel, are: greater durability, non-rusting, non-decaying, fire-proof, absence of maintenance costs; it does not require any preservative, it is not attacked by termites or salt or acid (air or moisture) from the atmosphere; it is readily adaptable to any shape, and it is easily dimensioned to any load. However, certain practices militate against the general use of reinforced-concrete poles. Neglecting for the moment the strange factor of safety at present enforced by law, we are jeopardised by present methods of making, and transporting and handling and erecting. Dangers and high costs confront the three latter operations before the pole is in place, and it is these (along with the *compounded* safety factor) that militate against the inherently superior qualities of the reinforced-concrete pole for overhead transmission and distribution lines in general.

To lessen the heavy weight and cost of transport and handling, designers have sought various processes of making them, either with a hollow shell or in separate sections. The former methods endeavour to force up the strength of a given concrete mass-section, with the result that hair-lines and cracks are far too common, due to the relatively thin shell of concrete, the relatively high expansion of the reinforcing steel and other reasons, which conditions result in failures or in decreased life and strength; the latter methods endeavour to facilitate transport by making them in sections with telescopic or butt jointing, both of which are undesirable and offer a pole with joints that, for equivalent unit length and cost, become weaker with age and increase the maintenance costs, etc.

Solid One-Piece Poles.

For any given figure of cross-section, the solid one-piece pole is always the stronger and always the most reliable, but it costs more, due to the cost of transport and handling, and the little extra concrete for the core. To offset all the objectionable costs, it is necessary to obviate almost entirely such costs as transport by rail, haulage by road, handling from works to site, erection, etc. In this way we can build a reinforced-concrete pole line at a total initial cost equivalent to that of a wood-pole line of equal strength—decidedly superior strength and rapidly decreasing annual expenditures always favouring the concrete pole-line during the life of the line. Also, apart from the heavy costs of transport, haulage, handling, erecting, etc., all of which can be avoided, as shown here, there is ever present the added danger or risks of totally or partly destroying or fracturing the poles during any one of these operations.

For the building of a more robust line offering the least annual expenses, practically every electricity supply undertaking will see the justice of paying a higher price per mile length of completed line. To more properly understand the merits referred to above, the reader is requested to examine page 419 of THE ELECTRICIAN of April 5th, 1929. When comparing the wood-pole and the concrete-pole line, the merits of the latter are soon made self-evident, that is to say:

(*a*) Longer spans can be used with better all-round reliability; the first cost is very little higher, and the extra cost is more than worth it because a concrete-pole line (which is the proper basis of comparison, not a pole) is less expensive with operating time—i.e., it becomes increasingly cheaper and more dependable with time as compared with the wood-pole line.

(*b*) Relative life favours concrete construction, especially the concrete pole referred to here, which is made from a rich proportion and is finished off while damp with a very rich mixture that interjoins organically with the pole and tightens all possible wounds.

(*c*) No preservative is required and no maintenance cost is involved; the pole line takes care of itself, at least as well as the best wall of any concrete building.

(*d*) As the very large majority of system troubles and interruptions are from insulators and birds, with this construction the number of insulators are less per mile of line, and troubles from birds are entirely eliminated because the arms are specially shaped to give the best electrical and mechanical results. The concrete pole is flexible, and is more dependable for balancing up unequal span-stresses; the flexibility is very much more dependable with age as compared with a wood or a steel-pole line.

Permissible Pull.

The allowable pull on reinforced-concrete poles is usually based on a working stress which, for steel, is around 17 000 lb./sq. in.; for concrete it is around 750 lb./sq. in. Such a steel would have an ultimate strength of around 55 000 lb./sq. in., and a yield point not less than 34 000 lb./sq. in. For high-grade concrete we may take 850 lb./sq. in. as the highest concrete bending compression. The factor of safety of 3·5 for both materials is a strange combination, because the one material does not bear relation with the other, and, for steel, it is out of all proportion. This factor of safety requires more steel or the use of a higher grade steel with a yield point not less than 50 000 lb./sq. in., as compared with $34\,000 \times 2{\cdot}5/3{\cdot}5 = 24\,300$ lb./sq. in. for a factor of safety of 2·5.* One difficulty to such high-grade steel is that it must be warmed before bending, which increases the cost, and is an objection from this viewpoint. Mild steel is bent cold and also has the facility of being stretched while cold.

The compressive strength of concrete may be taken at 2 600 lb./sq. in., based on testing in usual compressive cubes. This gives a factor of safety of $2\,600/750 = 3{\cdot}5$, but as reinforced concrete sustained to bending moments will show from 30 to 40% higher compressive strength, in a pole sustained to bending moments the factor of safety for the concrete will be much nearer $(3\,600 \times 1{\cdot}3)/750 = 4{\cdot}5$, which is the figure given by the writer on page 418 of the April 5th issue of this journal. Obviously, as concrete strength is more variable than strength of steel, a greater factor of safety for the concrete should always be stipulated.

Taking the allowable bending compression at 750 lb./sq. in., there is just reason for assuming that the first minute cracks or hair-lines (although not visible to the naked eye) will appear when the pole (especially a hollow-type pole of ordinary shell-thickness) is subjected to a working stress no greater than, say, 50% of this value where the reinforcing steel has not previously been given a preliminary stretch; the hair lines will increase in number, and will also broaden and lengthen as the working stress is increased up to its full allowable value.

Many of the troubles attributed to improper curing or puddling or high water-content, have been nothing more than insufficient depth of steel covering, or, using a figure of reinforcement of the cross-section of the pole (especially a round or curved figure) where the steel tensions on individual rods vary widely, due to their positions within the figure, or, absence of a preliminary expansion of the steel reinforcing, or, no means available for making the steel assist the compression of the concrete *after* the latter has hardened. For a hollow-type pole in particular, the steel reinforcing rods should be given a preliminary expansion, just as is done with conductors during the process of stringing—for concrete poles of the hollow type this is particularly important. Thus, in this state, the steel is embedded in concrete and, during and after a sufficient hardening period for the concrete, the reinforcing rods endeavour to contract, but, owing to the adhesion of the concrete, the condition creates a compression of the

* No sound reason can now, or ever, be given for not taking the same *steel* factor of safety as for usual all-steel poles. In New Zealand and Australia they are justified in using a factor of 2·0 because among other reasons their designs are of *solid* construction throughout.

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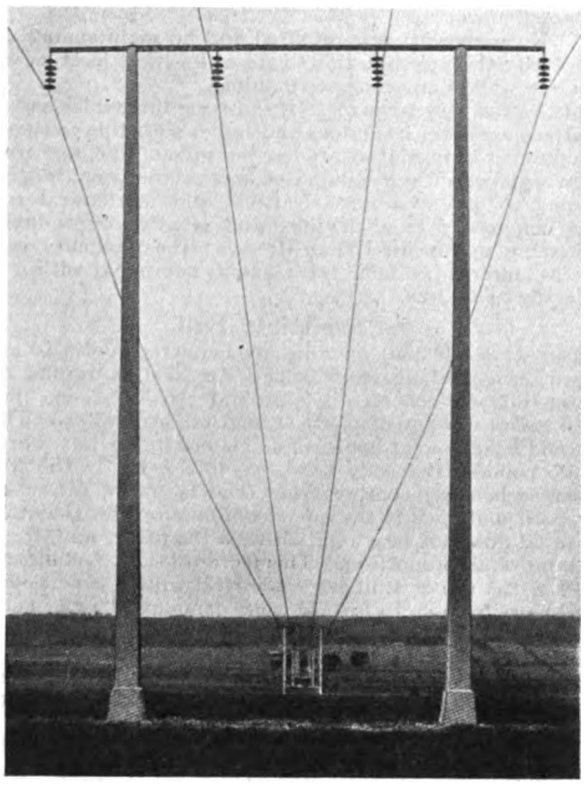
concrete throughout the whole pole and its sectional area. This compressive condition gives a much greater crack security than exists with all present makes and methods of working. The greatest security is obtained when the rods have received a preliminary straining at the time of casting the pole, and, when secured and held from possible contraction until the concrete is thorougly hardened. This creates in the concrete a very important additional compression strength, the magnitude of which varies with the chosen figure of reinforcement—the best type favouring the solid pole of rectangular and square outline.



Solid reinforced concrete pole for line of 120 000 V, carrying four 0·20 sq. in. conductors, including one spare 900 ft. span The height of the poles above the ground is 54 ft.

The total drawing capacity acting equally on *all* longitudinal rods should equal $T = e\,A_s$. During the time the concrete is thoroughly hardening, the steel rods endeavour to contract to their original length, but the surrounding concrete prevents this, and in this way compression in the concrete is caused. This results in a better concrete, also an excellently desirable state of equilibrium of steel and concrete. In practice we should seek to equate $e\,A_s = e^1 A_c$, the result of which we obtain an axial concrete compression in the whole cross-section, or $e^1 = e(A_s/A_c) = B\,e$, wherein, B is the figure of reinforcement of the cross-section of the pole. From this we see that there is created in the concrete a certain compression which is dependent on the figure of reinforcement B, as well as the preliminary steel expansion e, or/and ratio of steel to concrete.

About 440 lb./sq. in. can be reckoned as the preliminary expansion point of the steel. At below 440 lb./sq. in. concrete bending-tension, the first minute cracks appear, but are not visible to the eye. If a preliminary steel expansion is first given the steel, almost double the security can be secured against cracks; results can be achieved either by increasing the concrete mass or by decreasing the steel expansion, or vice versa. As the area of steel cannot be decreased for a given pole strength, the answers are obvious. A total preliminary steel expansion of 8 800 lb./sq. in. is approximately equal to a 5% steel reinforcement, that is 440/8 800 = 0·05; and a 5 700 lb./sq. in. preliminary steel expansion is approximately a 7·5% steel reinforcement, or 440/5 700 = 0·075. The lowest value of reinforcement, resulting from the elastic limit of the steel, is not far from 1·6%. As hair-line cracks are the real beginning of most of the damage or weakening and failures by exposure of the steel to air and moisture, it would appear most important and necessary to introduce preliminary expansion of the steel in the casting of every hollow-type pole, especially those of thin shell and curved outline, and in this way obtain from 50 to 100% greater security against *effectively permanent* hair-line cracks. When using unstretched steel in the hollow-round pole, an *excess* of concrete pressure can much more easily be borne by the reinforced-concrete than the *very smallest* excess lateral pull (or draw) which, through the minute loosening of the concrete texture, exposes the steel to air and moisture, causing failure or decreased strength or decreased life.

For a given diameter of pole, a solid figure will take greater bending moments than a similar-shaped hollow figure; a square will take greater bending moments than a hexagonal, and, so forth for the different forms and shapes and concrete mass-section of poles.

With respect to relative total costs, the most objectionable high costs (as already mentioned) are transport, haulage, handling and erecting—not the cost of casting concrete poles. It is not the relatively higher initial cost for the concrete pole that should be objectionable, it is the excessive annual expenditure for the relative wood or steel pole line. A good concrete-pole line should always be cheaper after a few years' operation than either wood or steel; the concrete-pole line has in its favour nearly all the advantages required for maximum annual economy and best operation. The arms, etc., for insulators are cast to any shape for greatest strength, lowest height of load application, best spacing of conductors, best earthing and/or bonding and, for *total absence of bird troubles*, etc. For the line construction mentioned on page 419 of April 5th, 1929, issue of THE ELECTRICIAN, the writer now presents the following as one reinforced-concrete pole line example of costs that permits of a reasonable margin of profit to the manufacturer and builder.

The heavier the line, the more favourable are the costs, reliability, flexibility, strengths, etc., to reinforced-concrete pole-line construction. In order to show as favourable a condition as possible to wood-pole construction, the smallest permissible size of conductor and the minimum number of circuits, are taken:

One three-phase, 11 000 V, 0·025 sq. in. copper line (giving relative costs per mile of complete line, assuming three changes of direction every two miles of line. Allowing 15% for insurance, depreciation, supervision, etc.; also allowing 5% capital-interest against annual expenses).

	First cost. £ s. d.	Annual expenses. £ s. d.
Wood-pole line	208 0 0	27 4 0
Steel-pole line	275 12 0	22 10 0
Reinforced-concrete-pole line ..	218 16 0	13 0 0

Hence:

	Wood-pole Line. £ s. d.	Steel-pole Line. £ s. d.	Reinforced-concrete-pole Line. £ s. d.
Cost of construction	208 0 0	275 12 0	218 16 0
Upkeep cost for 10 years	482 0 0	500 12 0	348 16 0
Upkeep cost for 20 years	756 0 0	725 12 0	478 16 0

Therefore, during 20 years the wood-pole line will have cost at least £277 more *per mile* than the reinforced-concrete pole line—this is more than the initial first cost of the reinforced concrete pole line. If we cancel out the annual expenses for the concrete construction, then we have a wood-pole and steel-pole line cost amounting to 3·1 *times* greater than reinforced-concrete pole-line construction.

If we really are looking into the future, and, if *the* responsible authorities are truly desirous of reducing the cost of electrical energy to rural consumers, then the time has arrived when much more consideration should be given to the composite safer and more reliable construction mentioned herein.

From the above-mentioned figures of costs—which are just and reasonable—the following facts are brought out:

(1) By building and operating the wood-pole line instead of the concrete-pole line, there is a saving of £10 16s. per mile of line in first cost for the former, *but*

(2) To make this saving, we must pay £14 10s. more per annum for maintaining the line 20 years, i.e., we must borrow money at 14·5% interest per annum for a period of 20 years to operate the wood-pole line.

(3) Considering four 11 000 V circuits aggregating 100 miles total length, each circuit capable of delivering 250 kW, or a total of 1 000 kW, then, annual saving of the concrete line over the wood-pole line is £1 450.

(4) By adopting the concrete-pole line the electricity undertaking would be able to deliver electrical energy for £1 9s. *cheaper* per kW than over the wood-pole line.

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THE HIGH TENSION CONFERENCE IN PARIS.

Properties of Insulating Materials—Test Pressures for Transformers—An American View—Overhead Line Considerations—The Ageing of Oils—The Calculation and Construction of Lines.

By THEODORE RICH, A.M.I.E.E.

(*Continued from page* 750.)

TWO papers were presented on insulating materials. The first of these was by M. GROSSELIN, General Delegate of the Société Française des Electriciens, being the results of the labours of a committee formed in 1927 by the Conference to study solid insulating materials.

The report deals with two groups of materials: the first being fibro-cements, silico-calcareous materials and asbestos boards; and the second, moulded insulators based on synthetic resins. The materials of the former group always retain moisture unless impregnated. They have but a poor dielectric rigidity, but offer security in the neighbourhood of an arc of short duration. The materials of the latter group have become of great importance, especially for telephonic high and low tension work, being suitable for immersion in oils.

Desirable electrical test methods relate to transverse and superficial resistivity, the dielectric constant, breakdown tests, effective volts per min. thickness, and energy loss, phase angle tests, which tend to indicate the dielectric qualities of an insulator, due to what has been termed dielectric viscosity.

The mechanical tests are to determine resistance to traction, compression, bending and shock, with Brinnell tests for hardness.

The thermal qualities are of great importance. Materials should be measured at different temperatures with regard to their mechanical properties, deformation, and so on. Where an insulating material contains organic matter, however small the quantity, it will of necessity be combustible if not inflammable.

The chemical properties are studied by tests of solubility or attack by water, oils, acids and various bases; moisture-absorbing tests are often measured by resistivity.

A paper on research on insulating materials by H. BRUCKMAN, of the Delft Polytechnic College, deals with apparatus for the dielectric testing of compound, and on methods used for testing the adhesion of compound to the lead of sheaths or the metal walls of joint boxes.

Reports on Transformers.

A group of three papers on transformers was taken on the morning of June 8th with the assistance of Mr. S. AUSTIN STIGANT (of Messrs. Johnson and Phillips). The first, by PAUL GIRAULT, dealt with "Test Pressures for Transformers with Neutrals Earthed." It was pointed out that national regulations have existed for some time fixing dielectric test conditions from windings to the body and between turns where no point is connected to earth. These tests, for the sake of simplicity, assume certain possible eventualities without taking into account the particular constitution of the line and apparatus to be connected up, nor atmospheric conditions. The first tendency would be to deduce a new set of rules from the old ones. This gives rise to certain difficulties, a general proposition has to take into account various types of winding, star, delta or zig-zag on the h.t. or l.t. sides, separate single-phase transformers, with three cores, of the shell type or of the triple flux-return type, various arrangements of neutral connections and the direct or with resistances and reactances. The French "Union des Syndicat Rules" lay down a test for three-phase transformers when the h.t. is in star and the l.t. in mesh, of twice normal pressure plus 1 000 V. The author thinks the same rule should apply when the neutral is solid earthed as well as when it is not, especially as transformers have often to operate after accidents with one of the terminals to earth.

In America the view is being taken that attacks on transformers are mostly due to atmospheric phenomena; supply authorities have, however, in many cases strengthened up the insulation of their lines to the detriment of the transformers, the idea being to harmonise the installation as a whole, with the line terminals and transformer windings, taking account of the various insulators, gaseous, liquid and solid, and their relative resistance to over-tensions, and in order to reduce break-down inconveniences to localise flash-overs by a reduction of line insulation at some convenient point near the transformer station.

Mr. S. AUSTIN STIGANT presented a paper on "The Interturn Insulation of Transformers," being the outcome of investigations of the Transformer Technical Committee of the B.E.A.M.A. At one time many failures of end turn insulation used to take place owing to lightning, switching and arcing grounds; external auxiliary protective devices such as gaps, reactances and reinforced end turns were adopted, but while they helped matters they did not tend to stop interturn shorts between internal windings. Some operators tried to improve arrestors; others believed in improved insulation between turns. Most recent failures have been in the body of the winding. It has been customary to ask for reinforcement for 5% of the turns at one end or both, with reinforcement around tapping leads, the end turns to be graded so that while 1% of the turns have to stand full pressure, the next 4% can be arranged so that 5% of the total turns from the extreme end shall stand one-fifth of the total line pressure. A sudden change in insulation at any one point tends towards a weak spot. Researches tend to show that abnormal interturn insulation is unnecessary. The pressure drops across different winding points vary with transient wave shapes and the type and disposition of the windings. About 10% of the crest value of an impulse striking a terminal may be found between end turns; with static end rings this can be reduced to 3%.

Basis of Proposals.

With overhead lines the greatest pressure which can occur under impulse flash-over forms a basis for the proposals made. The maximum pressure possible on a system with an insulated neutral without arrestors is approximately six times the phase voltage. With the aid of curves showing the volts per turn with various waves in proportion to the transient voltage at the terminals, as limited by the line spill-over values, the maximum stress can be calculated per turn. It is considered that 10 seconds of test is sufficient with coils at 90 deg. C., stresses usually being short in duration. Curves are given of test pressures and insulation grading.

Many engineers believe that the output per transformer should influence the pressure tests to be used and certain correction factors are proposed with regard to this. The author thinks there should be minimum limits of output of transformers which can be conveniently reinforced as proposed; curves are given regarding this.

As high interturn pressures have been found at neutral points, reinforcement should also be made at such winding ends. Tables are given regarding the proposed proportioning and testing of interturn insulation.

CO-RELATION OF TRANSFORMER INSULATION AND LINE INSULATION. By H. S. Holbrook, transformer engineer of the B.T.-H. Co.—There are many anomalies regarding the ratio between the insulation to earth of transformers and that of the overhead lines to which they are connected. For example, several inquiries were recently received for transformers. One undertaking using lightning arrestors wanted a high test; the other was satisfied with a low test. It used no arrestors, and was proposing to adopt a high line insulation. In another case, where sea salt deposits were to be feared, 33 000 V insulators were adopted for a working pressure of 11 000 V, no protecting devices being adopted.

To get minimum capital expenditure with maximum economy, the insulation in all parts should be balanced; no one part should be too weak or too strong. Repairs are not easy on transmission lines, so operating companies, to give reliable service, use the maximum amount of insulation consistent with economics, especially reinforced in mountainous countries; the insulation of such lines therefore tends to form a basis for the whole, but an excess of insulation may prevent local flash-over relief; all transient voltages below flash-over strength will enter sub-stations and also windings unless protective steps are taken.

Cathode ray and klydonograph methods have enabled figures to be obtained. Switching surges form but a small proportion of those experienced. They are of comparatively low frequency with few stresses exceeding five times the normal. Lightning effects are very local. Two million volts

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have been experienced. The steep waves do not travel very far, but the induced voltage is a function of the height of the line. Earthed overhead wires are an advantage in this respect.

A transient voltage may set up internal oscillations in the complex combination of inductance and capacitance that is

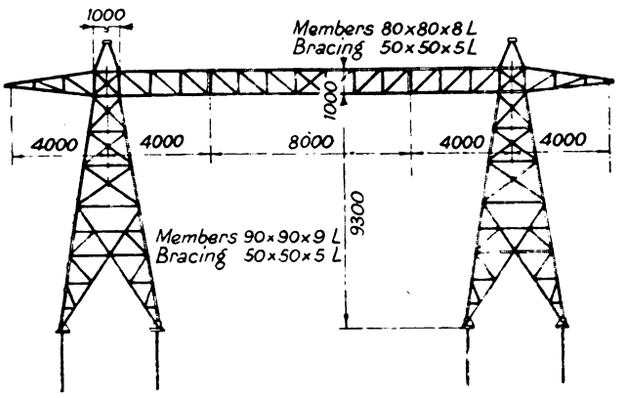

Fig. 1.

formed by a transformer winding; any resonance that might occur is quickly damped. Transformer insulation, paper, oil, and so on, stands up well for a short time. A line beyond the limit of half a mile from a transformer could be strengthened without risk. A 50-cycle basis of testing is found to be satisfactory, as the effect of different impulse wave forms is similar. It has the same effect on a line insulator, wet or dry.

Curves are given between line characteristics recommended to be used within half a mile of a transformer and the insulation of the latter. The breakdown of insulation is a cumulative effect. There is in transformers a lower limit up to which stresses can be applied indefinitely. The function of overvoltage protectors is to keep all stresses within this limit. Lightning arrestors are not designed. To avoid outdoor insulator trouble a spark-gap over transformer insulator bushings has been proposed. This practice may lead to dangerous shorts following flash-overs. A definite discharge gap at a convenient point within 100 ft. of the transformer is to be preferred.

In the discussion on the three papers, M. Marchand was of the opinion that the tests proposed in Mr. Stigant's paper were on the low side; tests with steep fronted waves were difficult to apply, although extra insulation of end turns could be overdone to the extent of weakening the winding mechanically. It was not sound practice to give relatively better insulation to large than to small transformers. A large transformer might mean a lot of capital out of duty, with disturbance of many customers, while if one small transformer broke down, probably all those of a similar type would give trouble.

Two Parallel Section Windings.

Another speaker recommended a winding wound in two sections in parallel, with the outward ends at or near earth potential and the h.t. side in the middle connecting loops being made between a number of points of equal potential through the walls of, and then inside, the core-insulating cylinder. Such an arrangement tended to act as a capacity bushing, thus damping out oscillations and giving good results.

M. Borgquist said that in Sweden lightning arrestors had been abandoned for the last 15 years, graded insulation being used. It was found to be worth while to go a little farther in the way of insulation than proposed by Mr. Stigant. A weak point was arranged on the accessible supports at sub-stations, Petersen coils being put in the transformer circuits. There was a tendency when a surge flowed into a sub-station for it to be reflected back radially over incoming lines. Mr. Holbrook said he recommended the use of sphere gaps at transformer stations as a final protection.

Now that various oils are used in such large quantities for transformer and switchgear filling, and for the insulation of paper cables, their properties are of great importance in the electrical world. In accordance with proposals made at the 1927 Conference, an international commission was set up to co-ordinate research, and a series of eight reports was presented. Messrs. Weiss and Salomon, of the École Supérieure de Pétrole of Strasburg, gave a general report on the researches made by members of the committee in different countries. These researches were divided into two sections; the first covered power factor as a measure of durability, the dielectric qualities and the electrical resistivity of oils; the second, the alteration of oils during service. Messrs. Weiss and Salomon at the Strasburg Petroleum Laboratory carried out tests to determine the alteration of oils. The oil is heated in a copper vessel at 115 deg. C. in the normal atmosphere, and the time taken to produce the first asphaltic deposit is noted, and the quantities deposited after extended times are taken and the results plotted.

Prof. Smouroff, of Russia, dealt with the ageing of oils. Mr. T. N. Riley, of the International Standard Electric Corporation, with the power factor of heated oils, and M. Masson, of the Est-Lumière Co., of Paris, pointed out the relation between resistivity, deterioration and water content, tests being made with an ingenious portable appliance, operating with a direct current from a Wilmshurst machine worked by hand. The effect of water with various fibres in suspension was investigated with the aid of a spark gap. Oils of various qualities, new or taken from transformer tanks, in most cases well shaken, after being subjected to heat at 50 to 60 deg. C. for four or six weeks or tested as received, were investigated. In some tests emulsions were used. Investigations showed the deleterious effect of the prolonged heating sometimes carried out to dry oil; Messrs. Weiss and Salomon thought that centrifuging, and not heating, should be used to separate out water, though the effect of the consequent aeration required study.

Research Results.

Mr. J. E. Cogle gave details of research carried out for the B.E.A.M.A., partly at University College and partly at the laboratories of the Metropolitan-Vickers Co. His investigations covered the effect of fibres from cotton or pressboard, dust, carbon, from arcing, of water alone, and of water with the above-mentioned impurities; also of gaseous matter, mainly air, and of acids and sludge formed in the oil by oxidation. The greatest deterioration takes place when both water and impurities are present.

Prof. Crustein gave a report on researches carried out at the Utrecht University to study dielectric losses, the variation of the dielectric constant with temperature, the electro-optical Kerr effect (the double refraction of a liquid in the electric field), sediments and oxidation.

M. Cassegrain, in a report on the testing of the electrostatic strength of transformer oils, gives details of his studies regarding the effect of the shape of electrodes, vertical or horizontal, points, discs or spheres, etc., the disc plus point arrangement in a horizontal plane giving the most

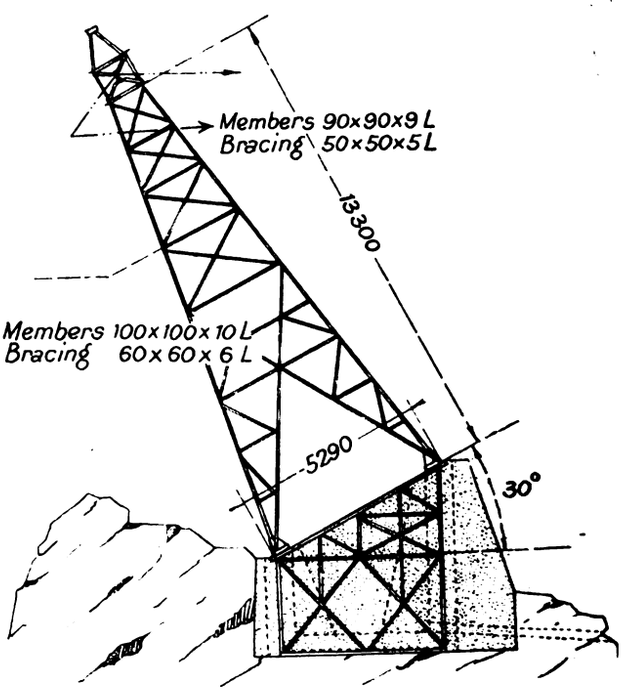

Fig. 2.

constant results. The disc or spherical electrodes give the best indications in the presence of wet fibres.

M. Pellissier communicated the results of researches made on the networks of the Société Alsacienne and of the Lorraine (Power) Company on the alteration of oils in transformers of 5-10 and 75 kVA after one and two years. His

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researches show that the alteration in small transformers is much greater than that in those of largest size, the alteration in transformers intermittently used being greater than in those in continuous operation, whether loaded or not. During the work done at the Sharburn Laboratory it was noted that lead seems to have a deleterious effect on transformer oil, in one case lead was found in suspension in a colloidal state. Copper can affect oil injuriously.

In their consideration of the work of the committee, Messrs. Weiss and Salomon consider that the power factor researches should be continued, also those on resistivity, dielectric, rigidity and alteration of oils. With regard to this last matter, they think investigations are desirable regarding the following: Alterations of oil under load in open-air stations and in transformer tanks not in service, and also on the influence of materials used in transformers on the oil, the alteration of oil in switches, and the effect of frequent centrifuging.

The Discussion.

In the discussion of the group of papers Prof. WEISS said that insulating oils, when new and clean, were almost all good insulators, but they were almost all deteriorated by water, dust, fibres, etc. Their properties could be renewed for a time by filtration, but in time they become oxydised; and in respect of this property oils differ as greatly. The experiments of M. MOISSON showed that power factor tests were more reliable as a measure of quality than breakdown tests. Mr. RILEY said the rate of deposition of sludge was not uniform. The initial test of power factor was not always a good test of the quality of an oil. Changes in power factor took place with alteration of chemical composition. M. KRIEGER said that when dust was dry its effect was small. If the temperature was not above 60 deg. C. the carbon created by arcing could be filtered out.

M. ROTH said that up to 45-60 kV various oils stood up very well to switch rupturing strains, but their behaviour was different according to quality at much higher voltages. It was not convenient for operating companies to have to keep two kinds of oil, one for transformers and the other for switchgear.

M. TRAVERSE said that resistivity tests up to a point gave consistent results regarding quality which are sufficiently good for operators as cos φ tests could not be so well carried out by them.

Overhead Lines in the French Alps.

A group of seven papers on the calculation and construction of lines was discussed on June 10th. The first report concerned two long spans at 60 000 V of the Société des Forces Motrices du Vercours, by M. R. FAVIER. This company owns several water power stations in the Grenoble region of the French Alps, and also acts as an undertaking for the collection of hydraulic power and the forwarding of it in the direction of the Rhone and Saint Etienne.

For the construction of a trunk line (10 000 kW) in this district two very long spans had to be negotiated, one at La Balme and the other at Gour Martel, to enable a plateau 400 to 500 metres high to be negotiated. As normal types of aluminium, steel or bronze cables did not give sufficient strength, it was decided to make a special cable with a high proportion of steel to aluminium, with an elastic limit of 4 tons and ultimate strength of 7·1 tons.

The spans horizontally are 1 274 and 1 152 metres, the real distance between supports 1 330 and 1 200 metres, the difference between heights of supports 435 and 336 metres, and the distance of level between the valley floor and upper supports 435 and 520 metres respectively. A weight of 2·30 kg. of sleet per metre run of cable was allowed for at −10 deg. C. The supports were designed so that no permanent deformation would result from any combination of broken conductors.

There are four conductors, one of which serves as a reserve, being normally grounded. The type of cable used, made by the Société de Matériel Français of Grenoble, was given a practical test with a similar span at Valence when a long crossing was run into by an Italian aviator; the plane was cut in two and the cables broke, but the cable anchorages were not damaged and the supports were not twisted.

Figs. 1 and 2 show two of the supports. Details of the calculations are given in the paper. A light cableway was used during the construction. Since its installation, under operation for six months from the time when the report was prepared, the line stood up to frosts of 26 deg. C. and several tempests. The distance of 8 metres between conductors has not so far given rise to any difficulties.

(*To be continued.*)

BOOK REVIEW.

Electric Circuits. By O. G. C. DAHL. Vol. I. Short Circuit Calculations and Steady-State Theory. (London: McGraw-Hill Publishing Co.) Pp. x+390. 25s. net.

Of all the problems that beset the electrical engineer, those of networks, unbalanced circuits, and transmission lines, form a very large percentage. Many works have been written on specialised subjects, as such, yet attention to the circuit theory in general has been rather neglected. Now, however, that the various "grid" schemes are materialising for this country, there will come into being a whole host of electric circuit problems to which attention has hitherto not been directed.

In a few years there will be throughout the country a network comparable to some of the great American schemes. It will, therefore, be appreciated that considerable complexity can arise in the calculation of the capacities at a point in such a network, or the effects of unbalanced loading, and the power loss and interference due to harmonics, to say nothing of the problem of the long overhead transmission line itself.

For this reason it would seem that "Electric Circuits" has made a very opportune appearance, since it deals with problems of the above kind very fully.

Kennelly's "Equivalence of triangles and three-pointed stars," may be well-known, and also the extension to the polygon given by Mr. Rosen in his "New Network Theorem"; but whether this is so or not, it is treated again by Mr. Dahl in "Electric Circuits," well, and with effect, and some very useful worked examples are given in demonstration of the practical application.

This feature of tables, and worked examples, is developed to quite a large extent, and is by no means the least admirable point in the book.

The first chapter deals with the theory of short circuit currents, transients, and the transient reactance of synchronous machines. There are given some tables of decrement factors, from which can be read the number of times full load current that will result at specified times after the advent of short circuit; and these for different reactances.

To the treatment of the transmission line, Mr. Dahl has allotted two chapters. In the first, which covers the short line—up to 40 miles, allowance has been made for only two of the four parameters—resistance and inductance. These are taken as lumped impedances, either at each end of the line, in the middle, or both.

In the case of the long line, all four parameters are acknowledged, and calculations made accordingly.

These two chapters, together with one on harmonics, another on transmission line charts, and the last on the steady state problems, form a very comprehensive treatment of the transmission line question. Furthermore, it is interesting to note that the formulæ employed are applicable to a.c. and d.c. problems by substituting zero value for the frequency in the latter case.

A chapter is also included on synchronous machine charts, and in this, as well as in that for transmission line charts, the theory and calculation involved in the preparation of them, are fully treated.

This chapter is preceeded by one on general circuit constants, in which is clearly defined the relationship between voltage and current sending, and voltage and current receiving, both for networks generally, and transmission lines in particular. Special reference is made to the work of Evans and Sels, and a modified form of their chart is used to give the performance of lines and transformers. All charts and tables are worked out for a frequency of 60 cycles, which is a little unfortunate for British engineers.

The method of dealing with unbalanced circuits is that based on Fortescue's method of symmetrical co-ordinates, and it is extended by Mr. Dahl to include the unbalanced loading of transformers, and induction motors on unbalanced voltages.

The whole work is evidently to comprise two volumes, of which this, the first, deals with short-circuit currents and the steady state. Such a subject is more easily to be made complex than clear. This author has treated it lucidly, and with a sufficient brevity to include without occluding. The mathematics rise to the occasion yet do not go to the head, and one can only await the appearance of the second volume with interest. In this first volume there appears to be only one insignificant numerical error—on page 9.

W. H. THOMPSON.

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I.E.E. SUMMER MEETING.

150 and 90 kV Transmission Lines—Motor Buses-de-Luxe—The Egeuzon Station—Electric Traction Facilities at the Largest Single Span Station in Europe.

(*Continued from page 755.*)

ON Sunday, June 16th, a cheery party left the Quay D'Orsay station for the south, in a special train provided free of cost by the administrations of the Orleans and Midi Railway Companies. The party was about 115 strong, made up of 100 from the Institution and a group of 15 belonging to the French hosts, the Société Française des Electriciens. Among the former may be mentioned Col. and Mrs. Edgcumbe, Mr. L. B. Atkinson (Past-President) and Mrs. Atkinson, Dr. C. C. Garrard and Mrs. Garrard, Mr. McMahon, Col. Cortez-Leigh, Mr. P. F. Rowell, the energetic secretary of the Institution, Mr. F. W. Crawber, Mr. Borlase Matthews, Mr. and Mrs. Hope Jones, and Mr. D. S. Munro. Among those from the Société Française des Electriciens were M. Bunet, the President, and Madame Bunet, and M. Grosselin.

A Train View.

The 90 kV twin transmission line from the south to Chevilly, outside Paris, keeps comparatively close to the railway after the plateau has been reached; the h.t. line loops in or branches into rotary convertor sub-stations arranged with outdoor transformers and switchgear, the busbars being supported by a lattice steel superstructure. The overhead equipment of the railway for 1 500 V d.c. operation is of a sound and solid character, rolled steel joints being used for the uprights in most cases; a third rail exists for a short distance outside Paris.

Soon after leaving Paris one noted distributing h.t. and l.t. overhead lines on both sides of the track, many of them being supported on concrete posts of very neat appearance, those made of grey Portland cement being perhaps more pleasing than others made of the quicker setting aluminous cements. Until the train was well into the Loire Valley one was rarely out of sight of a distribution line of some kind (usually three-phase 6 to 15 kV). The river Loire was crossed at Orleans, a very fine view being had of the Cathedral from the bridge. The river is very wide, and in the dry season has sandbanks, which, with the aid of electrically-driven grabs and cableways, form sources of supply of concrete for making large numbers of concrete fencing posts, power posts, and structures. The river at Orleans is not usually navigable, although it used to be so in the time of Joan of Arc, the cutting down of many forests in the Loire Valley since the middle ages having tended to aggravate the extremes in the dry and flood seasons. It is of interest, therefore, to note that in both France and Spain hydro-electric power authorities are taking a very friendly interest in re-afforestation as a means towards equalising the seasonal precipitation in water beds and the flow of rivers, thus making the construction and operation of water power installations an easier matter than otherwise. It was noted that many of the telegraph insulators alongside the railway are of green glass with steel cross-arms, and in a number of places alongside the line concrete bases were to be seen, some of them being of the split type. It can be realised that the cost of putting up a new post on a line with, say, 60 to 96 conductors is a more important item than the cost of the post itself; therefore by cutting off the post a little above the ground and putting in a concrete base, a post that has gone wrong below can in many cases have its life increased at a comparatively small cost. At present the trunk line from the south at 150 kV ends at Chainey, outside Orleans, where it is linked up with the twin 90 kV line that starts from Egeuzon and continues to Chevilly, near Paris, where it is linked up with the steam power stations of the outer Paris area. The 150 kV line, as a rule, is run cross-country farther away from the railway than the 90 kV, on account of the latter having to serve the rail-side convertor sub-stations which are placed 15 to 26 km. apart, the actual distance depending on the gradients and traffic density. At Orleans turbine-type synchronous condensers are used for voltage regulation along the 90 000 V distributing line, the condensers being connected up to the system by means of a third winding on the 150/90 kV interconnecting transformers. The rotary converters at sub-stations are operated in series pairs, each machine having 750 V across the terminals. Each pair has a capacity of 2 000 kW continuously, 3 000 kW for two hours and 6 000 kW for five minutes, while the pole pieces and slots are designed to minimise interference with railway circuits by a.c. ripples.

After lunch, the party disembarked at Egeuzon and boarded a number of country motor buses, which must have already made many journeys to market with chickens, ducks, bottles, and so on, the antics of one car during the putting in of the clutch ending in one electrical enthusiast being deposited on the floor! It was a merry party therefore that arrived at the Egeuzon station to admire the large amount of gear on view. The transformer station is divided into two sections, one for 150 kV and the other for 90 kV. The gear is placed out-of-doors, the busbars being supported by lattice steel structures. There is, however, a workshop with tackle, into which a phase transformer or switch can be taken for repairs. The phases are separated in the transformers and switchgear, directional h.f. circuits being used for inter-station communication. The sub-station lies on a hill above the dam, connection to the power station at the foot of the dam being made by underground cables at the generating pressure of 10 000 V. The dam is 61 metres (201 ft.) high and 355 metres long. The water is held up for several miles on the river Creuse, and there are five generators, each 10 000 kW. When the water is low, as it is at present, the reservoir is filled up and the load arranged so that a substantial daily peak can be taken. When there is an abundance of water the station can relieve the Paris end of the line, and further efforts are made so that only under exceptional conditions will water run to waste over the weirs, so that with the aid of observers up-stream the power available can be used to the best advantage. It must be remembered that once a dam and other headworks are installed, an increase in generating plant above that corresponding to the mean annual flow costs but little extra; reservoirs such as the one at Egeuzon are therefore of great value, even if they store water in quantities comparable in hours rather than weeks of water-turbine output, as their daily flow can be accumulated to a material extent to handle peaks; that is to say, to supply power at a time when it is most valuable.

The Backbone of the French "Grid."

There are three circuits to the south from Egeuzon, one at 150 kV and two at 90 kV. The former is switched in at peak loads, as at present there is no object in taking charging current. The power station at Coindre, farther to the south, is now completed and in operation, but as soon as further power stations on the flanks of the central plateau have been finished, there will be a much better transmission line load factor than there is to-day. The line from Paris to the south can be termed the backbone of the French grid system.

The party rejoined the railway at San Sebastian, dined on the train, and reached Bordeaux, via Toulouse, at dinner-time. Bordeaux is the north-western terminus of the Midi Railway, electric locomotives running from there to the Spanish frontier along the Bay of Biscay and inland to Toulouse.

The station of Bordeaux is the longest single-span station in Europe; the steam trains run in from the north and are coupled up to 1 500 V d.c. electric locomotives made by the Constructions Electrique de France at Tarbes. Bordeaux, the largest wine handling port in Europe, on the wide river Gironde, is a large city with some fine streets, and many dating back a century or more. The lighting is mainly by span wires, a number of concrete posts, ornamental and otherwise, being used in connection with both tramways and lighting. In the same way that surplus power from the central plateau flows towards Paris, so surplus from the Pyrenees flows towards Bordeaux, although electro-chemical works in the power generating area absorb a very material proportion of that power not wanted by the Midi Railway. On leaving Bordeaux the line runs for a long distance in the pine forests that cover the district of the Landes. Before the electrification many claims used to be made alleging that the steam locomotives had set light to the forests, and the money thus entailed was one of the reasons why the section was electrified. The Midi Railway is using special locomotives for very high speed traction from Bordeaux to Dax and Biarritz and the Spanish frontier; it is claimed that the express trains on this section are the fastest in Europe. The locomotives, which are of 2 250 H.P. (80 miles per hour), have twin vertical motors above each driving axle, with back-to-back bevel gear and spring connected quill

(*Continued on page 784.*)

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THE I.E.E. SUMMER MEETING.

THESE snapshots taken during the Summer Meeting of the Institution of Electrical Engineers show (1) *Mr. L. B. Atkinson with a friend;* (2) *Madame Grosselin, wife of the French Secretary;* (3) *Group taken outside the Sainte Assise wireless station;* (4) *Mr. and Mrs. L. B. Atkinson in the grounds of Sainte Assise wireless station;* (5) *At the Grand Condé, including Mr. Rowell and two other members;* (6) *Party (including Mr. Crawter) being entertained by M. Messager (in front) at the Research Laboratory, Bellevue;* (7) *Mr. Rowell conversing with some of the Bellevue staff;* (8) *Col. Edgcumbe with some of the hosts at the Research Laboratory, Bellevue;* (9) *Mrs. Rowell at Saint Assise;* (10) *M. Charles Maurichean-Beaupre, Curator of the Château de Versailles (in the garden of the Trianon Palace);* (11) *Col. Edgcumbe and M. Bunet;* (12) *Mr. and Mrs. Rowell, Mr. and Mrs. Marryat and Mr. L. B. Atkinson.*

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driving axles; the comparatively high centre of gravity thus obtained being an important feature with high speed running. The railway company has 140 electric locomotives in operation and a further 100 on order, with 29 auto-cars in operation and 15 on order.

The 150 kV Double Feeder Line.

For a long way to the south of Bordeaux the 150 kV double feeder line runs on each side of the railway, the distribution line for the supply of sub-stations being at 60 kV. There is a further line at 10 kV for the supply of stations, villages and small towns on the line of route.

The Pyrenees run from the shore at Hendaye to the shore at Port Bon on the Mediterannean, water power being available or awaiting development at intervals nearly the whole way. The western group of stations is in operation, namely, the Ossean Valley, Hourat, Miegebat, Artouste, with Soulom and Eget, in parallel valleys. With the exception of two small stations, the railway water power in the eastern area is in project. In connection with a group of stations above Hospitalet, near the frontier of Andorra, it is proposed to use down-the-valley flood-water to pump a smaller quantity of water into a high level lake for use during the dry season.

The party arrived at Pau at 4.30, one section visiting the old château of Henry of Navarre, while a party of engineering enthusiasts visited a railway sub-station equipped with six 400 kW Brown Boveri 6-phase rectifiers with step-down 3-phase transformers taken off a 60 000 V distributing line.

In the evening of the same day a dinner was given at the Hotel de France, at Pau, by the South-West Section of the Société Française des Electriciens, during which M. Grosselin, organiser of that society, was presented with a salver as a memento of the occasion.

On June 18th the party left in charabancs for the Ossean Valley, where the sub-station of Haut-de-Gan, feeding a section of the new Canfrane trans-Pyrenees line was visited. Like most of the stations on the Midi Railway, this station had 785–750 V rotary convertors running in series pairs to give 1 500 V d.c. on the line. Current is furnished by the Aspe-Valley Power Co. at 60 000 V. There are three 3-phase transformers feeding three pairs of convertors. The transformers are of the 3-phase type, with 6-phase l.t. windings 585 V, with 2½ and 5% up and down tappings and an auxiliary winding to give 32 kVA, which is used for station auxiliaries and for starting up the rotary convertors. The rotaries are fitted with centrifugal over-speed trip-out gear, designed for 375 kW nominal loading with 100% overload for two hours and 200% for five minutes. The commutators are fitted with zinc-cum-iron shields to minimise the effect of any flashovers, amortising bars are fitted to the poles. A special patented device, fitted to the rotaries, is an auxiliary transformer, the primary of which is in a d.c. series position with the armature, the secondary is across the commutating pole windings of the machine, and a sudden change, positive or negative, induces across the commutating pole winding a positive or negative temporary flow that aids or reduces the commutating pole flux. Extra-rapid 2 000 A circuit breakers are put on the d.c. side. The complete plant at the station was made by the Société Alsacienne de Constructions Mécanique, now incorporated with the French Thomson-Houston Company, under the name of the "Alsthom."

After visiting the sub-station the journey was continued to Hourat, near Laruns, the lowest of three stations in the valley of the Ossean, Miegebat and Artouste being two further stations up the valley. The turbines at Hourat, with about 700 ft. head, are of the Francis type; at the other two stations the heads are about 1 310 and 2 560 ft., Pelton turbines being installed. The generators are of the "English Electric" pattern made by the Constructions Electriques de France. Each hydraulic unit is of 10 000 H.P., each alternator is of 7 000 kW at Cos φ 0·878, running at 500 r.p.m.; the two lower stations each contain five units, and the upper one three. These three stations form the centre to a group of 16 stations which are worked in co-operation with the Union of Power Producers of the Western Pyrenees. The lowest station has a reservoir of 75 000 cu. metres capacity, the centre 125 000, and the top station is served by a lake with the aid of a pressure breaker, the inlet canals are 5·7, 7·65 and 8·5 kms. long respectively, all in tunnel. The valley wall tunnel system is very largely used in the Pyrenees. During construction a pathway is cut in the rocky valley walls or a series of cableways is constructed, and by means of electrically-driven air compressors and side headings the tunnel can be attacked every few hundred yards or so, the canal tunnel being placed well inside the rock, clear from risk of damage or troubles from snow or avalanches.

One might ask, why have three stations in one valley, one above the other? The answer is that if one were full the water coming down the lower side valleys would be lost, as it would join up below the head race; by having, therefore, three stations, water some way below the highest can be used. The top station has available several weeks' supply, but the lower stations about a day's supply, so that the despatcher for the co-operative system working at Lannemezan, and who is informed of the state of the reservoirs and streams at each of the 16 stations under his directional control, can arrange a sort of balance between the stations with no storage, those with a peak load storage, and those with weeks of storage. The chemical works buy power in various categories, as, for instance, those who want large quantities of power at any time of the year and who are supplied by arrangements in advance, and those who buy certain blocks at maybe a day's or an hour's notice, as convenient to the Co-operative Society. Power supplied on this last system is naturally the cheapest. By mutual co-operation on these lines the amount of water run to waste, even in flood-time, is reduced to a minimum, as those with reservoirs utilise the storage available, and naturally chemical people at such times accumulate stocks of manufactures to be completed, packed, and so on, when the rush time is over. It is owing to this co-operative system that economic use of seasonal water power becomes a possibility.

The local interconnecting lines are primarily at 60 000 V. On the trunk line there is a step-up transformer station, 60/150 kV, at Hourat, and one at Lannemezan, with step-down stations at Toulouse, Dax and Bordeaux.

Lunch was taken at Eau Bonnes, a thermal springs resort in the mountains, the wild pass of Aubusque was crossed, and the party stayed the night at Lourdes. During the season on many occasions the outline of the Basilica Church which stands above the celebrated grotto is lit up with electric lamps, part of the spire being illuminated by floodlighting; another interesting point is that on a hill outside the town there is a large cross of steelwork illuminated with electric lamps, the outline of which is visible at night from miles around.

On Wednesday, June 19th, the party left Lourdes in cars, and on the way to the electro-chemical works of the Tunis Phosphates Company, at Soulom, was photographed on the hill-side. (See page 793.)

At Soulom there is a power station put up by the Midi Railway Company taking water power at two different heads from two branching valleys. The station was originally designed to supply single-phase power to the railway and surplus power to neighbouring chemical works. The Tunis Phosphates Company, whose works are a few hundred yards from the railway power station, draws its current partly from this station and interlinked networks and partly from its own station up the Gavarnie Valley.

At Gavarnie.

After the visit to the chemical works the party proceeded to Gavarnie, a hollow in the mountains, which run to over 10,000 feet in height, with a reeking torrent running down the valley, and a small glacier up against a steep face of rock. After lunch the party returned down the valley and visited the Luz power station of the Gavarnie Valley Power Company. The head race sluices have automatically balanced overflow gear. The power station contains three units, each 11 000 kVA, wound for 10 000 V Cos φ 0·8 at 500 r.p.m. The generators are of the Grammont type, each being driven by a twin wheel 12 000 H.P. Pelton turbine made by Messrs. Neyrer, Beylier and Picard Pictet, of Grenoble. Each turbine wheel is of cast one-piece steel. There are two jets to each wheel, each jet being fitted with a needle valve. Besides the needle there is to each nozzle an annular jet divertor. In the event of a sudden throwing off of a material proportion of the load, in order to prevent a water-shock to the pipe line that works under a 280 metres (930 ft.) head, the divertor, which is actuated by the governor gear, throws part, or nearly the whole, of the jet off the cups of the Pelton wheel (depending on the load thrown off), and the needle valve slowly follows up, the radial divertor moving back the jet on to the cups again as the needle valve takes up the loading. The step-up transformers are of the 3-phase type, 10 000 to 66 000 V; the station being linked in with the West Pyrenees co-operative power undertaking. The complete power plant was designed by M. Bunet, the present President of the Société Française des Electricians, who accompanied the party.

(*To be continued.*)

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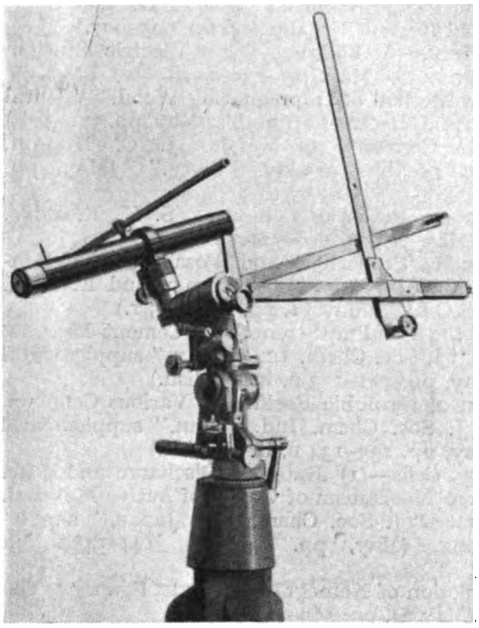
DETERMINING SAG IN OVERHEAD LINES.

An Instrument for Use in Long Span Transmission Line Engineering—Measuring the Separation of Crossing Lines.

THOSE engaged in erecting high-tension transmission lines on the long span system will be familiar with the difficulties encountered in adjusting the lines to a definite amount of sag, and in subsequently controlling the individual spans. Methods involving the use of sighting staves or single measuring staves (Vaupel, " E.T.Z.," 1923, No. 7), or even photography, are slow and troublesome, besides which they allow an undesirable element of error.



Illustrating the Küppers altimeter for use in the erection of overhead transmission lines.

The " Küppers" altimeter (patented in Germany), it is claimed, is easy to use and provides the means of rapidly ascertaining the amount of sag with accuracy. The distinguishing feature of the apparatus is a parallelogram device coupled with a telescope that is free to swing in any direction.

When stringing overhead wire with suspension insulators it is usual to pay out sufficient wire to cover several spans and to carry it over wheels placed at the ultimate suspension points on the cross-supports, so that the wire can balance itself uniformly through the several spans. A block and pulley worked from one end of the length of wire is used to regulate the amount of sag. The Küppers altimeter is erected at a conveniently accessible point, and its does not matter in the least whether the place chosen is in the middle or outside of the field of span. The distance selected should preferably be not less than about the height of the line supports. The plane of the parallelogram must be perpendicular to the plane of the span and the fulfilment of this condition is ensured by the familiar method of bringing down right angles. The sighting needle fitted to the instrument to facilitate rapid direction-finding will then be parallel with the wire.

The measuring apparatus is set truly perpendicular by means of a circular spirit level. The telescope is then used to sight first one of the suspension points, after which it is swung over to the second point; using the fine adjustment screws, the two points are made to coincide on the cross-web. The telescope will then describe a straight line between the two suspension points. In order to facilitate more rapid setting, the telescope is provided, as already stated, with a sighting needle by means of which the approximate connecting line can at once be set with the naked eye. There is a graduated scale which at once shows the angle of inclination between the line connecting the two suspension points and the horizontal. By tilting the telescope, the connecting line is brought down exactly parallel; the operator having next ascertained, by swinging to and fro, that the plane of the line of sight is identical with a plane tangent to the overhead line, only a small further calculation is needed.

The usual procedure is to set the measuring parallelogram so that the distance scale, which is graduated in millimetres, is pointed horizontally to a reference line, whilst the altitude scale, likewise divided in millimetres, is perpendicular to the former, this being achieved by pushing it up to a stop firmly attached to the instrument.

After setting the altitude scale to a proportional distance figure on the horizontal distance scale, the first reading can be taken as soon as the two suspension points appear in the cross-web. The second reading is provided by the tangential point. The difference between these two readings is then corrected by reference to a correction table provided, the adjustment varying according to the angle by which the line connecting the suspension points is inclined out of the horizontal.

Suppose, for instance, the line between the two suspension points has been found to be 12 deg. out of the horizontal, and the difference for sag 6·50 m, the exact amount of sag will be

$$F = \frac{6{\cdot}50}{\cos 12^\circ} = \frac{6{\cdot}50}{0{\cdot}978} = 6{\cdot}65 \text{ m.}$$

It will readily be appreciated that with this instrument any perpendicular heights occurring along the course of the transmission lines can be measured. For that purpose, the distance arm, which when measuring the sag is best set horizontal, is coupled to the telescope and pointed towards the foot of the height to be measured. The altitude scale is brought up against the stop in a manner similar to that previously described and is set to a proportionate distance figure. The summits having been sighted, the actual height can be read off on the altitude scale without any intermediate calculation. The same method can be used to determine the separation of transmission lines when they cross each other.

Supposing that the sag at a distance of C cm. from one point of suspension has been found to be f_c (cm) and that the length of the span, i.e., the distance between the suspension points is A cm., and that the weight of the cable in terms of 1 cm. of length and 1 sq. cm. of bearing section in kg. per cubic cm. is S. then the tensile stress of the cable, according to the well-known formula, will be :

$$p = \frac{S.c\ (a\text{-}c)}{2\ f_c} \text{ kg/cm}^2.$$

According to Vaupel, " E.T.Z.," 1923, No. 7, it is possible, when we know the tensile stress p and the atmospheric temperature t (°C.) to calculate for any cable by using this formula, the maximum tensile stress liable to arise under the most unfavourable conditions due to additional stress caused by wind or ice, p (kg. per sq. cm.) at a temperature of t_o (°C.). This sufficiently demonstrates the importance of subsequently determining the actual stress of the cable in relation to normal values based on the correct stress as prescribed.

This device has been patented by Mr. A. Küppers of Blankenburg-Harz, and is manufactured by Askania-Werke A.-G., of Berlin-Friedenau.

CONFERENCE BY TELEPHONE.

Meeting of the Verband Deutscher Elektrotechniker to be held in July.

THE annual meeting of the Verband Deutscher Elektrotechniker will be held at Aachen from July 7th to 9th, inclusive. A new departure will be the exchange, over the trunk telephone lines, of the speeches at the V.D.E. meeting at Aachen and those of electrotechnical associations which will be held simultaneously at the Hague (Holland), Vienna (Austria) and Budapest (Hungary), the distance between the most distant of these towns being 900 km. At the Aachen meeting, the president of the V.D.E., Dr. Ing.E.R. M. Krone, will make a report on the condition and development of electrical science and industry during the past year. Papers will be read by Dr. Ing.E.R. Frank and Dr. Ing.E.R. Rüdenberg on the " Linking-up of Networks," by Dr. Ing. Piloty on the " Effect of Interconnection upon Operation," and by Dr. Ing. Rogowski on " Kathode Oscillographs and Overhead Transmission," and numerous classified reports on electro-technical subjects will also be submitted.

I.M.E.A. CONVENTION PICTURES.

Many requests have been received from readers for copies of the photographs specially taken for THE ELECTRICIAN during the I.M.E.A. Convention, and published in our special Convention number of June 7th. To simplify the handling of such orders, readers desiring prints should write direct to the photographer, Mr. F. Parkin, 88, Kenwyn Road, Torquay.

Our attention has been drawn to the fact that in a picture on page 676 of the Convention Number Mr. J. Wetherell, borough electrical engineer of Leytonstone, was inadvertently referred to as Mr. H. H. Denton.

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N.E. ENGLAND ELECTRICITY SCHEME.

Scheme for the North-East Coast—Large Rural and Industrial Areas Covered—No New Stations Anticipated—Names of Selected Stations—Route of Transmission Lines.

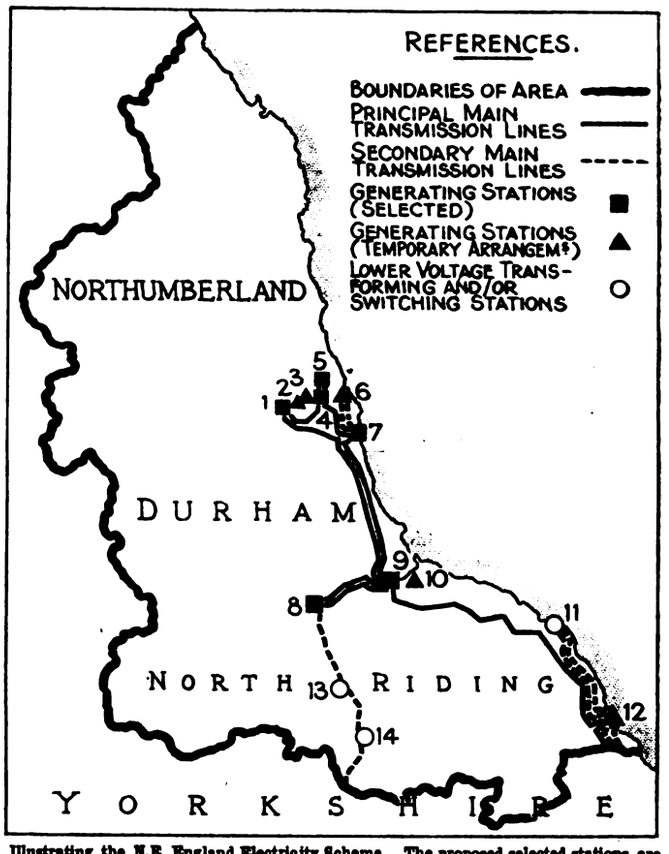
THE sixth of the schemes, submitted by the Electricity Commissioners to the Central Electricity Board in pursuance of section four of the Electricity (Supply) Act, 1926, covers the north east area and is called the North East England Electricity Scheme. The scheme is now being considered by the Central Board, which has, it will be remembered, already adopted five of the previous submissions of the Electricity Commissioners.

The area covered by the N.E. England Scheme deals with about 5 050 square miles, consisting of the administrative county of Durham; the county boroughs of Darlington, Gateshead, South Shields, Sunderland and West Hartlepool; the administrative county of Northumberland; the city and county borough of Newcastle-upon-Tyne; the county borough of Tynemouth; so much of the administrative county of the East Riding of Yorkshire as comprises:—the urban districts of Filey and Norton; the rural district of Norton; so much of the administrative county of the North Riding of Yorkshire as comprises:—the municipal boroughs of Redcar, Richmond, Scarborough and Thornaby-on-Tees; the urban districts of Eston, Guisborough, Hinderwell, Kirklington cum Upsland, Loftus, Malton, Northallerton, Pickering, Saltburn-by-the-Sea, Scalby, Skelton and Brotton and Whitby; the rural districts of Aysgarth, Bedale, Croft, Guisborough, Helmsley, Kirkby Moorside, Middlesbrough, Northallerton, Pickering, Reeth, Richmond, Scarborough, Startforth, Stokesley and Whitby; the parishes of Brandsby cum Stearsby, Crayke, Dalby with Skewsby and Thormanby and the townships of Angram Grange, Brafferton, Carlton Husthwaite, Coxwold, Helperby, Husthwaite, Newburgh, Oulston, Raskelf, Thornton on the Hill, Wildon Grange and Yearsley in the rural district of Easingwold, and so much of the township of Easingwold as lies to the north of the road from Huby to Tollerton; the rural district of Leyburn except the parish of Colsterdale; the townships of Amotherby, Appleton-le-Street, Aryholme and Howthorp, Barton-le-Street, Brawby, Broughton, Butterwick, Coneysthorpe, Fryton, Great Habton, Hildenly, Hovingham, Little Habton, Ryton, Scackleton, Slingsby, Southholme, Swinton and Wath in the rural district of Malton; the rural district of Thirsk except so much of the townships of Ellenthorpe, Kirby Hill, Langthorpe and Milby as lies within the circumference of a circle drawn with the south entrance door of St. James' Church in the township of Boroughbridge as centre and a radius of one and a half miles; the townships of Asenby, Baldersby, Cundall-with-Leckby, Dishforth and Rainton-with-Newby in the rural district of Wath; and the county borough of Middlesbrough.

The proposed selected stations for inclusion in the scheme are Carville A, Carville B, Dunston and North Tees (Newcastle-upon-Tyne Electric Supply Co., Ltd.); Darlington (Darlington Corporation); and Sunderland (Sunderland Corporation), making six altogether.

The suggested extensions and alterations of selected stations, are: (i) Carville A: an addition of 25 000 kW of three-phase 50-cycle generating plant and equivalent boiler plant for operation by the winter of 1932-33; a further addition of 25 000 kW and boiler plant for operation by 1934-35; and another addition of 25 000 kW of three-phase 50-cycle generating plant and equivalent boiler plant for operation by 1935-36; (ii) Carville B: an addition of 25 000 kW and boiler plant for operation by 1938-39; 25 000 kW of three-phase 50-cycle generating plant and equivalent boiler plant for operation by 1939-40; and a further addition of 25 000 kW and boiler plant for operation by 1940-41; (iii) Darlington: an addition of 25 000 kW of three-phase 50-cycle generating plant and equivalent boiler plant for operation by the winter of 1937-38; (iv) Dunston: an addition of 35 000 kW of three-phase 50-cycle generating plant and equivalent boiler plant for operation by the winter of 1936-37; further additions of 35 000 kW for operation by 1937-38; 50 000 kW for operation by 1938-39; 50 000 kW for operation by 1941-42; and 50 000 kW for operation by the winter of 1942-43; (v) North Tees: an addition of 25 000 kW of three-phase 50-cycle generating plant and equivalent boiler plant for operation by the winter of 1940-41; and a further 25 000 kW of generating and equivalent boiler plant for operation by 1942-43.

The principal main transmission lines for interconnection of selected stations with one another and with the systems of authorised undertakers or of the Board, are: (1) Extra high pressure overhead lines and/or underground mains; three-phase overhead lines designed for operation at 132 000 V between phases, and capable in each case of transmitting not less than 50 000 kW or (where such lines cannot reasonably be constructed) overhead lines or underground mains designed for operation at such voltages between phases as may subsequently be approved by the Electricity Commissioners, by the most convenient route in each case, from:—(1) Scarborough to Hull as far as the boundary of the area of the scheme; (2) Scarborough to North Tees; (3) North Tees to Carville A and B via or with connection to Sunderland; (4) North Tees to Carville A and B via or with connection to Dunston; and (5) North Tees to Darlington.



Illustrating the N.E. England Electricity Scheme. The proposed selected stations are (1) Carville A; (4) Carville B; (5) Dunston; (8) Darlington; and (9) North Tees. The temporary arrangement stations are (2) Close; (3) Manors; (6) South Shields; (10) Grangetown; and (12) Scarborough. The l.t. transforming and/or switching stations are (11) Whitby; (13) Northallerton; and (14) Thirsk. The principal main transmission lines, together with their secondary lines, are also indicated.

In connection with these main transmission lines, transforming stations are to be provided at such points as to the Board may seem convenient for the purposes of supply to or from the following places, each such station to comprise transformers having in aggregate a rating in kilo-volt amperes of not less than that specified unless otherwise determined:—Carville (60 000); Darlington (30 000); Dunston (60 000); North Tees (90 000); Scarborough (20 000); and Sunderland (35 000).

For interconnection between the system of the Board and the systems of authorised undertakers entitled to receive a supply or indirectly from the Board. Three-phase overhead transmission lines designed for operation at 33 000 V or other approved voltage between phases, or underground mains designed for operation at such voltages between phases as may be approved later by the Commissioners, are to be erected by the most convenient route in each case, from:—(1) Scarborough to Bridlington as far as the boundary of the area of the scheme; (2) Scarborough to Whitby; (3) Darlington to Boroughbridge via or with connection to Northallerton and Thirsk as far as the boundary of the area of the scheme; (4) Sunderland to South Shields; and (5) Dunston to Manors via or with connection to Close.

Transforming stations in connection with these secondary

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main transmission lines, will be provided at points convenient for the purposes of supply to or from Close (30 000); Darlington (1 000); Manors (15 000); Northallerton (600); Scarborough (6 000); South Shields (8 000); Thirsk (1 000); and Whitby (2 000); the figures in each case representing kVA.

The existing frequency of 40 cycles per second employed in a number of undertakings and selected stations are to be amended or altered to a frequency of 50 cycles per second, the undertakers and stations affected being:—Amble U.D.C.; Annfield Plain U.D.C.; Auckland R.D.C.; Cleveland and Durham County Electric Power Co.; County of Durham Electric Power Supply Co.; County of Durham Electrical Power Distribution Co., Ltd.; Crook U.D.C.; Eston U.D.C.; Guisborough U.D.C.; Hexham and District Electric Supply Co., Ltd.; Houghton-le-Spring and District Electric Lighting Co., Ltd.; Middlesbrough Corporation; Newcastle and District Electric Lighting Co., Ltd.; Newcastle-upon-Tyne Corporation; Newcastle-upon-Tyne Electric Supply Co., Ltd.; Northern Counties Electricity Supply Co., Ltd.; Redcar Corporation; Richmond Corporation; Seaham Harbour U.D.C.; Skelton and Brotton U.D.C.; Stanley U.D.C.; Stockton-on-Tees Corporation; Tanfield U.D.C.; Tynemouth Corporation; and West Hartlepool Corporation.

The temporary arrangements for the scheme, include Carville A, Carville B, Dunston, and North Tees stations of the Newcastle-upon-Tyne Electric Supply Co., Ltd.; the Close station of the Newcastle and District Electric Lighting Co., Ltd.; Darlington (Darlington Corporation); Grangetown (Cleveland and Durham County Electric Power Co.); Manors (Newcastle-upon-Tyne Corporation); Scarborough (Scarborough Corporation); South Shields (South Shields Corporation); and Sunderland (Sunderland Corporation).

The accompanying map indicates the routes to be taken by the transmission lines and the position of the selected and temporary generating stations, and transformer stations.

The cost of the scheme to the Board for the erection of the transmission system is estimated at £1 131 467. In addition, there will be an expenditure by undertakers of about £775 000 on extensions of certain existing stations. It is estimated that the full advantages of the scheme can be secured with a saving of about £2 040 958 on capital expenditure (up to the year 1935/36).

The Commissioners have outlined a provisional plan of working the stations with the necessary estimates. These suggestions are, of course, tentative, since the working of the scheme, including the fixing of tariffs, is the responsibility of the Board, but taking the figures as they stand, it is interesting to note that the Commissioners estimate that in the five years 1931/36 there will be a saving to the undertakers in the area of about £382 173.

"LIGHT'S GOLDEN JUBILEE."

I.E.E. Correspondence in Connection with the American Celebration.

WE reproduce below the text of two letters, copies of which have been sent to us by the Secretary of the Institution of Electrical Engineers, in connection with the celebration of "Light's Golden Jubilee."

May 30th, 1929.

The Secretary,
U.S. National Illumination Committee,
DEAR SIR,

The representatives of this Institution on the British National Committee of the International Illumination Commission have drawn the attention of the Council of the Institution to the proposed celebration of the jubilee of the electric light, which is noted with great interest and satisfaction.

Your Committee will probably have observed that this Institution, on December 20th last, celebrated the jubilee of the making and public exhibition of the first carbon incandescent lamp by the late Sir Joseph Swan, whose name was subsequently associated with that of Mr. Edison in the Edison and Swan Electric Light Co., of Ponders End, near London.

The celebration on this side took the form of a lecture on the work of Swan, delivered by Mr. James Swinburne, F.R.S., one of our Past Presidents, at the Institution on December 20th last. The lecture was illustrated by a comprehensive exhibition of Swan's early lamps, including the original specimen which had been publicly exhibited at a lecture given by Swan at Newcastle-on-Tyne on December 18th, 1878. This lamp—a successful design of incandescent carbon vacuum lamp—is now preserved in the National Science Museum at South Kensington, London.

Actually it will be seen that the production of this lamp slightly ante-dated the independent invention of the incandescent carbon lamp by Mr. Edison and the fact that Swan's was the first practical incandescent lamp is one of which we in England have always been rather proud.

It would be a source of gratification to this Institution if your Committee would recognise the pioneer work of Sir Joseph Swan by associating his name in some way with the celebrations. You will observe that in Mr. Swinburne's address a tribute was paid to the pioneer work of Mr. Edison.

It gives us great satisfaction to associate ourselves with you in honouring the great name of Edison, whom we are proud to count among the Honorary Members of our Institution. As there is good reason to hope that your general invitation will result in celebrations of a world-wide character, a copy of this letter has been sent to the appropriate organisations in other countries, coupled with an expression of our good wishes for the success of any steps they may be able to take towards making the proposed celebrations effective and fruitful.

I am, dear Sir,
Yours faithfully,
(Sgd.) P. F. ROWELL.
Secretary.

The Secretary,
National Illumination Committee of.....

May 30th, 1929.

DEAR SIR,

The proposals for the world wide celebration of "Light's Golden Jubilee" have aroused much interest here and I am desired by my Council to enclose for your information a copy of a letter which has been addressed by this Institution to the Secretary of the National Illumination Committee of the United States as organisers of the celebrations.

As you are aware the International Illumination Commission will hold its triennial session in England in 1931, and this will be coupled with an important Illumination Congress.

All the illumination interests in this country are so much occupied with preparations for the congress that this Institution, which is strongly supporting the congress, feels that it would prejudice the success of these preparations if any extensive part were taken in further celebrations before that date. So far as this country is concerned it is felt that the cause of good lighting can best be served by concentrating our attention upon the forthcoming congress.

The Institution of Electrical Engineers has, however, every sympathy with the efforts that will be made this year to attract widespread public attention to the subject, and we heartily wish you success in any action which you may take towards making the forthcoming jubilee celebrations effective and fruitful.—I am, etc. P. F. ROWELL.

CORRESPONDENCE.

The Editor welcomes the free expression in these columns of genuine opinion on matters of public interest, although he disclaims responsibility alike for the opinions themselves and the manner of their expression.

"Light's Golden Jubilee."

[TO THE EDITOR.]

SIR,—If Mr. Frank C. Wells is sincere in his letter published in the issue of your journal of June 14th, then we must thank him for an enlightening revelation of the working of the American mind.

His statement that "Swan's lamp is an interesting historical fact, Edison's an ever-present reality," is effectively and completely disposed of by letters from, among others, Messrs. K. R. Swan and A. A. Campbell Swinton. It will be sufficient to remark here that if indeed Edison's lamp is an ever-present reality in America, it is quite time that some kindly-disposed person introduced our cousins to the gasfilled metal filament lamp.

Mr. Wells's chief point appears to be that a great public, which presumes to represent world opinion, clamours for a hero around whom they may cut their capers. The Chinese laundryman is familiar with the name of Edison, but is unaware that priority of invention of the incandescent electric lamp cannot be claimed by him or for him, so let Edison be the hero. This proves nothing except that the organisers of the "jubilee" are merely pandering to public opinion instead of educating it.—I am, etc. E. C. CHILDS.

Ilford, Essex. June 21st.

[A number of letters are unavoidably held over—ED.]

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NEWS IN BRIEF.

Blackpool and Domestic Equipment—King's College Centenary—Tramways Conference—An Edison Stamp—Western Centre I.E.E.—Electrical Contractors at Coventry.

CLACTON U.D.C. requires an assistant electrical engineer at a commencing salary of £260 per annum.

A number of German municipal trade union officials are to visit the Stuart Street station of Manchester Corporation this week.

Lincoln City Council has decided that electricity for all purposes shall be installed in 12 houses being built in Geneva Avenue.

Fountains Hall, an old mansion near Ripon, is now lighted electrically, the energy being supplied by a generator driven by a water turbine in the old mill on the river Skell.

The new Burnley electricity showrooms in St. James' Street, have been opened.

An assistant engineer is required in Basingstoke Corporation's electricity department.

Electric lighting is to be adopted in St. Mary's Church, Hounslow, at an estimated cost of £150.

Among sanctions received by Blackpool Corporation is £8 000 for hiring-out apparatus in connection with the electricity undertaking.

The City Electrical Engineer of Liverpool has been authorised to invite tenders from selected firms for overhauling and repairing the Worthington cooling towers at the Lister Drive power station.

Members of the Cheltenham, Mid-Gloucestershire, Bristol and South Wales and Monmouthshire sections of the Electrical Association for Women visited Cardiff on Wednesday. The members inspected the General Electric Co.'s new showrooms, where Mr. W. F. Arnold delivered an illustrated lecture on "The Development of Artistic Electric Lighting Fittings." Luncheon and tea at the City Hall were also items in the day's entertainment. See page 800.

West Ham Corporation invites applications for the position of engineer and manager of its electricity undertaking.

A large number of members of the North Wales branch of the Electrical Association for Women on June 19th visited the generating station of the North Wales Power Co. at Dolgarrog.

The United States Government has issued a two-cent postage stamp inscribed "United States Postage, Edison's First Lamp, Electric Light's Golden Jubilee," to commemorate the golden jubilee of "Edison's invention of the incandescent lamp."

LOOKING BACKWARD.

FIFTY years ago it was recorded in THE ELECTRICIAN *of June 28th, 1879, that:*

Havre was experimenting with gas and electricity for harbour lighting.

The "Brooks" underground telegraph cable differed from all others in that the insulation for the line was paraffin oil, run into the iron pipe which contained the cable.

* * *

Twenty-five years ago, according to THE ELECTRICIAN *of July 1st, 1904:*

The preamble of the Electric Lighting (London) Bill was proved by a Select Committee of the House of Commons.

The City of Birmingham Tramways Co. trained their employees on their cars to deal expeditiously with breakages of electric wires, prizes being offered every three months.

* * *

Ten years ago THE ELECTRICIAN *of June 27th, 1919, announced that:*

For the first time since the outbreak of war the I.M.E.A. assumed, at its annual convention, some of the old aspects which made it a social as well as an engineering function.

The Cabinet had approved the recommendation of the Electricity Commissioners that an electrical engineer-in-chief to the Government be appointed.

Bradford Education Committee invites applications for the appointment of assistant lecturer in electrical engineering in the Technical College.

Viscountess Astor, M.P., has consented to serve as president of a branch of the Electrical Association of Women which is being organised at Plymouth.

A lady canvasser-demonstrator, with experience of cookers and other electrical apparatus, is required in the Preston electricity department.

Coventry Watch Committee recommends acceptance of a tender amounting to £570 for six additional sets of automatic traffic control signals of British manufacture.

Among workshops and factories at which arrangements have been made to receive scholars in connection with Accrington Rotary Club's Young Citizens' Week, is the Corporation's electric power station.

Bradford electricity department has received applications from a number of residents in the area of Clayton U.D.C. for electric cookers on hire. In view of the possibility of the early incorporation of Clayton in the city, the committee is willing to hire electric cookers to the U.D.C.

In connection with the Bournemouth Conference of the Electrical Contractors' Association, Messrs. W. T. Henley's Telegraph Works Co., Ltd., has issued an interesting booklet containing complete particulars of the arrangements for the Conference and also details of the electric lighting and power installations in the new Pavilion and on the giant Cunard liner "Aquitania."

The Duke and Duchess of York, the Duke of Connaught, the Archbishop of Canterbury and numerous delegates from other universities were present at the opening of the centenary celebrations of King's College, London, on Monday. The visitors inspected antique and modern electrical and other scientific instruments and witnessed various scientific demonstrations. The Duke of York claimed a sort of family association with the College's contributions to scientific discovery, as he believed the physics laboratory of the College was established through the gift of a collection of scientific instruments by Queen Victoria.

The annual conference of the Tramways and Light Railways Association will take place in Sheffield from July 3rd to 6th. There will be an informal reception on July 3rd and the delegates will be welcomed by the Chairman of the Sheffield and District Manufacturers' Reception Committee (Mr. P. B Brown). On July 4th the Lord Mayor of Sheffield will officially welcome the delegates, who will be entertained to dinner at the Royal Victoria Hotel by the Sheffield and District Manufacturers' Association. The proceedings will include a trip into Derbyshire, and a reception by the Lord Mayor and Lady Mayoress.

A trial of lighting effects on the façade of the new Underground Railway headquarters at St. James's Park, London, was made last week. Floodlights from the roof of the main building in the north block were turned on to the face of the central tower.

At the annual general meeting of the Western Centre of the Institution of Electrical Engineers, Mr. S. B. Haslam was elected chairman, Mr. W. A. Scott second vice-chairman, and Messrs. J. M. Bowman, R. Illingworth, T. E. Lewis, S. Thomas and A. M. Willis were added to the committee. Mr. C. T. Allan, 27, Newport Road, Cardiff, is hon. secretary.

About 150 members of the Western Section of the E.C.A. paid a visit to the works of the General Electric Co., Ltd., at Coventry on June 12th. The visitors were received by Sir William Noble, a director, and chairman of the Coventry Chamber of Commerce, and were entertained to luncheon in the pavilion on the works sports ground. They were subsequently conducted round the factory and shown the processes in the production of modern telephone and radio equipment.

At the meeting of the Physical Society at the Imperial College of Science, London, to-day (Friday), a demonstration of some contact devices used in an apparatus for the measurement of electrical resistance at high temperatures will be given by Dr. J. L. Haughton, and papers will be read on "The Relation Between Hydrogen Pressure and Filament Resistance in a Tube Containing Glowing Tungsten," by Dr. Teresa J. Dillon, and "The Absolute Measurement of Sound Intensity," by Mr. F. D. Smith. The Society has arranged a visit to Birmingham on July 6th.

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BUSINESS ITEMS.

IT is understood that the equipment of each of the locomotives for the Great Indian Peninsular Railway, the contract for which the METROPOLITAN-VICKERS ELECTRICAL Co. recently received, includes an " Exide-Ironclad " battery of 24 cells, type LMV3, manufactured by the CHLORIDE ELECTRICAL STORAGE CO., LTD., at Clifton Junction, near Manchester.

THE General Electric Co., Ltd., has put into service a motor van equipped with a number of electric cookers and cooking appliances. This van will make a tour of the country; and appeared for the first time at Torquay during the I.M.E.A. Convention.

The four winning Bentley cars in Le Mans Race, 1929, were wired throughout with " Rubite " cables for ignition, lighting and starting. The insulation of these cables is similar in every respect to the " Rubite " cables made by the METROPOLITAN ELECTRIC CABLE AND CONSTRUCTION CO., LTD., Grove Road, Chadwell Heath, as used in collieries, railways, dye houses, bleach houses, etc., where uninterrupted service is essential.

The West Midlands Joint Electricity Authority has just placed an order with the BRITISH THOMSON-HOUSTON CO., LTD., Rugby, for the complete electrical generating plant required for the first section of the new base load power station being erected at Ironbridge on the river Severn. Included in the contract are a 50 000 kW (67 000 H.P.) turbo-alternator, three 21 000 kVA outdoor type transformers, 33 000 V switchgear, and the necessary auxiliary equipments. The turbo-alternator consists of a 50 000 kW maximum continuous rated two-cylinder double-flow steam turbine with direct coupled three-phase 11 000 V 80% power factor 50-cycle alternator provided with closed system air cooler. The turbine is designed for a steam pressure at the stop valve of 375 lb. per sq. in. gauge, 750 deg. F. total temperature; the condensing plant will be manufactured by HICK HARGREAVES AND CO., LTD., Bolton. Connected solid with the alternator are three single-phase oil-immersed self-cooled outdoor type transformers of B.T.H. manufacture arranged in delta on the primary side and in star on the secondary side, giving 33 000 V between phases. These transformers are claimed to be the largest self-cooled units ordered in this country for power station service. Cooling water for condensing plant will be taken from the Severn, a separate pump house being erected on the river bank for this purpose. DRYSDALE AND CO. will act as sub-contractors for this part of the contract. The main power station switchgear is of the remote electrically operated, duplicate busbar, oil-insulated, vertical plugging, metal-clad type, suitable for 33 000V and fitted with oil circuit breakers having a rupturing capacity of 1 500 000 kVA. The 62 500 kVA generator equipment and the two 75 000 kVA grid transformer equipments are provided with duplicate circuit breakers, and the two group feed equipments have single breakers. In addition, there are two sets of group feeder reactors. Auxiliary 33 000 V switchgear for two distribution feeders, two standby feeders and two works supply feeders, together with a bus coupler and two group feeder isolating equipments, are also included in this order. It is of the duplicate busbar, compound-filled, horizontal plugging, metal-clad type arranged for remote electrical operation. The oil circuit breakers have a rupturing capacity of 500 000 kVA at 33 000 V.

PERSONAL.

MR. S. E. Garcke has been elected a vice-President of the Institute of Transport.

Mr. H. F. Castle has been appointed electrical engineer and manager to Bridport Town Council.

Mr. J. L. Gunn, the new manager of the Aberdeen Corporation tramways, took up his duties on June 17th.

Mr. R. Lessing announces that he has changed his address to 94A, Horseferry Road, Westminster, London, S.W.1.

From a list of 65 applicants, Mr. E. T. Price, of Cardigan, has been appointed electrical engineer to the Newcastle Emlyn and District Electric Supply Co., Ltd.

We offer our congratulations to the Earl of Bective, chairman and joint managing director of the Bective Electrical Co., Ltd., on the birth of a daughter on June 20th.

Sir Andrew Duncan and Mr. Archibald Page, who have been making an extensive tour of the American and Canadian electricity undertakings, returned to England last week.

Amongst those presented to President Doumergue of the French Republic during the E.H.T. Conference in Paris, were Mr. J. R. Beard, Mr. P. V. Hunter and Mr. R. Borlase Matthews.

St. Helens Electricity Committee has appointed Mr. W. S. Johnston, manager of the Dumfries electricity works, as borough electrical engineer and manager, at a commencing salary of £800, rising in four years to £1 000.

In our notes on the result of the General Election, in our issue of June 7th, we stated that Sir Frederick Hall's majority at the 1924 election was 15 611. This was the number of votes polled by Sir Frederick Hall in 1924, his majority being 8 435.

On the occasion of his leaving Odhams Press, Ltd., to join Edison Storage Batteries, Ltd., as assistant manager, Mr. W. E. Warrilow was presented with a handsome cut glass vase and a silver salver bearing the signature of his colleagues in the advertisement department.

We are informed that Mr. F. E. Stevens has retired from the Stanley Engineering Co. owing to continued ill-health. The partnership which hitherto existed between Mr. H. Jay-Coward and Mr. Stevens has been dissolved. Mr. Jay-Coward will continue the business under the same name and style.

Major Basil Binyon has been appointed a director of the Marconi International Marine Communication Co., Ltd., and the following rearrangement of duties of its higher officials will be effective from July 1st: Mr. J. Lewis, personal assistant to Mr. F. S. Hayburn, deputy managing director; Messrs. A. R. Harding and R. Ferguson, joint general managers; Mr. J. A. Carswell, general manager for the North; Commander J. A. Slee, manager, marine electrical equipments; Mr. Wm. Platt, manager B.W.M.S. (vice Mr. R. Ferguson); Mr. J. Connell, deputy manager B.W.M.S.; Mr. B. Newton, contract manager (vice Mr. A. R. Harding).

Mr. J. Williams, technical assistant to the city electrical engineer, Salford, has been appointed technical assistant to the engineer, South-East England, Central Electricity Board. Mr. Williams was for many years on the staff of the Yorkshire Electric Power Co., where he held successively the positions of assistant engineer in the operation department and superintendent of the testing department. He was at one time with the English Electric Co. at Stafford and was formerly a college apprentice at Metropolitan-Vickers' works in Trafford Park. On the occasion of his departure from Salford, Mr. Romero, the city electrical engineer, on behalf of the staff, presented Mr. Williams with a sectional bookcase. A presentation of a " Kodak " camera was also made by Mr. Bunting on behalf of the members of Mr. Williams's department.

Obituary.

MR. HENRY JOHN SUTHERLAND MACKAY, on June 19th, aged 57 years. He was vice-President of the Batti-Wallahs' Society, and was managing director of the Stirling Boiler Co., Ltd. Mr. Mackay was born in Peebles, and attended the Hillhead High School; he was a graduate of Glasgow University, and continued his education at the Glasgow and West of Scotland Technical School. In 1889 he was apprenticed to Alec. Chaplin and Co., of Govan, subsequently gaining drawing office and engine shop experience with D. and W. Henderson. From 1894 to 1898 he served as marine engineer with MacClay and McIntyre, of Glasgow, the last two of those years as chief engineer. He was a member of the Institution of Mechanical Engineers, of the Institution of Marine Engineers, and was an associate member of the Institute of Naval Architects.

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COUNTRY HOUSE LIGHTING.

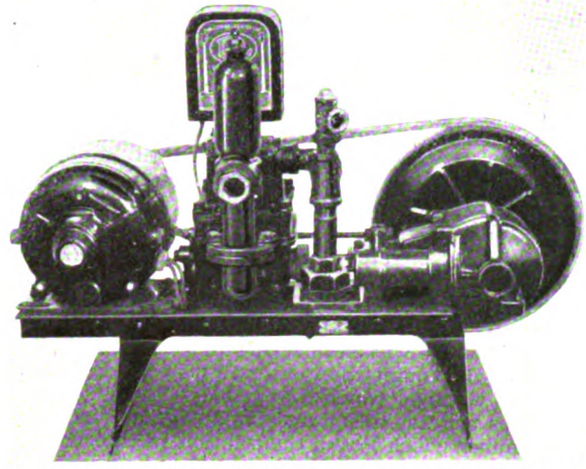
MESSRS. BLACKSTONE AND CO., LTD., of Stamford, and Aldwych House, Aldwych, London, W.C.2, manufacture home lighting and power plants in various sizes. The sets embody the Blackstone petrol engine direct coupled to the dynamo, mounted on a cast-iron base common to both. In all models, cooling is by thermo-syphon in conjunction with radiator and fan. The carburettor is fitted with a patented device, actuated by the governor, which regulates both quality and quantity of the mixture according to the load. The approximate petrol consumption varies between 1·44 pints per kWh for the 1 kW set and 1·1 pints per kWh for the 3½ kW set. We give below particulars of some representative Blackstone plants.

The 1 kW set is supplied to give either 50 or 100 V. The engine is rated at 2·5 B.H.P., and has a petrol tank with 1·25 gallons capacity, giving about 7 hours running. The lubricating oil consumption is 1 pint per 37 hours running. The 1½ kW plant is very similar in general characteristics. It is designed for 100 V only, and can produce 2 kW with full load on engine. The 2½ and 3½ kW sets have engines rated at 5 and 7 B.H.P., respectively, and will run for approximately 6 and 4·69 hours with one filling of the petrol tank. These Blackstone plants are not of the fully automatic type.

Storage batteries for use with Blackstone lighting plants are supplied for 25/37, 50/73 and 100/146 V. End-cell regulation is recommended. Iron-clad type switchboards fixed on the dynamos are sold as standard for the 1 kW and 1½ kW sets, while enamelled slate panel switchboards mounted on brackets for wall fixing are supplied with the larger engines. Simplicity is the keynote in the design of the switchboards, which contain a minimum amount of apparatus for controlling the dynamo and storage battery. When the engine is running at the correct speed, the starting switch is carried farther over and closes the charging circuit by bringing the cut-in into operation. Should the engine stop through any cause, the cut-in opens and prevents the battery discharging back through the dynamo.

When larger and more economical plants are required, Blackstone "Spring Injection" oil engine-driven generator sets are suggested. The inclusive cost of producing current with these plants is from ½d. to 1d. per kWh.

The Delco-Light Department of FRIGIDAIRE, LTD., Chapter Street, London, S.W.1, is ready to supply five different types of automatic water systems suitable for large or small country houses, farms and other purposes. Model 200 has a capacity of 166 gallons per hour, with a maximum suction lift of 22 ft. The motor is ⅙ H.P. Model 400 is of the same type, but has a capacity of 333 gallons per hour. The pump is of the double-action twin-cylinder type, driven by a ¼ H.P. motor by means of a "V" belt. This model is equipped with an automatic switch which allows any size or type of pressure tank to be installed in connection with it. Model 425 has the same characteristics as model 400, but includes a pressure tank of 20 gallons capacity. Model 202 differs from model 200 in that it is equipped with a pressure chamber of 1·66 gallons. The tanks permit automatic regulation and provide for



An example of the "Delco-Light" automatic pumps for country houses.

"direct pressure." Model 225 is similar to models 200 and 202, but has a pressure tank of 20 gallons capacity. This unit will supply water under pressure at two or more outlets at the same time. It is claimed to be "ideal" for home use.

The new service of trackless trolley vehicles between Maltby, Rotherham and Conisborough was commenced recently.

London County Council Highways Committee is to extend and reconstruct the tramway sub-stations at Limehouse, Tooting and New Cross, at a cost of £65 500. In each case three 1 000 kW rotary convertors are to be installed.—The committee is to obtain tenders for the supply of 150 modern type tramcars.

After inspecting the trackless trolley 'bus systems in Doncaster and Rotherham, Hull Tramway Committee has decided on a similar system for operation on existing petrol 'bus routes, and has asked the Manager to furnish a detailed estimate of cost per mile of construction and operation.

The construction of an oil-electric engine for hauling trains between Shildon and Middlesbrough, on the L. and N.E. Railway, has been commenced. A similar oil-electric locomotive is in experimental operation on the L.M. and S. system between Lytham and Blackpool.

THE first annual outing of the E.D.A. Circle, formed under the auspices of the Shropshire, Worcestershire, and Staffordshire Electric Power Co., was held recently, and approximately a hundred members—manufacturers and contractors and representatives of the company—spent a very pleasant day, the start being made from the central offices of the company. The journey was made in Midland "Red" motor coaches via Worcester, Evesham, Broadway, to Shipton-under-Wychwood, where a halt was made for lunch at the old Crown Inn. Following lunch and the customary toasts, the party left for an inspection of the high-power radio station at Leafield, where they were very cordially received by the engineer-in-charge, Mr. C. McDonald, and his assistants. After tea at the Cadina Café the party was conducted by Mr. G. A. King, a member of the Circle, round some of the places of interest in Oxford. Unfortunately, Mr. J. T. H. Legge, chief engineer and manager of the company, was detained in London, but he was ably represented by Mr. E. E. Hamar, commercial engineer of the company, and hon. secretary of the Circle. Mr. Hamar was assisted by Messrs. H. Roberts and G. A. King in the arrangements for the day.

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E.T.B.I. COMPETITION.

Cable Route Problem—First List of Prizes and Donors.

AS announced in our last issue, the Electrical Trades' Benevolent Institution is to launch a competition with a view to increasing its funds. Tickets for the competition will be available as from July 1st, and at the time of going to press a list of 66 prizes has been prepared.

The competition is based on the following extract from the will of the eccentric uncle of a young electrical engineer :—

" To my nephew, John Harris, I give and bequeath the sum of Twenty Thousand Pounds, provided he can prove to my Executors that the money I have already expended on his education and in enabling him to qualify as an Electrical Engineer has not been wasted.

" He must, therefore, within 14 days of reading these words, have submitted to my Executors the exact mileage of cable he would require to lay a cable by the shortest possible route from the G.P.O., London, through the General Post Offices of the following towns and back again to the G.P.O., London."

Each of the competition entry forms contains clues to the 16 towns through which the cable will run. The towns themselves are not definitely stated, but are indicated in a novel manner which leaves the solution to the general knowledge of the competitor.

The entry forms are given free on receipt of a donation of 2s. 6d. towards the funds of the Institution.

The following is a list of the firms who have so far given prizes :—

Name of Firm.	Prize.
The A.E.G. Electric Co., Ltd. ..	Radio voltmeters (3); time switch; electric kettle; electric heating pad; rotating vector diagram slide rule for meter testing; one year's subscription to " A.E.G. Progress."
The Arctic Fuse and Electrical Manufacturing Co., Ltd. ..	Electro-velocity radials.
The Arora Co., Ltd.	Electric fire.
Belling and Lee, Ltd.	Set of insulated indicating terminals.
Benjamin Electric, Ltd.	" Benjamin " products to the value of £3 3s.
Berkeley and Young, Ltd. ..	10 in. desk and bracket electric fan.
Berry's Electric (1928), Ltd. ..	Electric coffee percolator.
The British Thomson-Houston Co., Ltd.	C2 horn-type loud speaker.
The Brownie Wireless Co., of Great Britain, Ltd.	No. 2 Brownie Crystal Receivers (2).
Burne-Jones and Co., Ltd. ..	" Magnum " wave-trap.
Cryselco, Ltd.	Electrical goods to the value of £3 3s.
Drake and Gorham Wholesale, Ltd.	" Inventum " 1½ gallons electric hot-water cistern.
J. Dyson and Co., Ltd.	" Godwinex " h.t. eliminator.
Mr. Justus Eck	Pewter rose bowl (presentation to the person disposing of the winning ticket).
The Edison Swan Electric Co., Ltd.	Electric radiator, electric iron, and electric toaster.
Ferranti, Ltd.	Valve tester.
The Formo (Arthur Preen) Co., Ltd.	Radio components to the value of £2 2s.
Mr. J. Fotheringham	Electric radiator.
The General Electric Co., Ltd. ..	Portable " Gecophone " screen-grid 4 wireless-set.
J. Gledson and Co.	Domestic electric iron.
Graham Amplion, Ltd.	Standard cabinet cone loud speaker (A.C. 25).
Graham Farish, Ltd.	" Graham Farish " coupler, complete with resistances.
Hart. Bros. Electrical Manufacturing Co., Ltd.	" Harbros " radio wiring specialities.
The Houghton-Butcher Co., Ltd.	" Ensign " folding all-distance camera, and " Ensign " tropical No. 12 camera in hide case, with f/4·5 Aldis-Butcher lens.
Messrs. Kunzle	1½ lb. box of " Art Dessert " chocolates.
Lectro Linx, Ltd.	Case of " Clix " specialities.
Marryat and Place	" Neon " sign for any name of 12 letters.
The Mentmore Manufacturing Co., Ltd.	Mottled " Spot " fountain pen and rolled gold " Spot " pencil.
The Mullard Wireless Service Co., Ltd.	" H " type loud speaker; " C " type loud speakers (2); high-tension units (2).
John Player and Sons, Ltd. ..	Casket of medium " Navy Cut " cigarettes.
Philips' Lamps, Ltd.	Loud speaker (2).
Premier Electric Heaters, Ltd. ..	" Smoothwell " electric iron; " Accident proof " electric kettle.
Rothman's, Ltd.	Greywood cabinet of " Pall Mall " Virginia cigarettes.
John Shaw and Sons, Wolverhampton, Ltd.	" Trojan " electric iron.
Siemens Electric Lamps and Supplies, Ltd.	" Xcel " nickel-plated safety kettle, " Cosyglo " electric coal fire.
L. G. Sloan, Ltd.	" Waterman's Ideal " fountain pens (6).
Stuart Turner, Ltd.	" Stuart " model dynamo.
" Swan " Pens (Mabie, Todd and Co., Ltd.)	" Swan " No. 4 self-filling fountain pen with rolled gold clip.
Tungsram Electric Lamp Works (Great Britain), Ltd.	Tungsram barium valves (2 sets).
Varley (Oliver Pell Control, Ltd.)..	" Varley " radio components.
Ward and Goldstone, Ltd. ..	" Goltone " radio products to the value of £3 3s.
Wingrove & Rogers (Polar), Ltd...	" Polar Claricone " loud speaker.

Buxted P.C. has adopted a resolution passed by a meeting of the parishioners in favour of taking steps to secure the revocation of the powers of the Uckfield Gas and Electricity Co. so far as they apply to the portion of the parish which is outside the area supplied by the Weald Electricity Supply Co., with a view to obtaining a supply from the latter company.

ELECTRICITY SUPPLY.

BEDFORD Electricity Committee is to seek sanction to borrow £10 000 for meters.

Clophill P.C. had adopted a proposal for obtaining a supply from Bedford Corporation.

St. Pancras (London) electricity department is to lay additional feeder mains at a cost of £11 480.

Winslow R.D.C. has approved of a scheme submitted by the Northampton Electric Power Co. for supplying Winslow.

Dewsbury T.C. has received sanction to a loan of £7 164 in connection with the new infirmary and district electricity scheme.

Middlesex County Education Committee has decided to adopt electric lighting in the North Road Council School, Southall.

Considerable opposition is being offered by the local authorities of villages in the Cleveland district to the proposed use of overhead lines.

The Cumberland Waste Heat Co., Ltd., has informed Bootle R.D.C. Council of its intention to apply for an Order to supply Seascale.

The offer of the Irish Free State Electricity Supply Board of £5 800 for the Dungarvan Electric Light Co.'s undertaking has been accepted.

Bradford Markets Committee has asked the City Electrical Engineer to obtain estimates of the cost of re-wiring and lighting Kirkgate Market.

Wolverhampton Electricity Committee is to carry its supply to the Oxbarn housing estate, Wrottesley Hall and the Children's Camp at Kingswood, at a cost of £6 864.

Holywood U.D.C. is applying to the Electricity Commissioners for Northern Ireland for sanction of a loan of £10 000 in connection with the Holywood electricity scheme.

Marple U.D.C. has sanctioned capital expenditure amounting to £38 100 for giving a supply of electricity in the township. This should be available for the early winter demand.

Southend Corporation has applied for loans of £66 000 for three 1 200 kW land type Diesel-driven generators, with accessories, and £6 645 for a 1 500 kW converting plant.

Chailey R.D.C. has decided to offer no objection to the use of overhead lines by the Central Sussex Electricity Co., Ltd., from Haywards Heath, through Newick and Chailey to Uckfield.

Featherstone U.D.C. has accepted new terms offered by Electrical Distribution of Yorkshire, Ltd., for public lighting, by means of 150 W lamps at £4 5s. each per annum, and 100 W lamps at £4 each.

Bangor (Co. Down) Corporation has received sanction from the Ministry of Commerce to the borrowing of £37 000 for its electricity scheme. It has been resolved that tenders be invited for carrying out the work.

Aberystwyth R.D.C. has approved a draft Special Order authorising the Electric Development and Securities Trust, Ltd., to supply electricity in the district. The Trust intends to extend the cables to Borth and Gow Street.

A supply of electricity, provided by Aylesbury Corporation for the village of Chinnor, was switched on recently by Mr. W. E. Benton. The supply is by means of overhead lines, and the charge for all domestic purposes is 1½d. per kWh.

Hastings Electricity Committee has obtained sanction to borrow £2 500 for services and £1 500 for transformers.—A supply to Staplecross Village and Cripps Corner is to be provided at a cost of £5 362.—The Electricity Committee has voted £4 000 for improving the front line lighting.

Godstone R.D.C. has decided to object to the use of overhead lines by the Sevenoaks and District Electricity Co. at Oxted, as, in the Council's opinion, there is no room in the highway for the purpose and overhead lines would destroy the amenities of the neighbourhood.

In connection with the application of the High Street Traders' Association for the outside lighting of business premises, Ealing Town Council has agreed to provide current for such lighting at 3d. per kWh, subject to current being consumed by each lantern for not less than 800 hours per annum.

Last week a supply from Lytham St. Annes to Warton and Freckleton was officially inaugurated. The three municipal authorities concerned in the electrical development of the Fylde area are Blackpool, Lytham St. Annes, and Preston. From the electricity works at St. Annes there is a 6 600 V line to the sub-station at Warton, where current is transformed to 240–420 V and then distributed to the various supply areas.

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ELECTRICAL NEWS IN PICTURES.

A group of members of the Electrical Contractors Association of Scotland, taken before the annual golf match played between the East and West, at the Ferenze Golf Club, Barrhead. This year the West team were the victors, beating their opponents by a narrow margin. Further activities of the Scottish contractors are given on page 794.

Mr. H. J. S. Mackay, vice-President of the Batti-Wallahs' Society, whose death last week is referred to on page 790.

The ninth annual "Exide" Service Agents' Convention was held this year at the Royal Pavilion, Brighton, on June 11th and 12th. A civic welcome was accorded to them by the Mayor of Brighton, Alderman H. J. Galliers, whose firm are "Exide" service agents, in Brighton, Hove and Worthing. This photograph shows the Mayor speaking with Mr. D. P. Dunne and other officials of the Chloride Electrical Storage Co.

The next Selling Campaign window of the E.D.A. is, it will be remembered, designed to serve both July and August. The features, as will be seen from this reproduction, are small domestic appliances which tend to keep their users cool. The cubes are again introduced, together with the cut-out, the whole making a very pleasing display. The usual advertising and special literature are, of course, applicable to both months.

A group of I.E.E. members, and some of their French hosts, photographed outside Lourdes during the Summer Meeting. Both in Paris and the Pyrenees, the members of the Institution received welcome from every association connected with the French electrical industry. The Orleans and Midi Railway Companies provided special trains, while M. Bunet, President of the Société Francaise des Electriciens, made an ideal host. This year's meeting is voted one of the most successful, well over one hundred members and their friends attending. Further photographs will be found on page 783.

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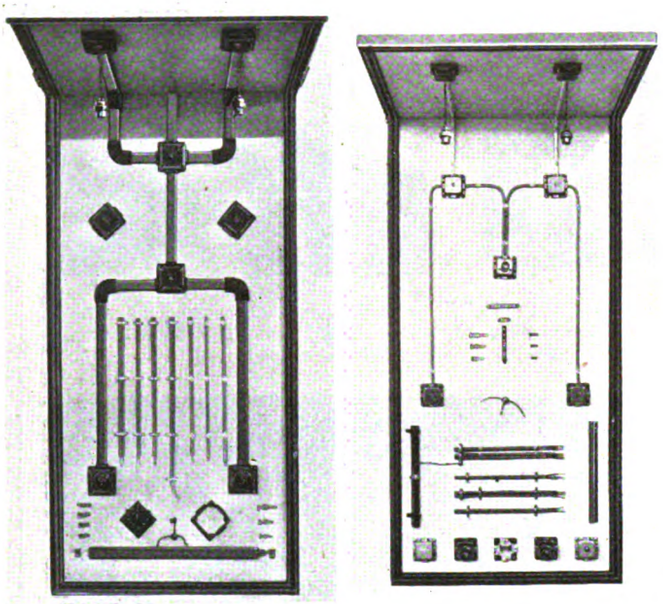
NEW WIRING SYSTEMS.

TWO new systems of wiring have been developed by the EDISON SWAN ELECTRIC CO., LTD., of 123, Queen Victoria Street, London, E.C.2, which warrant the attention of the trade.

The first system is unearthed for use with "Virite," and C.T.S. cables, and the second is an earthed system for use with metal sheathed cables.



Showing, on the left, the new "Ediswan" unearthed system of wiring, and, on the right, the earthed system for metal sheathed cables.

The unearthed system, a comprehensive illustration of which is given above, incorporates moulded bakelite boxes which are in three parts, the cover and base being common. A suitable intermediate piece is fitted to complete the required type of box, that is, 4-way, tee, 2-way (straight through), 1-way, and while there is no filing or chipping of the box necessary, there are no unused ways. All entries are fitted with extension pieces to shroud the ends of the wood channel, thus obviating the necessity for careful shaping or fitting of the latter, and each entry will take up to 3/·036 in. 3-core or 7/·036 in. twin, "Virite" or flat C.T.S. cable. Four connector pillars are moulded on to the base, these being of substantial design and cross drilled to facilitate wiring. Provision is also made for back entry. A special cover with a novel cord grip is provided to convert the box into a ceiling rose, the grip being a push fit into the cover. No screws are required, and the arrangement is suitable for twisted or circular flexible wires.

The channel is made in magnolia, and the fixing clips fit internally; the channel therefore butts close up to the wall leaving no space for dust to enter.

The clip fixing hole is elongated to allow of alignment after erection and ribs are provided in the base of the clip to give rigidity, and to prevent the head of the fixing screw coming into contact with the cable. The channel is suitable for all sizes up to 3/·036 in. 3-core or 7/·036 in. twin "Virite" or flat C.T.S. cable. Moulded corner pieces are provided to eliminate mitreing. At present only two types have been made, viz., surface and internal angle. The former allows for any necessary twist in the cable. Both types are made to shroud the ends of the wood channel, thus allowing the channel to be cut roughly.

For "Virite" cable the Edison Swan Electric Co. has made up a series of shaped saddles in tinned brass, which grip the cable at the junction between the cores and are an improvement on the standard saddle. For C.T.S. buckle clips are recommended and these are stocked in three sizes and are of special design. The base portion is indented, the indentations forming a rigid base for the cable and ensuring a good grip, while only one fixing screw is necessary even for the largest size.

The boxes for the earthed system, designed for metal sheathed cables, are obtainable in mild steel, tinned, or black bronze on copper plate, and are an improvement on the W.S. 1007/15 type. They have a larger capacity, are attractive, easy to erect, and have a positive visible bond. There are only two screws in the whole of the box, and all unused ways are closed. The bonding is automatic, is externally visible and is efficient when cables of varying diameters are employed. There is provision for back entry, the bonding device for both back and surface entry being common. Mild steel is employed for both cover and base. A cord grip and special cover is fitted for the ceiling rose box, a thin bakelite washer being inserted between the cord grip and the cover as additional protection.

In addition to the standard 1-way, 2-way and 3-way porcelain connectors, there is a new design somewhat similar to the Ramie one-piece porcelain, but an improvement on this connector in that the ends of the wire are gripped together by a conical spiral spring which makes its own thread on the conductor as it is screwed on. It is impossible to pull off the insulated cap and there is no fear of it becoming loose under normal conditions. A porcelain twister can also be supplied for giving an initial twist to the bunched ends of the conductors and also for tightening or loosening the insulated cap.

The new types of bonding strips are claimed to be more efficient than the old system, and have, in addition, a separate earthing terminal fitted to the two larger sizes. The indentations on the top plate provide a rigid contact surface, and a positive electrical contact. Each way will take two twin cables (up to 3/·036 in.), thus reducing the number of screws and the overall length.

The I.E.E. size of earth wire is 7/·029 in. and the earth terminal is designed for this.

Buckle clips are recommended for cable fixing, and these have already been described under the unearthed system. For damp situations and outdoor use, lead alloy saddles are recommended and sufficient sizes of these (semi-shaped) to cover normal requirements are available. Wood channel should be recommended for fixing lead covered cables where appearance is important. The earth clip is simple, the indentations ensure a firm grip on the pipe. The earth wire should be fitted between the shaped washer and the clip. The special shaped washer keeps the wire in position and there is no possibility of it becoming detached, as the second nut acts as a lock-nut.

SCOTTISH CONTRACTORS.

Annual Meeting of the Electrical Contractors' Association of Scotland—The Golf Match.

THE annual meeting of the Electrical Contractors' Association of Scotland was held in the Masonic Halls, West Regent Street, Glasgow, on June 12th, when there was a good turn-out of members from the various branches. The accounts of the association submitted showed the funds to be in a satisfactory state. The report of the Central Board dealt in detail with the various activities of the association, and the hope was expressed that before long a Fair Trading Agreement would be adjusted which would be acceptable to all branches of the industry. A year ago a Benevolent Fund was established within the association for the benefit of members and their families who were in distress. It was noted with satisfaction that all branches of the association had contributed to this fund and that already the fund had been found to be of considerable use. A satisfactory increase in the membership was reported during the year.

The following office-bearers were elected: President, Mr. J. Johnston Foggo, Edinburgh; Vice-President, Mr. D. H. Morris, of Lowdon Brothers and Co., Ltd., Dundee; Secretary, Mr. Walter Finlay, Edinburgh.

The Central Board representatives are: From Glasgow—Messrs. T. Rigg, D. Bennett, J. Allan, A. S. Nairn, H. Meighan, and R. A. Ure. From Edinburgh—Messrs. A. Pratt, R. E. Douglas, William Mackintosh and George Lyall. From Dundee—Messrs. J. Smith and R. Kilpatrick. From Aberdeen—Mr. J. L. Anderson.

After the annual meeting the members present were entertained to lunch by the Glasgow Branch in the Royal Hotel, and in the afternoon the usual golf match, East *v.* West, was held at the Fereneze golf course, Barrhead, the West team winning by the narrow margin of one match. All the members present much enjoyed the afternoon's outing.

A photograph showing a group of members taken before the golf match is reproduced on page 793.

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BUSINESS OPENINGS.

Latest Particulars of Electrical Engineering and Wiring Installation Contracts for which Tenders are being Invited at Home and Abroad.

WE give below the latest particulars of contracts for which tenders are invited. The closing date is given, where available.

FELLING URBAN DISTRICT COUNCIL, June 28th.—Electric light wiring and fitting of the Council Offices. Particulars from Mr. C. W. Hall, surveyor, Council Buildings, Felling.

ST. THOMAS' CHURCH, HENBURY, June 28th.—Electrical installation. Specification from the Rev. H. A. Potbury, Henbury Vicarage.

ERITH URBAN DISTRICT COUNCIL, June 29th.—Electric light wiring of West Street Schools. Specifications can be seen at the Education Offices, Picardy, Belvedere.

NORTHERN IRELAND GOVERNMENT, July 1st.—Electric light installation at R.U.C. Barracks, Newcastle, Co. Down. Form of tender, etc., from the Barracks or from the Ministry of Finance, 15, Donegall Square West, Belfast.

Power Plant.

PORTRUSH URBAN DISTRICT COUNCIL, July 1st.—Supply and erection of an additional 260 B.H.P. cold starting oil engine, direct coupled to 140 kW dynamo balancer, with auxiliary motor driven air compressor, pipes, tanks, etc., and two-panel extension of switchboard. Specification, etc. (10s.) from the Clerk, Town Hall, Portrush.

SALISBURY CORPORATION, July 1st.—Electric light installation at new police station. Particulars from Mr. W. J. Goodwin, city engineer; deposit £2 2s.

WEYMOUTH AND MELCOMBE REGIS CORPORATION, July 1st.—Electric wiring and fitting at Maternity and Child Welfare Centre and Public Health Office. Specification can be seen at Borough Surveyor's Office, Weymouth.

WHITTLESEY GUARDIANS, July 1st.—Electric light installation at the Institution. Specification can be seen at the office of Mr. J. W. Bowker, clerk to the Guardians, Arnold's Lane, Whittlesey.

BELFAST CORPORATION, July 2nd.—Twelve sets of upholstered spring seats for tramcars. Tenders to the Town Clerk.

HOLYWOOD URBAN DISTRICT COUNCIL, July 2nd.—(1) Three-phase transformers; (2) l.t. underground and overhead mains, laying and erection; (3) l.t. switchboard, erected; (4) h.t. armour-clad switchgear, erected; (5) h.t. truck type switchgear, erected; (6) h.t. cable, laid and erected. Specifications from the Town Clerk, Town Hall, Holywood, co. Down; deposit £1 1s. per specification, or £2 2s. per set.

STAFFORDSHIRE EDUCATION COMMITTEE, July 2nd.—Electric light installation in Kingswinford Brockmoor Council School and in new buildings on the adjoining site. Specification, etc., from Messrs. Moffett, Rosher and Mann, consulting engineers, Union Chambers, Temple Row, Birmingham; deposit £5 5s. Only registered electrical contractors are invited to tender.

GLASGOW CORPORATION, July 3rd.—Electric lighting installation at Plantation Baths and Washhouses. Specifications, etc., from the Office of Public Works, 64, Cochrane Street, Glasgow.

STEPNEY (LONDON) GUARDIANS, July 4th.—Installation of two electric lifts at South Grove Lodge, and one electric lift at St. George-in-the-East Hospital, Raine Street, Old Gravel Lane. Specifications from the Clerk, Bancroft Road, Mile End, E.1; deposit £1 1s. for each.

BELFAST ASYLUM COMMITTEE, July 8th.—Supply and erection of electric lighting equipment for main avenues. Specifications, etc., from the Secretary, Mental Hospital, Saintfield Road, Belfast.

EDINBURGH CORPORATION, July 8th.—Automatic electric elevator, for Portobello power station. Specification (No. 101) from Mr. E. Seddon, engineer and manager, Electricity Department; deposit £1 1s.

LONDON COUNTY COUNCIL, July 8th.—Manufacture, supply and maintenance of (*a*) 150 electric tramcar bodies; (*b*) 150 sets of swing bolster bogie trucks; (*c*) 150 sets of electrical equipment for tramcars, with assembly of bodies, trucks, electrical equipment, etc., into complete tramcars; and (*d*) 150 sets of magnetic track and wheel brake equipments. Specifications, etc., from the Clerk, County Hall, Westminster Bridge, S.E.1; deposit £2 for each section, or £7 for the four.

RHONDDA URBAN DISTRICT COUNCIL, July 8th.—Three centrifugal pumps, with two electric motors and a crude oil or gas engine. Specification, etc., from the Engineer, Council Offices, Pentre, Rhondda.

SUNDERLAND CORPORATION, July 8th.—Manufacture and supply of 12 months' requirements of (*a*) paper insulated, lead sheathed cable, (*b*) rubber insulated wire, (*c*) consumers' meters, and (*d*) gasfilled and vacuum lamps. Specifications from the General Manager, Electricity Offices, Dunning Street, Sunderland; 10s. deposit for each section. Applications must state the classes of goods for which specifications are desired.

DUNDEE CORPORATION, July 10th.—Supply of seven panel, e.h.t., compound filled sub-station switchboard, for 6 600 V, three-phase, 50-cycle system. Specifications from Mr. D. H. Bishop, Electricity Supply Department, Dudhope Crescent Road, Dundee.

METROPOLITAN ASYLUMS BOARD, July 10th.—Supply and fixing of a wireless installation at Princess Mary's Hospital, Cliftonville, Margate. Specification, etc., from the Board's Office, Victoria Embankment, London, E.C.4; deposit £1.

WEST MIDLANDS JOINT ELECTRICITY AUTHORITY, July 10th.—Supply and erection at Ironbridge power station of three boilers, each having normal rating of 225 000 lb. of steam per hour, with economisers, air heaters, fans, ironwork, pipework, coal pulverising plant, ash handling plant, etc. Specification (No. 3), etc., from Mr. E. F. Hetherington, chief engineer and manager, Phœnix Buildings, Dudley Road, Wolverhampton; deposit £2 2s.

CARLISLE CORPORATION, JULY 12th.—Supply and erection of switchgear for use in 11 000 V, three-phase, 50 cycle sub-station. Specification, etc., from Mr. C. W. Salt, city electrical engineer; deposit, £2 2s.

ILKLEY URBAN DISTRICT COUNCIL, July 12th.—Supply and erection of 11 000 V combined cubicle and truck type switchgear, transformer kiosk, 300 kVA and l.t. feeder gear; and 11 000 V feeder and l.t. distributors. Specifications from Mr. S. H. Fowles, Electricity Offices, Chantry Drive, Ilkley; deposit £1 1s. for each.

HULL CORPORATION, July 16th.—Installation of electric lift at Central Public Library. Specification from the City Architect, Guildhall, Hull.

CENTRAL ELECTRICITY BOARD, July 22nd.—Supply and erection of central indicators and telephones in connection with the Central Scotland Electricity Scheme. Specification (C.S.-S.S. 15) and form of tender from Mr. R. H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, 1, Charing Cross, London, W.C.2; deposit £2 2s.

CENTRAL ELECTRICITY BOARD, July 27th.—Supply and erection of 132 000 V overhead transmission lines, in connection with the Mid-East England Electricity Scheme. Specification (No. M.E.E.-P.L. 1), etc., from Mr. R. H. Fox, secretary, Central Electricity Board, Trafalgar Buildings, Charing Cross, W.C.2; deposit £2 2s.

Overseas.

UNLESS otherwise stated, particulars of overseas contracts are to be had from the Department of Overseas Trade (Room 52), 35, Old Queen Street, Westminster, London, S.W.1. *Note.—An asterisk denotes that local representation is, in practice, essential.*

GRONINGEN MUNICIPALITY.—Supply of a second-hand 3 000 kW, 10 500 V turbo-alternator. (Reference B.X. 5 394.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, June 30th.—Supply of two 5-ton electrically-driven hoist blocks, complete with overhead conductors, and switches. (Reference A.X. 7 867.)

CHILEAN PORTS ADMINISTRATION, July 1st. (extension of time).—Four electric travelling cranes for Valparaiso and 12 for Anzani. (Reference A. 8 122.)

VICTORIA STATE ELECTRICITY COMMISSION, July 1st.—Supply and delivery of 44 000 V transformers. (Reference B.X. 5 293.)

MELBOURNE AND METROPOLITAN TRAMWAYS BOARD, July 3rd.—Supply of two electrically-driven rail grinding machines (contract 704). (Reference A.X. 8 097.)

NEW ZEALAND POSTS AND TELEGRAPHS, July 3rd.—Supply of black adhesive insulating tape. (Reference B.X. 5 378.)

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TURKISH ADMINISTRATION OF RAILWAYS AND PORTS, July 4th.—Supply of electric wire and cables and general lighting accessories. (Reference B.X. 5 368.)

IXELLES COMMUNAL ADMINISTRATION, July 5th.—Supply of a.c. meters. (Reference B.X. 5 400.)

NEW ZEALAND POSTS AND TELEGRAPHS, July 6th.—Supply of v.i.r. wire (No. P. and T. 151/1 576). (Reference B.X. 5 411.)

NEW ZEALAND POSTS AND TELEGRAPHS, July 10th.—Supply of enamelled and cotton core, lead sheathed cable. (No. P. and T. 151/1 577). (Reference B.X. 5 413.)

INDIAN STORES DEPARTMENT, July 8th.—Supply of 30 kW oil-engine-driven generating set for Military Engineering Services, St. Thomas Mount, Madras. (Reference B.X. 5 364.)

LOURENCO MARQUES PORT AND RAILWAYS BOARD, July 8th.—Supply of two 5-ton electric portal cranes (Circular No. 60). (Reference A.X. 7 904.)

STATE ELECTRICITY WORKS, MONTEVIDEO, July 8th.—Construction and equipment of 50 000 kW power station.

NEW ZEALAND POSTS AND TELEGRAPHS, July 9th.—Supply of dial cords (No. P. and T. 151/1 557.) (Reference B.X. 5 412.)

POSTMASTER - GENERAL'S DEPARTMENT, MELBOURNE, July 9th.—Resistances and reactances. (Reference B.X. 5 281.)

NEW SOUTH WALES GOVERNMENT RAILWAYS, July 10th.—One 750 kW turbo-alternator; 2 200 V ironclad switchgear; two switch operating batteries; and two motor generator sets. Specifications from the Chief Electrical Engineer, 61, Hunter Street, Sydney.

PORT ELIZABETH MUNICIPALITY, July 11th.—Transformers, overhead line equipment, etc. (Reference B.X. 5 375.)

INDIA STORE DEPARTMENT, July 12th.—Supply of three continuous wave wireless transmitting sets (580 to 3 000 metres). Forms of tender (5s.) from the Director-General, Belvedere Road, London, S.E.1.

EGYPTIAN STATE RAILWAYS, July 13th.—Supply of underground, lead-covered, paper core telephone cables (approximate value £E.25 000.)

EGYPTIAN MINISTRY OF THE INTERIOR, July 15th.—Supply and erection at Mena power station of one Diesel engine driven a.c. generating set of 250 kVA. (Reference B.X. 5 331.)

VICTORIA ELECTRICITY COMMISSION, July 15th.—Two 750 kVA transformers and spares (No. 29/42). (Reference B.X. 5 325.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, July 16th.—Supply of 250 galvanised steel transmission line towers to carry copper conductors, or 190 towers to carry steel-core aluminium conductors. (Reference A.X. 7 735.)

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, July 23rd.—Telegraph instruments (schedule C. 436). (Reference B.X. 5 323.)

VICTORIAN RAILWAY COMMISSION, July 24th.—Electric overhead travelling cranes, spare motors, and down shop trolley wires (contract No. 42 672). (Reference A.X. 8 092.)

SOUTH AFRICAN RAILWAYS AND HARBOURS, July 25th.—Supply of two 2-ton electrically-driven hoist blocks (tender No. 1 471). (Reference A.X. 8 072.)

Electric Crane.

SOUTH AFRICAN RAILWAYS AND HARBOURS, August 1st.—One 10-ton electrically-driven overhead travelling crane, for Maritzburg workshops (tender No. 1 487). (Reference A.X. 8 105.)

SOUTH AFRICAN POSTS AND TELEGRAPHS, August 1st.—Supply of telephone cable (tender No. 160). (Reference B.X. 5 345.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, August 6th.—Supply of 120-ton, four-motor, overhead travelling crane and runway (specification No. S.M. 358). (Reference A.X. 7 810.)

NEW ZEALAND POSTS AND TELEGRAPHS, August 7th.—Enamelled and silk-covered resistance wire (No. P. and T. 151/1 497). (Reference B.X. 5 322.)

SOUTH AFRICAN POSTS AND TELEGRAPHS, August 8th.—Telegraph material, including g.i. tubular side-arms, insulators, paper sleeves, insulator spindles, etc. (tender No. 161). (Reference A.X. 8 112.)

NEW SOUTH WALES PUBLIC WORKS DEPARTMENT, August 12th.—Supply and erection at Burrinjuck of auxiliary hydro-electric generating plant. (Reference B.X. 5 365.)

EGYPTIAN MINISTRY OF THE INTERIOR, August 13th.—Supply of electric power plant, with underground and overhead network, for the town of Maghagha, Minieh Province. (Reference B.X. 5 318.)

NEW ZEALAND PUBLIC WORKS DEPARTMENT, August 13th.—Water turbine driven generating sets and switchgear, for Waitaki power development (section 2). (Reference B.X. 5 278.)

PIETERSBURG (TRANSVAAL) MUNICIPALITY, August 13th.—Supply of h.t. and l.t. cable, lamps and sundries, in connection with extensions of the electricity undertaking. (Reference B.X. 5 312.)

PIETERSBURG (TRANSVAAL) MUNICIPALITY, August 13th.—Supply and erection of steam raising plant, engine, alternators, and switchgear (contract A). (Reference A.X. 7 983.)

EGYPTIAN MINISTRY OF THE INTERIOR, August 15th.—Supply and erection of additional Diesel engine and alternator at Zagazig power station. (Reference B.X. 5 393.)

CHILEAN STATE RAILWAYS, August 16th.—Material for overhead lines, underground cable and cable boxes (Group 41); and material for lighting of locomotives and carriages (Group 43). (Reference C. 3 069*.)

CHILEAN STATE RAILWAYS, August 16th.—Supply of instruments of staff or tablet type, for installation at 36 stations between Alameda and Talca, locking apparatus for switches, batteries and telephone combinations. (Specification C. 3 070*.)

AUCKLAND ELECTRIC POWER BOARD, August 19th.—Single-phase transformers. (Reference B.X. 5 324.)

NEW ZEALAND GOVERNMENT RAILWAYS, September 4th.—Supply of motor generator (specification 287). (Reference B.X. 5 308.)

VICTORIAN ELECTRICITY COMMISSION, September 30th.—Supply, erection and maintenance of coal conveying plant. Specification (No. 29/68) from the Agent-General, Victoria House, Strand, London, W.C.; deposit, £2 2s.

Tenders Accepted.

BLACKBURN CORPORATION.—British Insulated Cables Ltd., supply of 10 drums of l.t. cable, £1 289.

OLDHAM CORPORATION.—Hall and Stinson, electric light installation at 200 houses on Limeside estate.

WREXHAM CORPORATION.—Jones and Williams, electric light wiring of 6 houses at Hightown, £297 10s.

GLASGOW CORPORATION.—Bolckow, Vaughan and Co., Ltd., 2 000 tons of No. 8 B.B. steel tramway rails.

PRESTON CORPORATION.—English Electric Co., Ltd., supply and erection of 600 kW motor generator set at Ribble power station, £2 235.

CROYDON CORPORATION.—Purdie, Lumsden and Co., Ltd., erection of concrete cooling tower, £18 680; Aiton and Co., Ltd., pipework, £5 352. (Recommended.)

BRADFORD CORPORATION.—Metropolitan-Vickers Electrical Co., Ltd., supply of two 300 kVA indoor type rotary convertors; A. Reyrolle and Co., Ltd., supply of 6 600 V metal-clad switchgear, for Valley Road power station. (Both recommended.)

SOUTHEND-ON-SEA CORPORATION.—British Mannesman Tube Co., Ltd., 14 heavy traction poles, £168; Frederick Smith and Co., three miles of trolley wire, £364 7s. 4d.; Chloride Electrical Storage Co., Ltd., materials for repair of battery at Chalkwell Park, £992; John Le Boutillier, Ltd., pistons and cylinder heads for Diesel engines, £660.

DURHAM COUNTY EDUCATION COMMITTEE.—Electric lighting installations at schools:—Law and Burns, electrical laboratory at Jarrow Secondary School, £222 8s. 8d.; F. Reid, Ferens and Co., Ludworth New Council School, £101 19s.; Robson and Coleman, Ryton New Council School, £220; F. Reid, Ferens and Co., New Seaham New Council School, £262.

GRIMSBY CORPORATION.—Stothert and Pitt, supply of an electric capstan, £252; Johnson and Phillips, Ltd., erection of overhead transmission line to Louth, £5 477 16s.; Metropolitan Electric Cable and Construction Co., Ltd., £3 593 4s., supply of extra high pressure feeder cable and pilot cable, required in connection with completion of ring main between Old Clee and Tetney, £3 593 4s. (All recommended.)

DEVIZES RURAL DISTRICT COUNCIL.—Edwards and Armstrong, Ltd., electric light installation at 42 houses: £212 17s. Also tendered: A. R. Fox, £197 5s.; Tower Electrical Supply Stores, £203; H. Rossiter and Co., £214 11s.; James Bros., £219; W. Drysdale, £227; Harden and Chinnery, £231 11s. 6d.; Ramsay and Sons, £232 13s. 6d.; David Henderson, £240 6s. 9d.; Thos. Humphries, £260 15s.; Cross Bros., £261; H. H. Burrows, £276 18s. 6d.; J. W. E. Simpson, £294 1s.; Webb and Rogers, £300; V. H. Dipple, £320 10s.; F. Wadman, £420; Marsh and Yeomans, £480 3s. 5d.

LONDON COUNTY COUNCIL.—Alpha Manufacturing and Electrical Co., Ltd., electrical work at extension of Hammersmith School of Arts and Crafts and Hammersmith Building Trades School, £1 585. Also tendered: Smethurst and Co., Ltd., £1 660; Stegman and Co., £1 695; H. J. Cash and Co.,

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Ltd., £1 795 ; Electrical Installations, Ltd., £1 799 ; J. Briggs, Ltd., £1 841 ; A. Hawkins and Sons, £1 998 ; Burdette and Co., Ltd., £2 000 ; A. Dean and Co., Ltd., £2 049 ; Berkeley Electrical Engineering Co., Ltd., £2 073 ; Pinching and Walton, £2 220.

HESTON AND ISLEWORTH URBAN DISTRICT COUNCIL.—Honor Bros., Ltd., electric light installation in the showrooms at Neal's Corner, £350 ; Enfield Cable Works, Ltd., 3 750 yd. 0·25 4-core cable, £4 237 ; 200 yd. 0·0145 4-core cable, £42 ; 880 yd. 0·15 by 0·08 by 0·15 3-core cable, £470. Pirelli-General Cable Works, Ltd., 800 yd. 0·15 4-core cable, £603 ; 1 850 yd. 0·064 4-core cable, £737 ; 1 000 yd. 0·0145 by 0·007 by 0·0145 3-core cable, £165 ; 3 200 yd. 0·15 single-cable, £528 ; 1 600 yd. 0·08 single-cable, £184. Siemens Bros. and Co., Ltd., one 0·25 sq. in. 4-core T box, £4 ; six 0·15 sq. in. 4-core T boxes, £24 ; two 0·15 sq. in. 3-wire T boxes, £10 ; one 0·15 sq. in. 3-wire, 4-way box, £6 ; one 7-way pillar for 0·25 sq. in. 4-core cables, £46 ; one 7-way pillar for 0·15 and 0·06 4-core cables, £40 ; one 4-way pillar for 0·25 sq. in. 4-core cables, £31 ; two 3-way pillars for 0·15 sq. in. single cables, £41. General Electric Co., Ltd., h.t. cubicle, £283, and l.t. board, £220. Hackbridge Electric Construction Co., Ltd. 300 kVA transformer, £215. (All recommended.)

BENN BROTHERS' ANNUAL OUTING.

ON Saturday, June 15th, the staffs, including the country representatives, of Benn Brothers, Ltd. (proprietors of THE ELECTRICIAN and numerous trade journals and annuals) and Ernest Benn, Ltd. (the associated company engaged in the production and publication of books) had their annual outing. The party, numbering nearly 250, travelled by special train to Eastbourne, were favoured with fine weather, and spent a very enjoyable day. Luncheon and tea were served in a most satisfactory manner at the Assembly Rooms, Saffrons Road. Sir Ernest J. P. Benn, who was accompanied by Lady Benn, said he regarded it as an enormous privilege to be allowed to preside over that great "fellowship of work" at Bouverie House. He believed that the firm had founded a concern that would last, and which would become a good and permanent part of the life of society. This was the firm's 49th year, and he wanted all the members of the staff to think out suggestions for celebrating its jubilee next year.

THE SOCIAL SIDE.

THE staff of Siemens Lamp Works, Preston, held an 18 holes Medal Play Competition on June 1st, on the links of the Dick Kerr Club at Ashton Park. The competition was for the "Dr. Wright Prize," and the successful competitors were S. Facer, 75 ; W. Higginson, 77 ; and J. W. Lawrence, 82.

The staff and employees of Christy Bros. and Co., electrical engineers, Chelmsford, had an outing on June 15th when they visited Bristol. At Paddington they were joined by the employees from St. Neots, and the party was accompanied by the governing directors, Mr. Frank Christy and Mr. L. F. Christy. Luncheon was served at Cheddar, and was presided over by Mr. Frank Christy, who said that the firm had been in business 45 years, and this was the first time everyone had been brought together at an outing.

On Saturday, June 15th, the seventeenth annual athletic sports organised by the employees of Metropolitan-Vickers Electrical Co., Ltd., took place at Belle Vue Gardens, Manchester. The cycling events were competed for on the Salford Football Ground on the previous Wednesday evening, as there is now no cycle track on the Belle Vue ground. While these last-named events were highly competitive and very interesting, there were not many spectators owing to heavy rain in the early part of the evening.

The annual sports meeting of the Hackbridge Construction Co., Ltd., and its sister company the Hewittic Electric Co., Ltd., were held on the sports ground adjoining the works at Hersham, on June 22nd. Twenty-eight events were scheduled, including members', open and children's events. In spite of the rather showery weather, all the events went off to time, Mr. A. Taylor winning the challenge cup in the men's and Miss P. Nightingale in the ladies' events. It was largely through the efforts of Mr. Taylor that the drawing office won the Inter-departmental Challenge Shield. Mrs. W. W. Hughes presented the prizes and the response to Mr. T. F. Lister's (general manager) request for cheers shows that the wife of the chairman of the Hackbridge Construction Co., Ltd., is not unknown to the staff. Mr. W. W. Hughes thanked the members and friends on behalf of his wife and left them to enjoy at leisure the excellent side shows provided in the fair ground adjoining. The Addlestone Military Band gave an excellent musical programme.

ELECTRICAL SPORTS.

A NUMBER of electrical sports have been held this month, and the two top pictures show (left) the ladies' obstacle race, and (right) the tug-o'-war at the Charlton ground of Siemens Brothers and Co., Ltd., on June 15th. The bottom pictures are snapshots taken at the sports of the Metropolitan-Vickers Electrical Co., Ltd., on the same day. The push ball match was played by the apprentices, "Home" v. "Overseas." The latter team were dressed as Maoris (see right-hand picture), and the "Home" team wore "costumes" of special M.-V. design.

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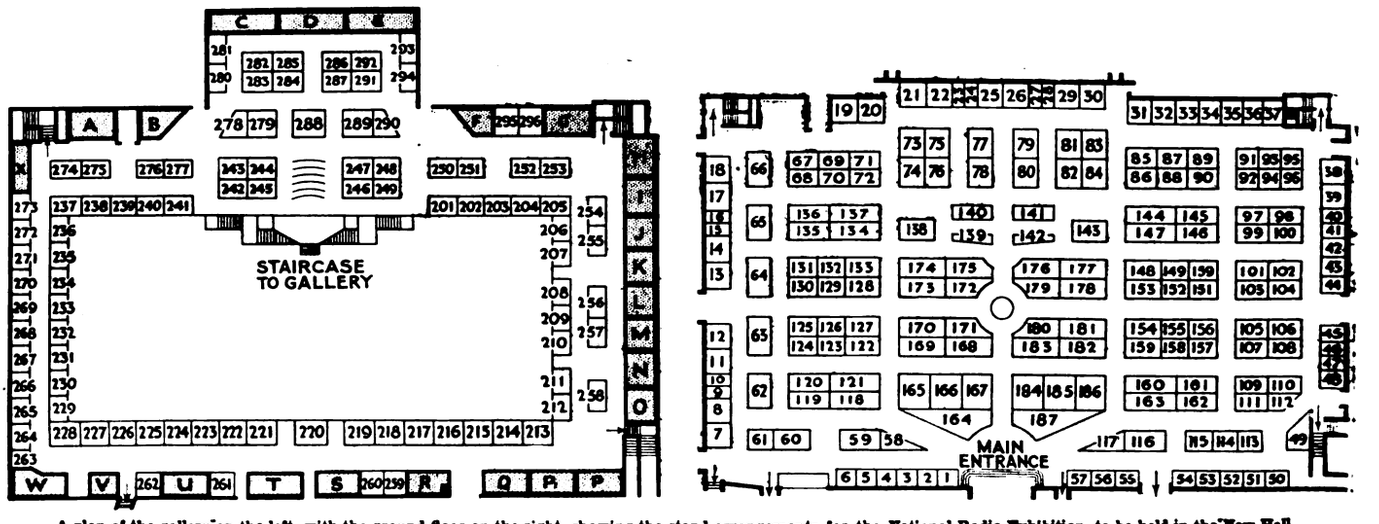
THE NATIONAL RADIO EXHIBITION.

Preliminary List of Exhibitors and Result of Ballot for Stand Numbers.

Name.	Stand No.
Aeonic Radio, Ltd.	73
Atalanta	234
Automatic Coil Winder and Electrical Equipment Co., Ltd.	5 & 6
B. & J. Wireless Co.	285
Baker, A.	23
Bakelite, Ltd.	255
Beaver Electrical Supply Co.	287
Bedford Electrical and Radio Co.	45
Belling & Lee, Ltd.	263 & 264
Benjamin Electric, Ltd.	31
Bird & Sons, Ltd., Sydney S.	155
Bowyer-Lowe Co., Ltd.	130 & 131
British Ebonite Co., Ltd.	21
British Gen. Mfg. Co., Ltd.	107
British Radio Gramophone Co.	156 & 157
British Thomson-Houston Co.	150 & 151
Brown Bros., Ltd.	34 & 35
Brown, Ltd., S. G.	213, 214 & 215
Brownie Wireless (Great Britain) Co., Ltd.	143
Bulgin & Co., A. F.	295 & 296
Bullphone, Ltd.	60 & 61
Burndept Wireless (1928), Ltd.	144 to 147
Burne-Jones & Co., Ltd.	125
Burgoyne Wireless, Ltd.	50 & 51
Burton, C. F. & H.	36 & 37
Carrington Mfg. Co., Ltd.	270 & 271
Catesbys, Ltd.	3 & 4
Celestion, Ltd.	180 & 183
Chloride Electrical Storage Co., Ltd.	172 & 175
Clarke & Co. (Manchester), Ltd.	220
Cleartron (1927), Ltd.	22
Climax Radio Electrical, Ltd.	91 & 92
Cole, Ltd., E. K.	8, 9, 10 & 11
Cook's Wireless Co., Ltd.	223
Cossor, Ltd., A. C.	173, 174, 138 & 78
Columbia Graphophone Co., Ltd.	94 & 96
Colvern, Ltd.	99
Curry's (1927), Ltd.	256 & 257
D.X. Coils, Ltd.	262
Day, Ltd., Will	7
De la Rue & Co., Ltd., Thos.	260
Dew & Co., A. J.	26, 27 & 28
Dibben & Sons, Ltd., Wm.	65 & 15
Donotone (Regd.) Loud Speaker	268 & 269
Dubilier Condenser Co., Ltd.	181 & 182
Dulcetto-Polyphon, Ltd.	278
Dunham, C. S.	47 & 48
Dyson & Co. (Works), Ltd., J.	1
Eagle Engineering Co., Ltd.	77
Eastick & Sons, J. J.	272 & 273
East London Rubber Co.	274 & 275
Econasign Co., Ltd.	238
Edison Bell, Ltd.	116
Edison Swan Electric Co., Ltd.	153 & 149
Electron Co., Ltd.	288
Ellison & Hillman	29 & 30
Epoch Radio Mfg. Co.	218
Ever Ready Co. (G.B.), Ltd.	139 & 142
Falk, Stadelmann & Co., Ltd.	279
Fellows Manufacturing Co., Ltd.	32 & 33
Ferranti, Ltd.	74 & 76
Flinders (Wholesale), Ltd.	282
Formo Company	72
Fuller Accumulator Co. (1926), Ltd.	75
Gamage, Ltd., A. W.	258
Gambrell Radio, Ltd.	62
Garnett Whiteley & Co., Ltd.	63
General Electric Co., Ltd.	85 to 90
Graham & Co., R. F.	230
Graham Amplion, Ltd.	164 & 187
Graham Farish, Ltd.	140 & 141
Gramo-Radio Amplifiers, Ltd.	247
Gripso Co., The (L. H. Reid & Co.)	227
Grosvenor Battery Co., Ltd.	237
Halcyon Wireless Co., Ltd.	168 & 171
Hardyson Radio, Ltd.	158
Harlie Bros.	277
Hart Accumulator Co., Ltd.	289
Hart Bros. Electrical Mfg. Co., Ltd.	239
Hart Collins, Ltd.	49
Henderson & Co., Ltd., W. J.	201
Hunt, Ltd., A. H.	259
Huntly, Norman	235
Igranic Electric Co., Ltd.	161 & 162
Itonia Gramophone, Ltd.	286
J. R. Wireless Co.	266
Jackson Bros.	97
Jewel Pen Co., Ltd.	267
Junit Mfg. Co., Ltd.	207
"K.N." Electrical Products, Ltd.	254
Kalisky (Aldgate), Ltd., S.	24 & 25
Kolster-Brandes, Ltd.	17, 176, 177 & 179
Lamplugh, Ltd., S. A.	126 & 127
Langham Radio, Ltd.	59
Lectro Linx, Ltd.	261
Lever (Trix), Ltd., E. J.	211 & 212
Lissen, Ltd.	184, 185 & 18
Lithanode Co., Ltd.	232
Lock, Ltd., W. & T.	202 & 203
Loewe Radio Co., Ltd.	291
London Electric Stores, Ltd.	293 & 294
London Electric Wire Co. & Smiths, Ltd.	64
London Metal Warehouses, Ltd.	222
London Radio Mfg. Co., Ltd.	112
M.P.A. Wireless, Ltd.	165
McMichael, Ltd., L.	101 & 103
Mainten Mfg. Co., Ltd.	226
Manufacturers' Accessories Co. (1928), Ltd.	236
Marconiphone Co., Ltd.	79 to 84
Metro-Vick Supplies	148 & 152
Mic Wireless Co.	56
Montague Radio Inventions & Development Co.	52, 53 & 54
Mullard Wireless Service Co., Ltd.	134, 135, 136 & 137, 58 & 117
New London Electron Wks., Ltd.	67
Oldham & Son, Ltd.	68 & 70
Ormond Engg. Co., Ltd.	118 & 121
Pandona, Ltd.	225
Paroussi, E.	206
Partridge & Mee, Ltd.	98
Partridge Wilson & Co.	283
Perfectavox, Ltd.	114
Peto & Radford	108
Peto Scott Co., Ltd.	42, 43 & 44
Philips' Lamps, Ltd.	169 & 170
Pye Radio, Ltd.	160 & 163
Quest Radio Mfg. Co.	93
Radielle Co., Ltd.	2
Radio Gramophone Development Co.	292
Radio Instruments, Ltd.	122 & 123
Radio Service (London), Ltd.	204
Redfern's Rubber Works, Ltd.	46
Regent Radio Supply Co.	16, 17 & 18
Rees Mace Mfg. Co., Ltd.	105
Reproduction, Ltd.	55
Rolls-Caydon Sales	166
Rooke Bros., Ltd.	119
Royal Radio Co.	12
Sel-Ezi Wireless Supply Co., Ltd.	205
Selectors, Ltd.	102 & 104
Selfridge & Co., Ltd.	208, 209 & 210
Sells, Ltd.	216
Siemens Bros. & Co., Ltd.	69 & 71
Standard Wet Battery Co.	57
Stratton & Co., Ltd.	109
Sun Electrical Co., Ltd.	250 & 251
Swift Levick & Sons, Ltd.	240
Sylvex, Ltd.	231
Symphony Gramophone and Radio Co., Ltd.	129 & 132
Telegraph Condenser Co., Ltd.	248
Telsen Electric Co., Ltd.	110
Tonex Co., The	265
Trelleborg Ebonite Works, Ltd.	281
Truphonic Radio, Ltd.	167
Tulsemere Manufacturing Co.	276
Turner & Co.	95
Ultra Electric, Ltd.	106
Universal Gramophone and Radio Co., Ltd.	100, 40 & 41
Vandervell & Co., Ltd., C. A.	120
Varley (Oliver Pell Control)	154 & 155
Voltron Co., Ltd.	217
Ward & Goldstone, Ltd.	290
Watmel Wireless Co., Ltd.	111
Webb Condenser Co.	284
Westinghouse Brake and Saxby Signal Co., Ltd.	13 & 14
Whiteley Boneham & Co., Ltd.	66
Whittingham Smith & Co.	113
Wilkins & Wright, Ltd.	115
Williams & Moffat, Ltd.	229
Wingrove & Rogers, Ltd.	128 & 133
Wright & Weaire, Ltd.	221



A plan of the gallery on the left, with the ground floor on the right, showing the stand arrangements for the National Radio Exhibition, to be held in the New Hall, Olympia, London, in September. The shaded portions indicate the special loud speaker demonstration cabinets.

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COMPANY NEWS.

Quiet Market in Electrical Securities—German Television Developments—Marconi One-Pound Shares—General Electric Co.'s Report—Conversion of Hastings Tramways to Railless System Completed—New Companies.

THE market in electrical stocks and shares this week has been steady, and there are few changes to record. In the electricity supply section, County of London ordinary rose 1s. and Yorks Electric Power ordinary 6d. British Electric Traction preference rose from 127½ to 130½, doubtless as a result of the excellent report submitted at the recent meeting, but there was little movement in other traction securities. British Insulated ordinary have risen from 71s. 10½d. to 77s. 6d. Callender's ordinary from 75s. to 77s. 6d., Henley's, from 130s. to 132s. 6d., and Siemens Bros. and Co. from 31s. 3d. to 37s. 1½d. Marconi's ordinary declined from 77s. 6d. to 75s. 9d.

Last Annl. Divd.	Description	This Week.	Last Week.	1926 to 1928. Highest.	Lowest
	% Electricity Supply.				
(*d*)	Brompton & Kensington Ord. ..	26/-	26/-	35/6	23/9
4	Central Elec. Sup. 4% Deb. ..	94½	94½	95½	88½
(*a*)	Charing Cross Elec. Ord. (£1) ..	26/6	26/6	51/-	24/3
4½	,, ,, ,, 4½% C.P. (£1)	17/6	17/6	18/3	16/6
(*b*)	Chelsea Elec. Sup. Ord.	26/6	26/6	45/3	24/-
10	City of Lond. Elec. L'ting Ord. ..	33/1½	33/1½	52/10½	20/-
6	,, ,, ,, ,, ,, 6% C.P.	23/-	23/-	24/3	21/6
10	County Lon. Elec. Sup. Ord. ..	55/6	55/6	68/6	25/9
6	,, ,, ,, ,, 6% C.P.	23/-	23/-	24/-	21/3
(*e*)	Kensington & K'bridge Ord. (£1)	26/6	26/6	27/6	23/9
1/9⅜	Lon. Elec. Sup. Ord. (£1) ..	28/-	28/-	37/6	23/-
1/9⅜	Metro. Elec. Sup. Ord.	47/6	47/6	53/-	24/9
4½	,, ,, ,, 4½% C.P. ..	17/6	17/6	18/3	16/3
7½	N'castle & Dis. Elec. Ltg. Ord. ..	30/-	30/-	31/9	17/6
1/2⅝	N'castle-upon-Tyne Elec. Sup. Ord.	26/10½	26/10½	30/3	19/3
6	N Metro. Elec. 6% C.P.	23/-	23/-	23/9	20/10
6	Notting Hill 6% C.P. (£10) ..	11	11	11½	9½
(*c*)	St. James & P.M. Ord (£1) ..	27/6	27/6	28/6	23/6
6	Shrops. Worcs. & Staffs. Power Pref.	22/6	—	—	—
1/9½	W'minster Elec. Sup. Ord. (£1) ..	26/-	26/-	52/9	24/-
4½	,, ,, ,, 4½% C.P. (£1)	17/6	17/6	17/10½	16/7½
8	Yorks. Elec. Power Ord.	37/-	36/6	38/9	24/6
6	,, ,, ,, 6% C.P. ..	24/-	24/-	26/9	20/7
	Railways and Tramways.				
8	Brit. Elec. Trac. Pfd. Ord. Stk. ..	130½	130½	152	117
6	,, ,, ,, 6% Pf Stk.	130½	127½	133	103½
4	Cent. Lon. Ry. Ord. Stk. (asstd.)	72	72	72	54
4	,, ,, ,, 4% Deb.	80	80	83	77½
4	City & S. Lon. 4% Perp. Deb. ..	78½	78½	81	76½
5	Lon. Elec. Rly. Cons. Ord. Stk. ..	73½	73½	75½	42½
4	,, ,, ,, ,, 4% Pf. Stk.	73	73	77	68
4	,, ,, ,, ,, 4% Deb. ..	78	78	83	76½
5	Lon. & Sub. Trac. A. Deb. ..	95½	95½	97½	74
4	Lon. Un. Trams. 1st Deb... ..	62	62	63	39
4½	Met. Elec. Trams, 4½% Deb. ..	72	72	73½	62
5	,, ,, ,, 5% Deb. ..	67½	67½	70½	65½
3½	Met. Rly. Cons. Ord. Stk... ..	60½	60½	81	54½
3½	,, ,, ,, 3½% Pf. Stk. ..	63	63	67	60½
3½	,, ,, ,, 3½% Deb. ..	70	70	73½	67½
5	Met. Dis. Rly. Ord. Stk.	76	76½	77½	52½
4½	,, ,, ,, 4½% 1st Pref. ..	81½	81½	84	74½
6	,, ,, ,, 6% Perp. Deb. ..	114½	114½	118½	110
4	S. Met. Elec. Trams, 4% Deb. ..	70	70	70	64½
7	Underground Electric Rlys. Ord.	23/-	22/6	28/2	11/-
—	Yorks. (W.R.) Trams, Ord. ..	5/-	5/-	16/-	3/-
4½	,, ,, ,, 1st Deb. ..	59	59	78	60
	Electrical Manufacturing.				
7	Brit. Elec. Transformer 7% C.P...	13/9	13/9	19/10	4/6
15	Brit. Insulated Cables Ord. ..	77/6	71/10½	86/3	56/-
6	,, ,, ,, 6% C.P. ..	22/6	22/6	23/10	21/-
7	British Thomson-Houston Pref. ..	23/3	23/3	24/9	19/7
7	,, ,, ,, 7% Deb.	103½	103½	109½	102½
10	Brush Electrical Ord Stk... ..	†135	—	—	—
15	Callender's Cable Ord.	77/6	75/-	91/3	66/-
6½	,, ,, 6½% C.P. ..	25/-	25/-	25/9	22/-
7½	,, ,, ,, 7½% B. Pref. ..	27/6	27/6	28/3	25/-
8	Crompton-Parkinson 8% Cum. Pf.	25/-	25/-	27/-	14/-
6	,, ,, 6% Cum. 2nd Pf.	17/6	17/6	19/6	9/7
7½	Edison Swan Elec. 1st Pref. ..	25/7½	25/7½	13/-	7/4½
5	,, ,, ,, 1st Deb. Stk.	86½	86½	92	81½
7½	Elec. Construction Ord.	18/9	18/9	32/6	23/6
7	,, ,, 7% C.P. ..	22/6	22/6	22/9	21/-
—	English Elec. Ord.	6/3	6/3	15/9	5/-
—	,, ,, 6% C.P. ..	8/1½	8/1½	18/9	7/-
7	Ericsson Telephones 7% Pref. ..	20/-	20/-	22/7½	17/6
35	Ever Ready (Gt. Britain) Ord. ..	21/6	22/-	92/3	18/1
6	Ferranti 6% Pref.	18/-	18/-	19/4½	16/9
7	,, 7% 2nd Pref.	21/3	21/3	19/3	13/9
10	General Elec. Ord.	52/6	53/9	46/6	26/6
25	W. T. Henley's Ord.	132/6	130/-	120/-	69/3
10	Johnson & Phillips Ord.	36/3	36/3	67/11	34/-
7½	Lon. Elec. Wire. & Smith's Pref...	23/9	23/9	25/-	22/3
7½	Siemens Bros. & Co. Ord. ..	37/1½	31/3	36/6	24/9
10	Telegraph Const. Ord. (£12) ..	23½	24½	30½	20
	Telegraph.				
3½	Anglo-Am. Tele. Ord. Stk. ..	61½	61½	63½	56½
10	Eastern Ord. Stk.	265	265	273	135
3½	,, 3½% Pref. Stk.	67½	67½	70½	59
4	,, 4% Deb.	78½	78½	81½	74
10	Eastern Extension Ord. (£10) ..	26½	26½	27½	14
22	Gt. Northern Telegraph (£10) ..	31½	31½	43½	26
10	Indo-European (£25)	50½	50½	48½	30
20	Marconi's Wireless T. Ord. ..	75/9	77/6	84/4	12/-
15	,, Int. Mar.	65/-	65/-	90/-	16/6
10	Western Tel. Ord. (£1)	26½	26½	27½	12½

(*a*) 19.⁹d. per share. (*b*) 1s. 9·3d. per share. (*c*) 1s. 6·949d. per share.
(*d*) 1s. 8·706d. per share. (*e*) 1s. 7·181d. per share. † Ex share bonus.

CORK ELECTRIC SUPPLY CO., LTD.—Intm. div. of 5% has been declared.

WORCESTER ELECTRIC TRACTION CO., LTD.—Div. at rate of 5% for year has bn. declared.

MIRRLEES, BICKERTON AND DAY, LTD.—Nett pft. for year ended March 31st, 1929, £31 895, agst. £20 162. Div. of 7% less tax, recommended on ord. shs. for year, agst. 6%. Fwd. £8 504, agst. £5 829.

COOKHAM AND DISTRICT ELECTRICITY CORPORATION, LTD.—Rev. for 1928, £7 553, agst. £6 607. To depreciatn. res., £1 250; written off cost of changing over to bulk supply, £1 000. Div. on ord. shs., 4%.

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD.—Fin. div. on ord. shs. of 2s. 6d. p.sh., less tax, makg. w. intm. div. of 1s. 6d. p. sh. paid on Dec. 1, 1928, 4s. per sh. for year, and cash bonus of 2s. p. sh., less tax, will be payable on July 13.

CHADBURN'S (SHIP) TELEGRAPH CO., LTD.—Gross pft. for year ended March, 1929, £20 805, agst. £18 301. Divs. at rate of 6% p.a. on pref. shs., less tax, for half years ended Sept., 1925, and March, 1926, will be paid on July 1st. Fwd., £1 421.

NEW GERMAN TELEVISION CO.—It is stated that, at the request of the German Government, a company has been formed comprising the Baird Television, Robert Bosch, Zeiss, Ikon and Loewe Radio interests. Loewe Radio is a well-known company in the radio manufacturing industry.

GREENWOOD AND BATLEY, LTD.—Blce. to credit of pft. and loss acct. for year ended March 31, 1929, £28 385, to wh. is added blce. brt. in from previous year, £13 459. To depreciatn., £6 000; intm. divs. paid to Dec., 1928, pref. 3½% and ord. 2½%, absorbed £12 224. Fin. divs., pref. 3½% and ord. 2½%, also require £12 224. Fwd. £11 396.

MARCONI £1 SHARES.—The committee representing the £1 ord. shhldrs. announces that it has come to the conclusion that it is not justified in proceeding with the formation of an investment co. to which hldrs. of £1 ord. or pref. shs. of Marconi's Wireless Telegraph Co., who elected to stand out of the merger company could transfer their shs., as the total support from both pref. and ord. shhldrs. amts. to only about 30% of the total number. The committee states that it has not altered its views that the £1 shhldrs. who stand out of the merger co. will ultimately benefit by so doing, and that a number of the larger hldrs. of £1 ord. shs. have decided to follow this course.

DELHI ELECTRIC SUPPLY AND TRACTION CO., LTD.—Net rev. for 1928 £59 558, agst. £49 639. After addg pft. on exchange, int. and miscellaneous income, and deductg. administratn. charges, and exes. in connectn. w. reorganisatn. of cap., pft. for year was £62 887 (agst. £50 583), plus £1 583 brt. in. Intm. div. of 4% absorbed £6 000. To gen. res., £25 028, depreciatn. and renewals £10 000; res. for taxatn., £8 000; staff benefit, £1 500. Fin. div. 8%, makg, 12% for year. Fwd. £1 941. Extraordinary mtg. will be held on July 1 to consider resolutions to increase the directors' remuneration and to amend the articles of association so as to permit profits of the co. to be capitalised.

MARCONI'S WIRELESS TELEGRAPH CO., LTD.—Directors announce that sufficient shs. of the co. have already been deposited with the Bank of England under the plan, dated May 14th, to warrant them concludg. that the required percentage of "assented" shs. will be obtained to enable the plan to become operative. Having regard, however, to the imperial and national importance of the merger scheme, the directors hope that the number of "assented" shs. will be much in excess of the minimum required merely to put the plan into operatn., and the directors desire to impress upon shhldrs. the importance of sendg. their sh. certificates to the Bank of England forthwith. Unless the time is extended, to-day, (June 28th), is the last day by which shs. can be so deposited.

GENERAL ELECTRIC CO., LTD.—Pfts. for year ended March 31, 1929, £1 084 077 (increase £26 000), plus £338 456 brought in. Deb. stk. int. required £222 380, depreciatn. £206 055, contributn. to pension fund, £24 662, div. on 6½% "A" pref. shs. for year, £117 000, and on 7½% "B" pref. shs., £135 000, and £130 000 has been placed to res. Div. of 10% on ord. shs. for year is recommended. Fwd. £362 072. The co.'s works have

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been fully employed. Output, both at heavy engineering works and at telephone works, has reached a high level, and volume of orders received has been satisfactory. Demand for gen. elect. commodities has shown steady expansn., which has

MEMBERS of the Cheltenham, Mid-Gloucestershire, Bristol and South Wales and Monmouthshire branches of the Electrical Association for Women were entertained to luncheon by the Lord Mayor of Cardiff, Ald. W. R. Williams, and the Lady Mayoress, on June 19th. Following the luncheon, the party visited the new showrooms of the Cardiff branch of the General Electric Co., Ltd. The party numbered some 250, and the above group, taken during the visit, includes Mr. W. E. Hobbs, district manager G.E.C., Cardiff branch; Mr. H. B. Duce, assistant manager; Mr. W. F. Arnold, who lectured on modern domestic fittings; the Lady Mayoress of Cardiff; Ald. W. R. Williams; Miss C. Haslett; Mrs. A. L. Snow (hon. secretary of the South Wales branch) and Mr. F. Goddard (G.E.C.).

to some extent counteracted a tendency towards lower prices. Volume of overseas trade has been well maintained. Branches in India and Argentine have again had a successful year's trading. Some improvemt. is visible in South Africa; in Australia and China, however, conditns. have remained difficult. New h.t. switchgear and transformer works have been erected at Witton, and head office has been extended.

OFFICIAL QUOTATIONS.—Official quotations have been granted by Stock Exchange Commee. to following securities: 21 432 £1, fully paid, ord. shs. of Brompton and Kensington Electricity Supply Co., Ltd.; 140 833 £1, fully paid, ord. shs. of the Oriental Telephone and Electric Co., Ltd.; 4 702 £1, fully pd. ord. shs. of Underground Electric Railways Co. of London; 8 989 £1, fully pd. ord. shs. of Chelsea Electricity Supply Co., Ltd.; £1 496 £22, fully paid, 6% bearer certificates of Constantinople Telephone Co.; 395 200 5s., fully paid, ord. shs. of Ever Ready Co. (Great Britain), Ltd.; 550 000 £1, fully paid, 6% cum. pref. shs. of Mersey Power Co.

GLOBE TELEGRAPH AND TRUST CO., LTD.—Net rev. for year ended May 31, 1929, after deductn. of exes., £347 390, makg., with £52 322 brt. fwd., £399 712. Intm. divs. of 5s. p. sh., tax free, on ord. shs., and 3s. per sh., less tax, on pref. shs. have been paid, and fin. div. of 5s. p. sh., tax free, on ord. shs., and 3s. p. sh., less tax, on pref. shs. will be paid on June 30, leavg. £77 371 to carry fwd. the next account. The Earl of Midleton has been elected chairman of the co., in successn. to late Sir John Denison-Pender, and Mr. F. A. Johnston has been appointed to fill vacancy on the board. A resolutn. will be submitted to mtg. on June 25 providg. for widening of co.'s present restricted powers of investmt. to enable it to participate in further development of communicatns. and electrical enterprises. In view of more extensive operatns. of co., directors consider it advisable to add to their number, and shhldrs. will be asked to increase directors' remuneratn. to £4 500 p.a. tax free.

WHITEHALL ELECTRIC INVESTMENTS, LTD.—Rpt. for year ended March 31, 1929, states that whole of co.'s investmts. in co.'s operatg. in Chile and Mexico have bn. sold to American and Foreign Power Co., Inc. Pft. from sale, £2 738 793, has bn. transferred to cap. res. acct. There has bn. charged agst. this, £625 000, which has bn. contingently passed to special res. acct., and £729 313 written off disct. on issues of deb. stk., etc., thus releasg. taxed income formerly allocated for this purpose. Gross income for year £517 105; net income £292 193, plus £80 000 brt. in. Pref. div. absorbs £187 500, leavg. £184 693. Addg. pfts. previously applied in writg. off discts., etc., including income-tax correspondg. thereto, £915 707, there is total of £1 100 400. Div. proposed for year on ord. shs. 2%, with bonus div. of 18%; fwd., £100 400. Two subsidiary co.'s. have bn. formed—Hallminster Investments and Whitehall Canada—for carrying out financial transactns. not appropriate to the Whitehall co. as a holdg. co. While in the past the co.'s investmts. have bn. confined to co.'s. in which sh. control was held, future interests will be more widely distributed and will not necessarily carry sh. control.

Company Meetings.

MINEHEAD ELECTRIC SUPPLY CO., LTD.—At the recent annual meeting, Mr. Harry D. Leather (chairman) said the business had shown a very satisfactory extension. In a short time the extensions would more than pay for the outlay involved. The past year's profit was £5 317, compared with £4 377. It was decided to pay a dividend of 8½%, tax free, on the ordinary shares and to carry forward £463, subject to the payment of directors' remuneration.

HASTINGS AND DISTRICT ELECTRIC TRAMWAYS CO., LTD.—Mr. G. T. Moody, presiding at the recent meeting, said the circular route trolley bus service came into operation on May 15th, completing the conversion to the new system. The road conditions in Hastings were probably more adverse than those which obtained in the twenty other towns during their trolley 'bus system construction, as in almost every instance those systems were owned by the local authorities, who would take care to facilitate the regular running of their own 'buses. A further cause of trouble arose from the fact that immediately following the passing of their Trolley Vehicles Act in 1927, Hastings Corporation proceeded to license a large number of petrol vehicles to run in competition with the company's, although previously they had refrained from that course, and had maintained at a Ministry of Transport enquiry the undesirability of additional traffic being thrown on their roads. When they were no longer disturbed by road reconstruction and their staff was able to work under normal running conditions, they might anticipate more satisfactory results than those disclosed in the figures now submitted. The reports and accounts were adopted.

BRAZILIAN TRACTION, LIGHT AND POWER CO., LTD.—Mr. Miller Lash, presiding at the meeting on June 20th, said, in reference to the reconstruction and extension of the mechanic shops in Rio de Janeiro and São Paulo, their scope was not limited to repair work, but a great deal of material required for the company's business was manufactured in them more quickly and at less cost than if the material was imported. With regard to the telephone section of the enterprise, the installation of the automatic telephone system at Bello Horizonte, the capital of the State of Minas Geraes, was being proceeded with, and the telephone system in the neighbourhood of Cataguazes, consisting of about 1 000 telephones and 1 200 km. of toll lines, was being acquired. During the last year the long-pending dispute with the holders of the French issue of the second mortgage bonds of the Rio de Janeiro Tramway, Light and Power Co. had been settled on satisfactory terms, and on June 1st of the present year the first mortage bond issue of the São Paulo Tramway, Light and Power Co. was redeemed. Mr. A. W. K. Billings, chief engineer and a vice-president of the company, referred to the progress with the hydraulic developments at Serra and Parahyba, and expressed the opinion that the electrical business, both in Rio and São Paulo, was now secure against the injurious effect of even a serious drought. The report and accounts were adopted.

UNITED RIVER PLATE TELEPHONE CO., LTD.—Mr. H. M. Pease, presiding at the meeting on June 18th, said: In December last, an offer was made to the ordinary shareholders by the International Telephone and Telegraph Corporation of New York to purchase their holdings upon certain terms, of which you are aware, which offer was accepted by a majority of the ordinary shareholders. The company has continued to make fair progress, but the accounts have been adversely affected by the cancellation last October of the increase in the tariffs granted in October, 1922, without the company being heard. Consequently, we find ourselves only able to maintain the usual dividend upon the ordinary shares by drawing upon past profits, and instead of showing, as usual, an addition to the amount carried forward, we end the year with a reduced amount. A serious strike which took place in Rosario last July resulted in considerable loss before a settlement was arranged, and later in the year we were threatened

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with a strike in Buenos Aires. Many conferences were held with the men, but it was not until the early part of March that an arrangement was come to between the company and the employees. This arrangement will entail a considerable increase in the working expenditure, and we are now looking to the Argentine Government to sanction adjustments of the tariffs so as to enable the company to earn the reasonable return to which it has been accustomed. Our total stations have increased during the year by 16 684, and are now 194 566, and of these, 131 154 are in the Federal capital of Buenos Aires and suburbs, against 119 265. We have continued our programme of converting the manually-operated exchanges in the City of Buenos Aires to automatic, and a few weeks ago our most important exchange "Avenida," was successfully changed over to this system. We are continuing our automatic programme, and, at the present moment, equipment equal to 53 000 lines is in course of installation or manufacture. When these are completed—at about the end of 1931—the City of Buenos Aires will be approximately 90% automatic. The report and accounts were adopted.

WHITEHALL ELECTRIC INVESTMENTS, LTD.—Mr. Clive Pearson, presiding at the meeting on June 20th, said: You were advised by letter dated October 9th, 1928, of the sale of our holdings in the various Chilean and Mexican companies which then constituted the entirety of our investments. I consider we have made an advantageous sale both from the point of view of profit, and because our investments need no longer be confined to two countries only. Our investments having been sold as at January 1st, 1929, cum accrued interest and dividends, our gross income for the year amounted to the reduced sum of £517 105. After charging debenture interest and expenses and providing for income-tax, net revenue amounts to £292 193. The preference share dividend absorbs £187 500, leaving £104,693, to which has to be added the amount brought forward from last year of £80 001, and the amount previously applied in writing off discounts, etc., £915 706, making a total of £1 100 400. Your directors recommend a dividend of 2% for the year on the ordinary shares, with a bonus dividend of 18%, which will require £1 000 000, and leave a carry-forward of £100 400. Reference is made in the report to the formation of two subsidiary companies. As an investment or holding company it would not be our practice or policy to traffic in securities, and we have formed Hallminster Investments, Ltd., and Whitehall Canada, Ltd., as trading companies. These will act as preliminary investigators, and only the finally selected investments will take their place among the securities held direct by this company. Through the intermediary of Whitehall Securities Corporation, Ltd., we have acquired controlling interests in a number of companies operating electric undertakings in Devon and Somerset. So far as plans have matured, this enterprise will require an investment of some £750 000 over the next two or three years. Your directors are considering other investments in electrical and other public utility undertakings, in some of which, although not necessarily in all, we anticipate obtaining share control. The report and accounts were adopted.

METAL AND CHEMICAL PRICES.

TUESDAY, June 25th.

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£76 0 0	—	£1 15 0
Electro Wirebars	,,	£84 15 0	5s. 0d.	—
H.C. Wires, basis	per lb.	11 11/16d.	1/16d.	—
Sheet	,,	11 11/16d.	—	—
Phosphor Bronze—				
Wire (Telephone) basis	per lb.	1s. 2 11/16d.	1/16d.	—
Brass 60/40—				
Rod, basis	per lb.	9d.	—	—
Sheet ,,	,,	10 1/2d.	—	—
Wire ,,	,,	11 1/2d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£3 15 0	—	—
Galvanised Steel Wire, basis 8 S.W.G.	,,	£14 15 0	—	—
Lead Pig—				
English	per ton	£25 5 0	5s. 0d.	—
Foreign or Colonial	,,	£23 17 6	5s. 0d.	—
Tin—				
Ingot	per ton	£201 15 0	12s. 6d.	—
Wire, basis	per lb.	2s. 8d.	—	—
Aluminium Ingots	per ton	£95 0 0	—	—
Spelter	,,	£26 2 6	2s. 6d.	—
Mercury	per bottle	£22 5 0	—	—

Sulphur—Flowers, Ton £12 0 0 *Copper Sulphate*—Ton £25 to £25 10 0
,, Roll, ,, £10 10 0 *Boric Acid* (Crystals) ,, £30 0 0
Sulphuric Acid (Pyrites, 168°) Ton £6 15 0 *Sodium Chlorate*—Per lb. 2 1/2d.
Sodium Bichromate—Per lb. 3 1/2d.
Rubber—Para fine, 11d.; plantation, 1st latex, 10 1/2d.

.*. The metal prices are supplied by British Insulated Cables Ltd.

NEW COMPANIES.

R. S. MACKERETH, LTD.—Cap., £1 000. Electricians, manufacturers of and dealers in wireless apparatus, etc. Reg. Office: 11, Lord Street, Liverpool.

BAKER CLARKE AND CO., LTD.—Cap., £500. Electrical engineers and merchants, etc. Solicitors: Lach Smyrma and Co., 18, Old Compton Street, London, W.1.

ACME ELECTRIC WELDING AND MARINE SCALING CO., LTD.—Cap., £2 500. Electric and oxy-acetylene welders, etc. Reg. Office: 59, Govan Road, Glasgow, S.W.1.

CHESHAM AND DISTRICT ELECTRICAL INSTALLATION CO., LTD.—Cap., £100. To carry on business indicated by title. Reg. Office: 111, High Street, Chesham, Bucks.

SUNLIGHT AND HEALTH CENTRE (LEEDS), LTD.—Cap., £500. Medical and general electricians, proprietors of medical and electric baths, etc. Reg. Office: 63, Albion Street, Leeds.

PEACOCK AND WALLER, LTD.—Cap., £2 000. To acquire business of electrical engineers, etc., carried on by A. T. Peacock and F. Waller at Leicester Road, Hinckley, as "Peacock and Waller."

EASITIME, LTD.—Cap., £1 000. To acquire the business of merchant and dealer in electrical appliances, etc., heretofore carried on by C. J. L. Green at 45, Hallewell Road, Edgbaston, Birmingham.

REGIONAL RADIO, LTD.—Cap., £500. Radio engineers and contractors, wireless electricians, manufacturers of wireless apparatus and accessories, etc. Reg. Office: 9, Southampton Street, London, W.C.1.

T. G. HUNTER AND SONS, LTD.—Cap., £1 000. Electricians, electrical engineers, etc. Reg. Office: 3, St. James's Square, Manchester.

VIBRATONE CO., LTD.—Cap., £1 000. Manufacturers of and dealers in electrical instruments, apparatus, machines, accessories and goods, etc. Solicitors: E. C. Kilsby and Son, 21, College Hill, London, E.C.4.

ELECTRIC SPELLING SIGNS, LTD.—Cap., £5 000. To acquire from W. Stafford benefit of certain patents and foreign rights relating to electric sign controllers, etc. Reg. Office: 11, Southwark Street, London, S.E.1.

LONDON PLATINUM SCREW MFG. CO., LTD.—Cap., £1 000. Mfrs. of platinum, iridium screws and electrical parts and accessories, electro-metallurgical engineers, etc. Reg. Office: 116, Albany Street, London, N.W.1.

ELECTRIC CARBONS AND SUPPLIES, LTD.—Cap., £100. Electrical engineers, manufacturers of and dealers in wireless receivers' television instruments, carbons, projectors, etc. Reg. Office: 73/5, Albion Street, Leeds.

AUTO CALL CO., LTD.—Cap., £1 000. To carry on business of electrical engineers; to let on hire or hire-purchase, sell, deal in and manufacture articles of an electrical character, etc. Reg. Office: 27, Martin Lane, Cannon Street, London, E.C.4.

CHASETOWN AND DISTRICT ELECTRICITY CO., LTD.—Cap., £100 000. To acquire business of electricity distribution authorised by Chasetown and District Electricity Special Order, 1924, and carried on by Cannock Chase Colliery Co., Ltd. Reg. Office: Parliament Mansions, Victoria Street, London, S.W.1. (Public co.)

B.O.W. PATENTS, LTD.—Cap., £300. To adopt agreement with A. Wright and H. J. Osborn, to develop and turn to account inventions forming the subject of British, colonial and foreign patents comprised in said agreement, to carry on the business of electrical engineers, etc. Reg. Office: 451, Southbury Road, Enfield.

PROTOS ELECTRIC, LTD.—Cap., £1 000. To manufacture, export and import and deal in electrical apparatus, to adopt an agreement between Siemens Schuckertwerke A.G. and J. A. Milne for acquisition by latter of licence from former to sell in Great Britain goods bearing the trade mark "Protos." Reg. Office: New Bridge Street House, 30-34, New Bridge Street, London, E.C.4.

NORTHERN CABLES, LTD.—Cap., £500. Electricians, electrical and general engineers, manufacturers of and dealers in wireless component parts and accessories, telegraphic, telephonic, wireless and television apparatus and appliances, wires, cables, batteries, dynamos, generators, accumulators, insulators, magnetos, electrical signs, etc. Reg. Office: Wells Mills, Northgate, Huddersfield.

FARADEX-SERAPHONE CO., LTD.—Cap., £125 000. To acquire businesses (1) of Rooke Bros., Ltd., portable and mains wireless receiver manufacturers, etc., carried on at Cardington Street, Euston Road, London, N.W.1, with British patents, covering "A new and improved method of coupling thermionic valves for the amplification of electrical impulses, etc," and the trade mark "Faradex"; (2) of the Seraphone Co., Ltd., manufacturers of wireless sets, etc., with the trade marks "Seraphone," "Daneaphone" and "Orkestraphone." Reg. Office: Friars House, 39/41, New Broad Street, London, E.C.2. (Public co.)

BRITISH POWER AND LIGHT CORPORATION (1929), LTD.—Cap., £2 000 000. To acquire (1) not less than 90% of issued share cap. of North Wales Power Co., Ltd., and (2) not less than 90% of the respective share caps. of East Suffolk Electricity Distribution Co., Ltd., Trent Valley and High Peak Electricity Co., Ltd., South Somerset and District Electricity Co., Ltd., West Hampshire Electricity Co., Ltd., and Ringwood Electric Supply Co., Ltd., to carry on business of electric light and power co., electrical engineers and manufacturers, power or otherwise, manufacturers of and dealers in plant, etc. Reg. Office is at 27, Old Broad Street, London, E.C.2. (Public co.)

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COMMERCIAL INFORMATION.

County Court Judgments.

[NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debt. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*]

ATTRACTA SIGN ELECTRIC CO., Attracta Yard, Morriston. £16 9s. 7d. May 15th.

COLLER, J. AND F., 218, Hinckley Road, Leicester, wireless dealers. £11 7s. 8d. May 11th.

CORBETT, Mr. P. W., Stratford Road, Shirley, wireless dealer. £17 17s. 1d. May 10th.

COULSON, Fred A., Archway Stores, 273, Archway Road, Highgate, wireless factor £16 18s. 6d. May 14th.

ELECTRADIO CO., LTD., 25, Westbourne Grove, W., wireless dealers. £17 2s. 6d., May 14th; £21 13s. 11d., May 18th.

GARD, Mr. W., Townhall Chambers, Coleford, electrical engineer. £18 1s. 6d. April 15th.

HUBER, Mr. J. Meyer, 3, Chorley Lane, Leeds, electrical contractor. £12 5s. May 15th.

LITTLEWOOD, Mr. G. H., Church End, Finchley, wireless dealer. £17 1s. 1d. May 10th.

RAIES GRAMOPHONE SALON, 107, Devons Road, Bow, wireless dealers. £16 10s. 10d. April 15th.

SECRETT, Mr. B., 57, Dingwall Road, West Croydon, wireless dealer. £12 19s. 10d. May 14th.

SHAW, Mr. W. A., 23, Empress Avenue, Manor Park, wireless engineer. £18 17s. 6d. May 16th.

SMITH, Mrs. L. M., 249, Ewell Road, Surbiton, wireless dealer. £17 3s. 5d. May 14th.

Deeds of Arrangement.

BENNETT, Maurice Lee, War Memorial Square and Orwell House, Norwich Road, Fakenham, wireless dealer. Dated June 12th, filed June 19th. Trustee, F. G. F. Platten, 7, Queen Street, Norwich, I.A. Liabilities unsecured, £1 395; assets, less secured claims, £326.

GARDNER, Colin Hamilton, trading as MELLOWTONE, 27, High Street, Stourbridge, wireless accessories dealer. Dated June 14th, filed June 18th. Trustee, E. P. Q. Carter, 33, Waterloo Street, Birmingham, C.A. Liabilities unsecured, £874; assets, less secured claims, £431.

HARDIMAN, Horace John, trading as ISCA ELECTRICAL ENGINEERING CO., 177, Sidwell Street, Exeter. Dated June 17th, filed June 24th. Trustee, H. H. Fielding, Westminster Bank Chambers, High Street, Exeter, C.A. Liabilities unsecured, £1 139; assets, less secured claims, £401.

Receiverships.

ALSACE-LORRAINE AND GENERAL PRODUCTS CO., LTD. W. B. Paton, C.A., of 8, Breams Buildings, Chancery Lane, W.C., was appointed receiver and manager on June 15th, 1929, under powers contained in debenture dated October 27th, 1928.

RICHMORE VALVE CO., LTD. C. H. Shelvoke, of 33, New Hall Street, Birmingham, was appointed receiver on June 7th, 1929, under powers contained in debentures dated October 18th, 1928.

TRIOTONE, LTD. S. B. Hereford, of 41, Wigmore Street, W., was appointed receiver and manager on June 12th, under powers contained in debenture dated June 7th, 1929.

London Gazette, etc.

Companies Winding-up

EARLSDON RADIO SUPPLIES LTD. Winding-up order, June 20th.

THE RADIO ELECTRIC CO. (BOURNEMOUTH), LTD., 188, Old Christchurch Road, Bournemouth. Winding-up order, June 18th.

Companies Winding-up Voluntarily.

ASTRA DYNAMO CO., LTD. By reason of its liabilities. June 14th. H. C. Faulkner, 27, Disraeli Road, Putney, S.W.15, appointed as liquidator. Meeting of creditors at Gladstone Club, Goldhawk Road, Shepherds Bush, W.12, on Thursday, July 4th, at 10.30 a.m.

MIDLAND FACTORS, LTD. By Extraordinary Resolution, June 11th. R. V. Newland, 159, Great Charles Street, Birmingham, appointed as liquidator.

PERRING-THOMAS WIRELESS SYNDICATE, LTD. By reason of its liabilities, June 20th. A. Williams, 82, Queen's Road, Brighton, appointed as liquidator.

Bankruptcy Information.

DEAN, Joseph, electrician, lately 4, Gogerddan Place, Aberystwyth. First meeting, July 1st, 2 p.m., 3, Baker Street, Aberystwyth. Public examniation, July 11th, 2 p.m., 3, Baker Street, Aberystwyth.

PENMAN, Alexander Nisbet, electrical engineer, 35, Ivanhoe Crescent, Wishaw, Lanarkshire. Estates sequestrated, June 21st. Meeting to elect the Trustee and Commissioners at 11 a.m. on Wednesday, July 3rd, within the Solicitors' Library, County Buildings, Hamilton. A composition may be offered at this meeting.

WARNES, Elizabeth Ann (widow), 10, Crescent Gate, Wilmslow Road, Rusholme, Manchester, electrical and radio engineer, formerly trading as "VICTORIA RADIO CO.," but now as E. A. WARNES AND CO. First meeting, July 2nd, 2.30 p.m., Official Receiver's Offices, Byrom Street, Manchester. Public examination, September 13th, 10 a.m., Court House, Quay Street, Manchester.

Partnership Dissolved.

NELSON AND HALEY (Herbert NELSON, Percy HALEY, and Simeon LISTER), electrical engineers, 25, Grosvenor Road, Manningham, Bradford, by mutual consent as from May 1st, 1929.

Bankruptcy Proceedings.

BLOOD, Ralph, 44 and 46, Station Road, Padiham, Lancs, wireless dealer and electrician. The public examination herein was held last week at the County Court House, Bankhouse Street, Burnley, when the debtor attributed his failure to insufficient turnover and keen competition. A statement of affairs was disclosed showing ranking liabilities of £476 and there was a deficiency of £309. It would seem that the debtor commenced trading on his own account as a wireless engineer and electrical dealer in September, 1923, with £80 capital. He used the front room of the dwelling house at 20, St. John's Road, Padiham, as a shop, and continued his employment as an engineer, his wife supervising the business. It was successful for about five years, and in March, 1928, he left his employment, and devoted his time entirely to his business. His weekly turnover since March, 1928 has been £10, with a gross profit of 15 per cent., against weekly expenses of £2 17s. 6d., and drawings amounting to £4. He became aware of his position six weeks before he filed his petition. The house at St. John's Road, Padiham, was purchased in 1922 in the joint names of himself and his wife for £390, of which £300 was advanced on mortgage by a local building society. Of that amount £257 13s. was still owing. The examination was adjourned for closing.

JOHN, Daniel Blodanfryn, trading as D. B. JOHN AND BROTHERS, 8, Commercial Place, Pontycymmer and the Nanthir Stores, Nanthir Road, Blaengarw, Glamorganshire, ironmonger and electrical engineer, etc. The public examination of this debtor was held on June 20th at the County Court, Wyndham Street, Bridgend. The debtor stated that the real cause of his failure was the loss on a contract for wiring 1 300 houses, through quoting 14s. per point, whereas the actual cost worked out at 18s. per point. His father had lent him £485, but that amount had not been included in the deficiency account, which amounted to £1 005. The examination was adjourned in order that the debtor might submit additional accounts.

McBEAN (John Horace), trading as H.W.D. BATTERY CO., 29, Bradford Road, Batley Carr, electrical engineer. This debtor, examined by the Deputy Official Receiver, said his liabilities were £386, assets £17, and deficiency £369. In 1915 he commenced as an electrical engineer at Clarence Mills, Bradford Road, Batley, with £10 capital. On February 8th, 1921, the business was formed into a limited company as J. H. McBean, Ltd. On April 26th, 1923, a resolution to wind up the company was passed, and Appleyard and Co. were the liquidators. Debtor further said he again commenced business on his own account as an electrical engineer at 14, South Street, Dewsbury, without capital, but owing to ill-health he gave up the business in October, 1923, at which time he had £100 liabilities. In March, 1926, he recommenced business at 29, Bradford Road, Batley Carr, without capital, as the H.W.D. Battery Co. He had promise of capital, but only £5 was forthcoming. His deficiency account showed that on March 1st, 1928, his liabilities exceeded his assets by £210, but an amended account showed that that figure was wrong and the liabilities over assets were £337. His business had been a failure, except just at the commencement of his career. Lack of capital, ill-health and bad trade were the causes of failure. There were twenty-eight judgment and suing creditors at the date of the receiving order, and a commitment order issued against debtor led him to file his petition. The principal creditors' claims dated back to 1923 and 1924. The examination was concluded.

THE LEAD MARKET.

A slightly more active tone was seen in the market last week, and, according to James Forster and Co., prices opened firmer on Monday and slowly advanced until on Wednesday £24 1s. 3d. was paid for June. The American price is unchanged at 7 cents.

Closing prices on June 21st were £23 16s. 3d. for June, £23 15s. for July, £23 13s. 9d. for August, and £23 12s. 6d. for September, 3s. 9d. to 1s. 3d. per ton higher on the week.

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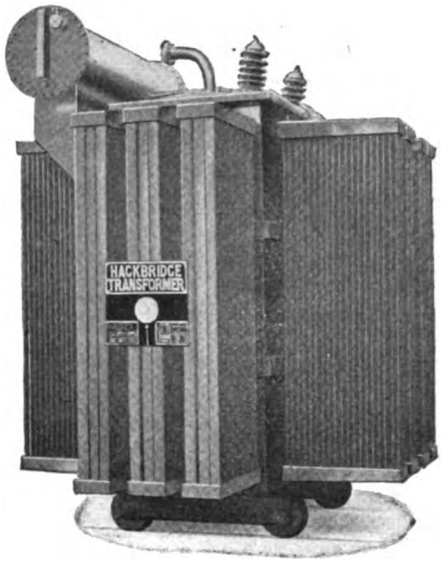

A MOST IMPORTANT LINK IN THE "GRID"

The Central Electricity Board of Great Britain has decided that the Metropolitan area shall be equipped with over half a million Horse Power of "Hackbridge" Transformers. These will be supplied in Units of 45,000 kVA and 30,000 kVA.

HACKBRIDGE TRANSFORMERS

Advertisement of the Hackbridge Electric Construction Co., Ltd., Walton-on-Thames, Surrey.

Telegrams: "Electric, Walton-on-Thames." *Telephone: Walton-on-Thames 760/1.*

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PATENT RECORD.

The following information is prepared from the Illustrated Official Journal (Patents) by permission of the Controller of H.M. Stationery Office. Printed copies of full Patent Specifications, when accepted, may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at 1s. each.

Specifications Accepted.

310 829 S. G. S. Dicker (N.V. Philips' Gloeilampenfabrieken). Electric discharge tubes. (17/7/28.)
279 861 Dr. S. Loewe and W. Kunze. Receiving-circuits employing local oscillation, applicable for use with multiple thermionic valves. (28/10/26.)
280 214 Siemens and Halske A.-G. Method of and means for electrically controlling a sub-station from a remote main station. (3/11/26.)
310 759 British Thomson-Houston Co., Ltd., and A. P. Young. Electromagnetic acoustic devices. (30/11/27.)
310 760 W. R. Bullimore. Thermionic valves. (30/11/27.)
310 984 A. Reyrolle and Co., Ltd., B. H. Lesson, and O. C. F. King. Electrical selective remote-control systems. (6/12/27.)
310 761 A. H. Marks and P. Russell [legal representatives of E. C. R. Marks (deceased)]. (A. O. Smith Corporation). Still, more particularly for use in oil-refining, and method of making same by electric arc-welding. (24/12/27.)
283 208 Fansteel Products Co., Inc. Electrolytes for electrolytic rectifiers or the like. (7/1/27.)
310 902 Hotpoint Electric Appliances Co., Ltd., and W. J. Sims. Electric heating units. (3/1/28.)
310 986 J. Neale. Moving-coil apparatus for controlling illumination and like purposes. (4/1/28.)
283 165 Allgemeine Elektricitats-Ges. Device for transmitting signals from the railway track to a moving train. (5/1/27.)
310 903 Edison Swan Electric Co., Ltd., and L. H. Soundy. Thermionic valves. (24/1/28.)
310 764 Edison Swan Electric Co., Ltd., and L. H. Soundy. Circuit arrangements employing thermionic valves. (24/1/28.)
310 766 Nalder Bros. and Thompson, Ltd., and C. L. Lipman. Electric alternating current measuring instruments. (26/1/28.)
310 824 H. F. Joel, Sen. Portable electric battery lamps. (27/1/28.)
284 357 Dr. E. Giebe and Dr. A. Scheibe. Piezo-electric crystals. (28/1/27.)
310 826 G. Heptonstall and W. Shaw. Service and meter boards for electric supplies. (30/1/28.)
285 056 Siemens-Schuckertwerke A.-G. Driving of reciprocating machines by asynchronous electric motors. (10/2/27.)
310 787 Automatic Telephone Mfg. Co., Ltd., and W. H. Paulett. Automatic cleaning devices for instrument dials and like designation plates, etc.
310 915 N. W. McLachlan. Electric oscillation generators. (3/2/28.)
290 152 Westinghouse Brake and Saxby Signal Co., Ltd. Electrical controlling-apparatus. (7/5/27.)
310 997 A. Stanley. Wireless loud-speakers, microphones, and the like. (6/2/28.)
285 373 I.G. Farbenindustrie A.-G. Manufacture of electrolytic zinc. (14/2/27.)
311 011 E. Elliot. Terminal for electric leads. (9/2/28.)
311 013 W. T. Taylor. Electrical transmission and/or distribution systems. (9/2/28.)
285 062 Neufeldt and Kuhnke Betriebs-Ges. Photo-electric signalling, regulating, or measuring device. (10/2/27.)

Applications for Patents.

April 10th.

11 074 Associated Electrical Industries, Ltd., and N. R. Davis. Induction furnaces.
11 093 E. A. G. Baker and W. A. Lake. Electric switches.
11 141 British Thomson-Houston Co., Ltd. Windings for transformers. (13/4/28, France.)
11 033 C. B. Brown. Coupling magneto-electric generators, etc., to driving shafts.
11 086 E. P. S. Cattle. Electric junction boxes.
11 087 E. P. S. Cattle. Conduit fittings.
11 083 L. A. Chapman. Wireless telephony, etc.
11 090 Drake and Gorham, Ltd., and A. F. Harmer. Electric switches.
11 131 W. G. Graham. Thermionic valves.
11 127 C. M. L. Grundy. Telephone mouthpieces.
11 098 T. S. Horgan. Wireless aerial lead-in, etc.
11 039 R. J. Jay. Terminals for electric cables.
11 096 A. P. Lundberg and Sons, Ltd., and G. Pegg. Combined switches and wall connectors.
11 151 A. J. Payne. Electric discharge tubes.
11 147 W. Rogers. Electric switches.
11 128 F. Rother. Light electric cells. (14/5/28, Germany.)
11 078 J. H. Runbaken. Portable electric lamps.
11 085 W. B. Savage. Apparatus for smoothing pulsations of electric rectifiers.
11 111 Siemens-Schuckertwerke A.G. Manufacture of telephone cables. (23/5/28, Germany.)
11 152 H. J. Taylor. Electric discharge tubes.
11 140 Wireless Music, Ltd. Sound radiating apparatus.

April 11th.

11 202 Allmanna Svenska Elektriska Aktiebolaget. Reverse current relays (14/4/28, France.)
11 226 British Thomson-Houston Co., Ltd. Thermionic valve amplifying systems. (11/4/28, U.S.)
11 227, 11 229 British Thomson-Houston Co., Ltd. Electrically wound clocks. (12/4/28, U.S.)
11 228 British Thomson-Houston Co., Ltd. Thermionic electrodes. (12/4/28, U.S.)
11 272 F. G. G. Davey and Wireless Music, Ltd. Electromagnetic vibratory devices.
11 300 J. C. N. Eastick. Electrical wander plug.
11 287 E. F. Ehrhart (Soc. des Usines Chimiques Rhone-Poulenc). Photo-electric cells.
11 215, 11 216, 11 217 F. G. Flower and R. May. Combined wireless receivers and gramophones.
11 197 General Electric Co., Ltd. Measuring apparatus, etc.
11 297 D. N. Handcastle. Magnetos.
11 223, 11 224, 11 225 International General Electric Co., Inc. Manufacture of insulating material. (11/4/28, Germany.)
11 282 J. H. Keep. Device for use with telephone instruments.
11 247 Marconi's Wireless Telegraph Co., Ltd. Commutating, etc., devices.
11 286 A. Negromanti. Electric heating appliances.
11 168 R. Neill. Inductance coils.
11 271 E. R. Ritter and Scherbius and Ritter. Vacuum switches. (2/5/28, Germany.)
11 167 H. R. Soutter. Electrically heated irons, etc.

April 12th.

11 310 C. P. Allinson. Thermionic amplifiers.
11 348 Allmanna Svenska Elektriska Aktiebolaget. Induction furnaces. (21/4/28, Sweden.)
11 391 Belling and Lee, Ltd., and W. J. Byrne. Electrical plug connections.
11 328 L. Blundell and W. H. Curtis. Induction coils.
11 327 H. Courteen. Imitation candle lamps.
11 349 E. Fabianke. Electric illumination for tents.
11 341 Graham Amplion, Ltd., and A. D. A. Hodgson. Electricity supply means for wireless apparatus.
11 342 Graham Amplion, Ltd., and C. F. Phillips. Incandescent lamps and holders.
11 311 E. K. Gray. Electric boiler.
11 339 T. Harden and H. A. Mepham. Reinforced lead-covered cables.
11 351 L. P. Haussauer. Automatic electric water heaters.
11 361 W. T. Henley's Telegraph Works Co., Ltd., and H. C. Hoban. Electric circuit testing device.
11 408 I.G. Farbenindustrie A.G. Electrolysis of molten substances. (14/4/28, Germany.)
11 326 F. W. Lanchester. Armatures for dynamos, etc.
11 405 Marconi's Wireless Telegraph Co., Ltd. Means for combining electrical energies, etc. (12/4/28, U.S.)
11 404 Siemens and Halske A.G. Manufacture of discharge devices. (12/4/28, Germany.)
11 336 W. J. Taylor. Wireless speaker unit for gramophones.
11 322 A. J. Wilkins. Wireless aerials.

April 13th.

11 497 A. G. Clark, W. O. Heyne and Plessey Co., Ltd. Wireless cabinets.
11 454 H. Clarke and Co. (Manchester), Ltd., and H. Ingham. Electrical energy supply systems.
11 471 W. T. Henley's Telegraph Works Co., Ltd., and W. H. Nichols. Electric cut outs.

April 15th.

11 505 J. E. Adey. Electrical driving means.
11 549 A. Boeker and Norddeutsche Sekabeelwerke A.G. Machines for laying cables.
11 589 British Thomson-Houston Co., Ltd. Power installations. (14/4/28, U.S.)
11 687 British Thomson-Houston Co., Ltd. Switch-operating mechanism. (13/4/28, U.S.)
11 653 Burndept Wireless (1928), Ltd. Control mechanism for gramophone motors.
11 567 D. A. Christian and Siemens Bros. and Co., Ltd. Telephone control systems, etc.
11 506 S. O. Cowper-Coles. Talking pictures.
11 599 W. J. Davis. Variable resistance devices.
11 596 J. W. Dennis. Accumulator holders.
11 680 Electrical Research Products, Inc. Sound transmission systems. (4/5/28, U.S.)
11 548 J. Engler and Norddeutsche Seekabelwerke A.G. Machines for laying cables.
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11 546 P. Webber. Electric lamp stands.

COMING EVENTS.

Friday, June 28th.

Electrical Contractors' Association.—Bournemouth. Annual Conference. Paper by Mr. H. R. Taunton on "Possibilities for Contractors in Rural Electrification"; 9.30 *a.m.* Short address by the new President, Mr. H. Willoughby Ellis, 12 noon.

Physical Society.—Imperial College of Science, Imperial Institute Road, South Kensington. Demonstration of an Apparatus for the Measurement of Electrical Resistance at High Temperatures, by J. L. Haughton; Papers on "The Relation between Hydrogen Pressure and Filament Resistance in a Tube containing Glowing Tungsten," by Teresa J. Dillon; "The Band Systems of Titanium Oxide," by Frances Lowater; and "The Absolute Measurement of Sound Intensity," by F. D. Smith, 5 *p.m.*

Monday, July 1st.

Royal Institution.—21, Albemarle Street, London. General meeting. 5 *p.m.*

Tuesday, July 2nd.

Institution of Electrical Engineers (South Midland Centre). Summer meeting. Visit to the Avonmouth Docks.

Electrical Contractors' Association (Derby Branch).—Ordinary meeting. 5 *p.m.*

Tuesday, July 2nd—Thursday, July 4th.

North-East Coast Institution of Engineers and Shipbuilders.—Summer meeting. Newcastle-on-Tyne.

Wednesday, July 3rd.

Electrical Contractors' Association (Bath Sub-Branch).—Ordinary meeting.

Electrical Contractors' Association (London Branch).—15, Savoy Street, Strand, London. General meeting.

Electrical Contractors' Association (Southern Branch).—Ordinary meeting.

Electrical Contractors' Association (Cardiff Branch).—Ordinary meeting. 2.30 *p.m.*

Wednesday, July 3rd—Friday, July 5th.

Tramways and Light Railways Association.—Sheffield. Annual Congress.

Thursday, July 4th.

Electrical Contractors' Association (Newcastle Branch).—Ordinary meeting. 11 *a.m.*

Electrical Contractors' Association (Bristol Branch).—Ordinary meeting. 3.15 *p.m.*

Friday, July 5th.

Overhead Lines Association.—Summer meeting. Charabanc tour in the Mid-Cheshire area, starting from Winsford (L.M. & S.), 12.15 *p.m.*

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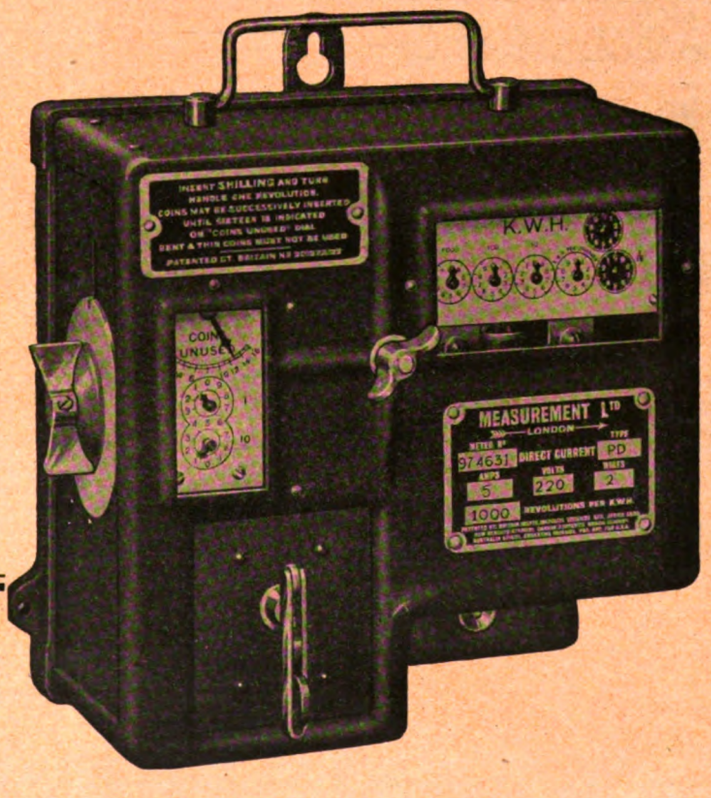

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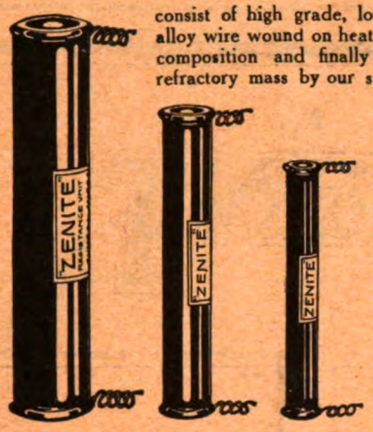

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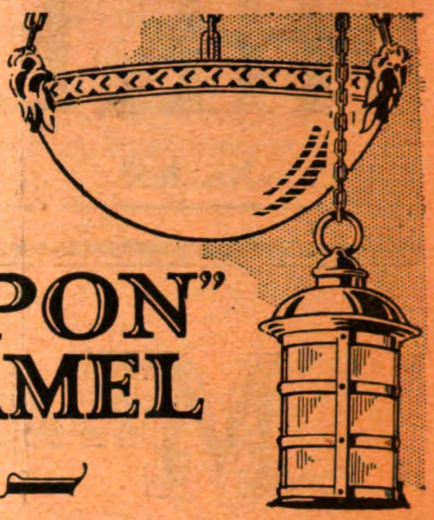

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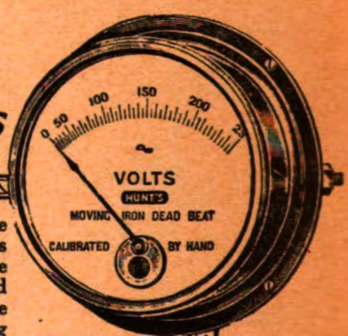

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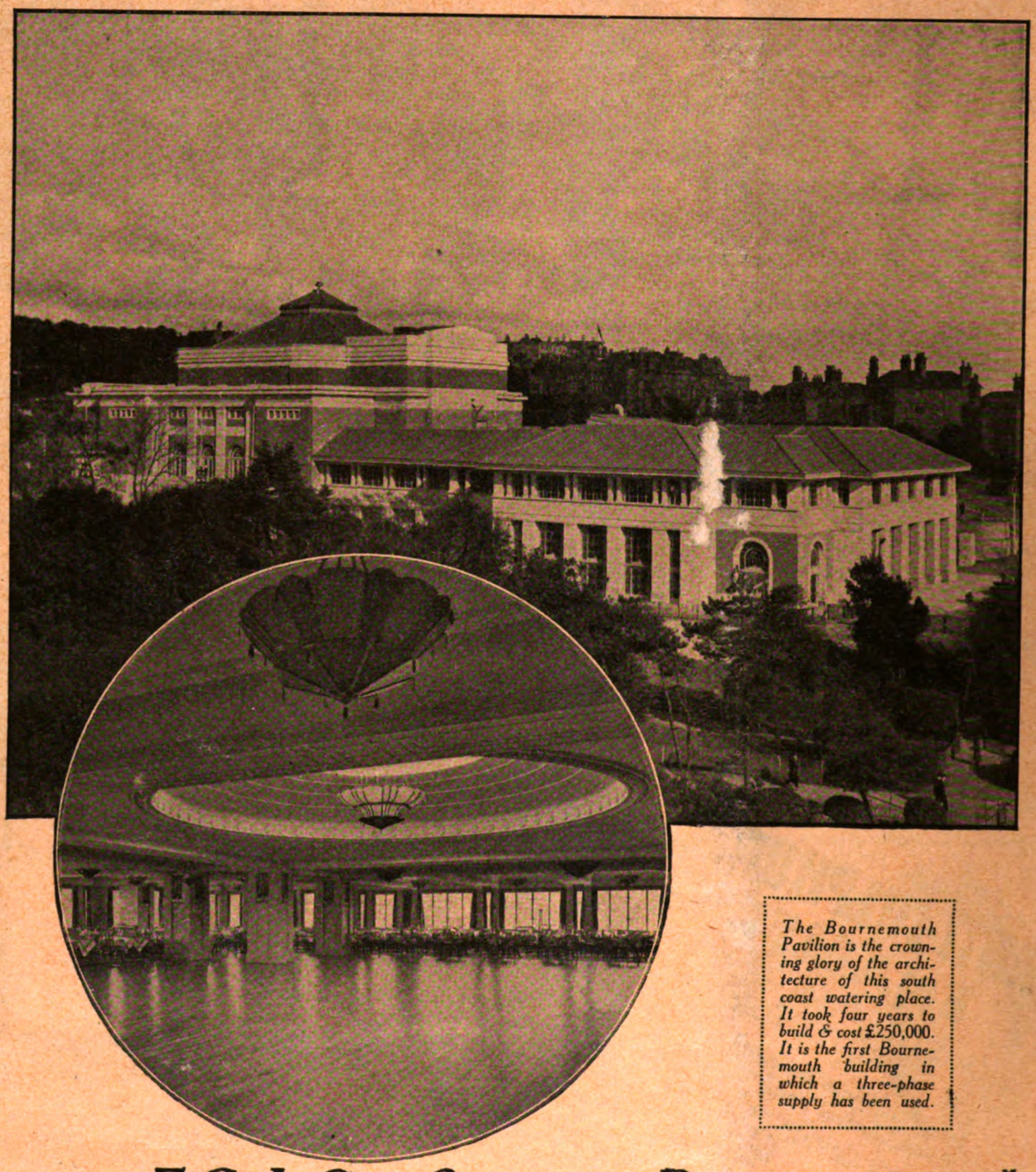

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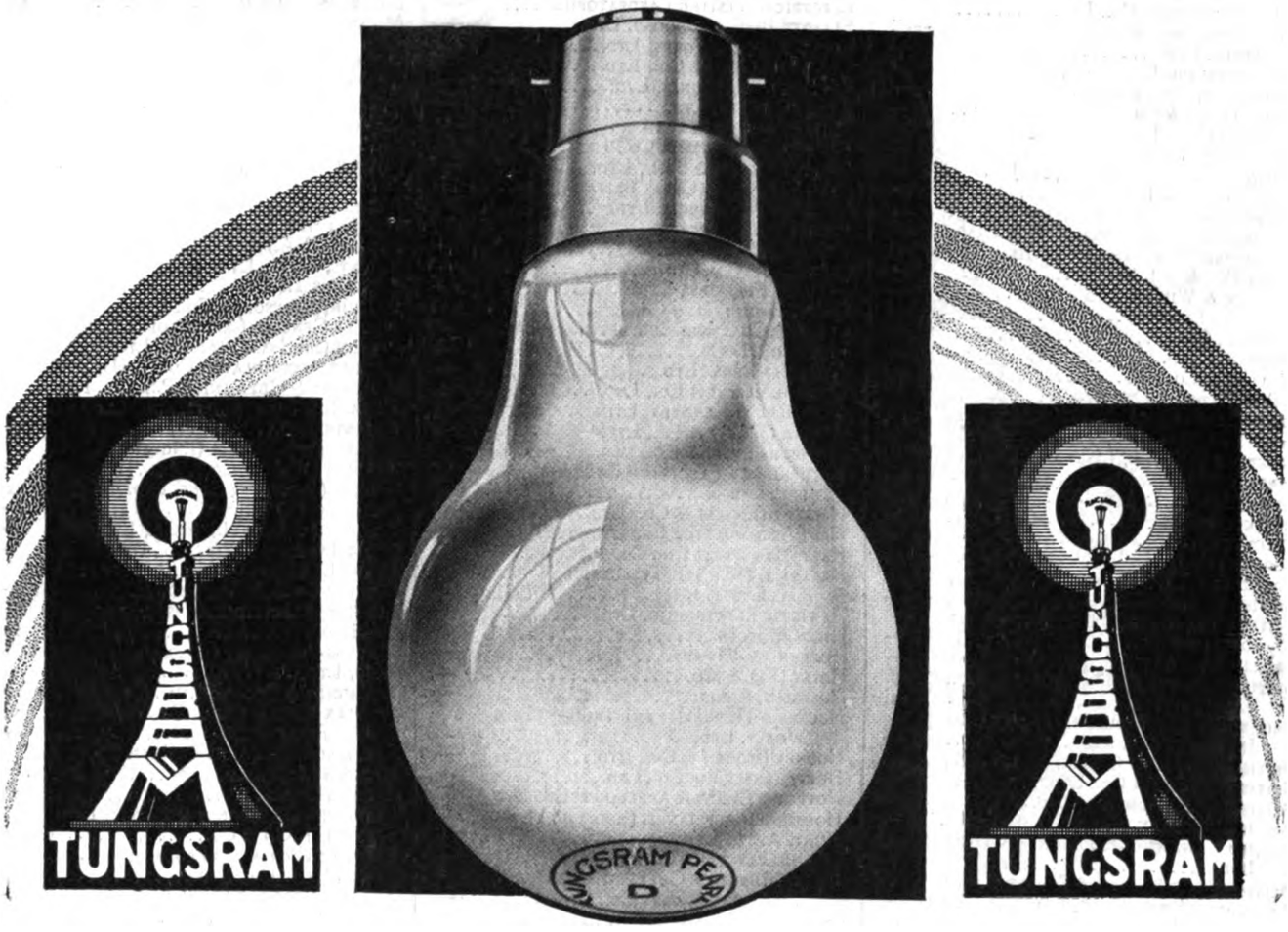

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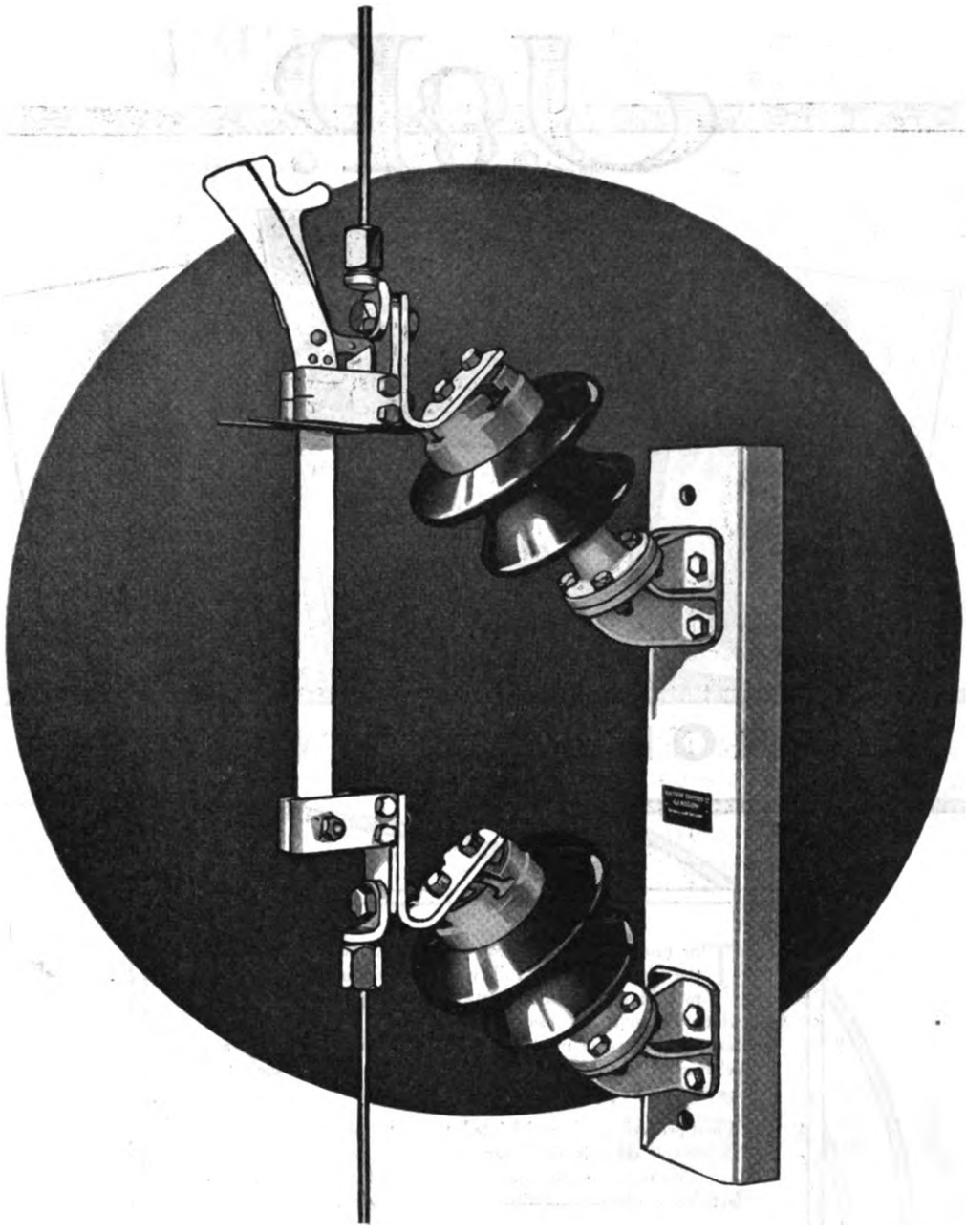

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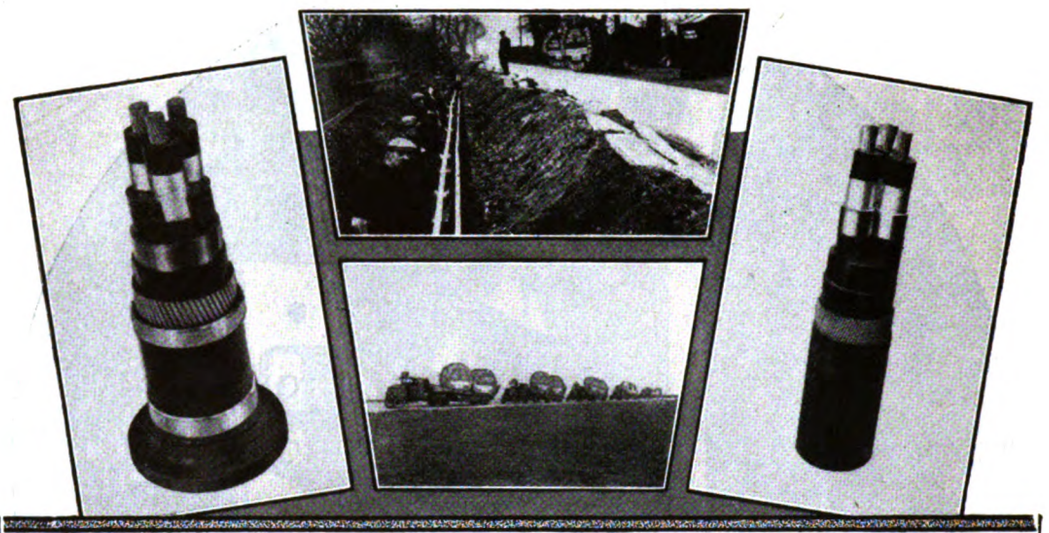

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The problem of 33,000-volt cable transmission is solved by the "H" and "H.S.L." types of cable, in which, by the metallised layer immediately over the paper insulated cores, which expands *and contracts* along with the dielectric, the formation of voids in the dielectric is obviated, the fillers are relieved of all electrical stress, and the stresses in the dielectric are made purely radial.

When properly made and jointed, the factor of safety of such a 33,000-volt cable is ample and permanent, as shown by our "stability tests" made on the many miles of such cable manufactured and laid by us within the last few years.

We have experimental and research work in progress on cables for still higher voltages. The results so far achieved are very promising, but it has always been our deliberate policy to make absolutely certain before placing any such products on the market. When the time comes for us to do so, our customers can be quite sure that this problem also has been solved beyond possibility of failure.

ELECTRICAL ENGINEERS J.&P. CABLE MAKERS

Johnson & Phillips, Ltd.
Charlton · London · S.E.7

London Office & Stores:
Columbia House, Aldwych, W.C.2

THE MARK THAT MEANS THAT "LITTLE MORE" IN QUALITY

CABLES OVERHEAD LINES SWITCHGEAR TRANSFORMERS

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"The Lamp with Two Skins"

The Lamp that attracts attention–

Whilst glareless lighting is now universally recognised as an enormous advance on the employment of the clear glass lamp, and our Pearl lamps discreetly hide the glare of the filament—we particularly recommend

CRYSELCO

Gasfilled OPAL LAMPS

The ultimate in glareless lighting

because the famous two skin construction not only ensures a brilliant white light with a gently diffused radiance but means actually less deterioration in use. That is why they attract such wide attention.

SEND FOR NEW PRICE LISTS

Home Branches:

BRIGHTON: 35, Duke Street. 'Phone: Brighton 5512.

BIRMINGHAM: 40-41, Clarence Chambers, 39, Corporation Street. 'Phone: Midland 5852.

NEWCASTLE-ON-TYNE: 27, Grey Street. Telegrams: "Cryselco, Newcastle-on-Tyne." 'Phone: Central 3295.

GLASGOW: 23, Douglas Street. Telegrams: "Starter, Glasgow." Phone: Central 1253.

LONDON: Thanet House, 231-2, Strand, W.C.2. Telegrams: "Cryselco, Estrand, London." 'Phones: Central 3016-7-8.

BRISTOL: All Saints' Chambers, 41, High St. 'Phone: Bristol 8069.

LEEDS: 11, New Station Street. Telegrams: "Cryselco, Leeds." 'Phone: Leeds 27866.

MANCHESTER: Douglas Chambers, 63, Corporation Street. Telegrams: "Cryselco, Manchester." 'Phone: Blackfriars 4871-2.

CARDIFF: 30, Charles Street. 'Phone: Cardiff 7466.

CRYSELCO LTD.,
Kempston Works,
BEDFORD.

Telegrams:
"Cryselco, Kempston."
Telephone:
Bedford 3277 & 3278.

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BY APPOINTMENT

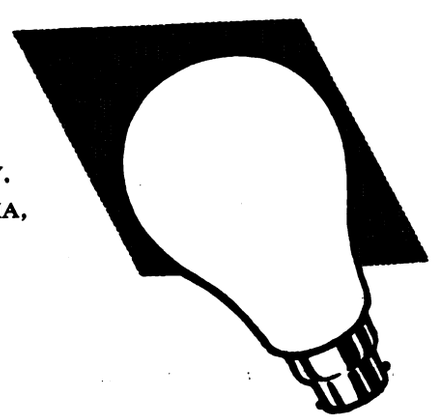
A great deal, when it's a question of selling a good Pearl Lamp.

Sell ROYAL "EDISWAN"

Good lamps with a good name.

15, 25, 40, 60 and 100 watt sizes (Standard Voltages) sell at less than Clear Lamps.

BY APPOINTMENT



THE EDISON SWAN ELECTRIC CO., LTD.,
123/5, Queen Victoria Street, London, E.C.4.
Works: Ponders End, Middlesex.

Depots in all the Principal Towns, and
AUSTRALIA: ADELAIDE, MELBOURNE, BRISBANE, SYDNEY.

Agents in PORTUGAL, MALAY STATES, SOUTH AFRICA, INDIA, CEYLON AND NEW ZEALAND.

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MISCELLANEOUS ADVERTISEMENTS.

All classified advertisements 2/- for the first line and each line of capitals; 1/- every other line (10 words to a line); Semi-display 12/- per column inch.

TENDERS INVITED. SALES BY AUCTION. LEGAL NOTICES PARTNERSHIPS. AGENCIES.
BUSINESSES FOR SALE AND WANTED. PREMISES FOR SALE, TO LET, AND WANTED. FOR SALE
APPOINTMENTS VACANT AND WANTED. EDUCATIONAL ANNOUNCEMENTS. PATENTS
PATENT AGENTS. PLANT AND MACHINERY FOR SALE AND WANTED. MISCELLANEOUS

Announcements of this description *must be prepaid.* Replies to Advertisements can be addressed to the Office to be called for, but where these replies are to be sent on to Advertiser by Post, 6d. must be added for postage

'Phone: City 0244 (10 lines). **"THE ELECTRICIAN" ADVERTISEMENT DEPARTMENT, Bouverie House, 154, Fleet Street, London, E.C.4.** Wire: "Bembrotric, Fleet, London."

REGISTERED ELECTRICAL INSTALLATION CONTRACTORS

PLACE YOUR INSTALLATION WORK WITH FIRMS ON THE NATIONAL REGISTER OF ELECTRICAL INSTALLATION CONTRACTORS.

THE National Register is an independent institution representing all bodies connected with the Electrical Industry, and grants to contracting firms satisfying its requirements the right to use this sign. Particulars on application to Secretary, 1, Lincoln's Inn Fields, London, W.C.2.

TENDERS INVITED.

CITY OF CARLISLE.

ELECTRICITY DEPARTMENT.

TENDERS are invited for the supply, delivery and erection of Switchgear for use in an 11 000 Volt 3-phase, 50 cycle Substation.

Specification and Drawing may be obtained from the undersigned on payment of Two Guineas, which sum will be refunded provided a *bona fide* tender has been sent in and not withdrawn.

Tenders, endorsed "Tenders for E.H.T. Switchgear" and sealed with wax, to be sent to the undersigned at the Electricity Offices, Victoria Viaduct, Carlisle, not later than 12 noon Friday, July 12th, 1929.

The lowest or any tender will not necessarily be accepted.

CHAS. W. SALT, M.I.E.E., City Electrical Engineer.

Electricity Offices, Victoria Viaduct, Carlisle.
June 11th, 1929.

COUNTY BOROUGH OF SUNDERLAND.

ELECTRICITY DEPARTMENT.

THE Corporation of Sunderland are prepared to receive Tenders, from actual makers only, for the supply of the following items for the twelve months ending September 30th, 1930.

Specifications and forms of tender may be obtained from the General Manager, Electricity Offices, Dunning Street, Sunderland, upon payment of a deposit of ten shillings for each specification and form of tender (in duplicate), which deposit will be returned after a *bona fide* tender has been received and adjudicated upon.

In writing for specifications, applicants should state for which of the following Sections they are required, viz:—

Paper Insulated, Lead Sheathed Cable, for general main laying requirements.
Rubber Insulated Wire.
Consumers' Meters.
Incandescent Lamps, Gas Filled and Vacuum.

Sealed tenders (which must be upon the forms provided with the specifications), addressed to "The Town Clerk, Town Hall, Sunderland," and endorsed "Tender for Electricity Supplies," must be delivered at my office not later than first post on Monday, July 8th, 1929.

The Corporation do not bind themselves to accept the lowest or any tender.

H. CRAVEN, Town Clerk.

Town Hall, Sunderland.
June 1st, 1929.

CITY AND ROYAL BURGH OF DUNDEE.

ELECTRICITY DEPARTMENT.

THE Corporation invites Tenders for the supply of: EXTRA HIGH TENSION and LOW TENSION PAPER INSULATED LEAD-COVERED AND DOUBLE STEEL TAPED ARMOURED CABLE, all to B.E.S. Specification, for working pressures up to 6 600 volts and 660 volts respectively

Specifications, quantities, etc., may be obtained on application to the undersigned.

Tenders (sealed in envelopes provided) to be lodged with the Town Clerk, City Chambers, Dundee, not later than by Wednesday, July 10th, 1929.

The Corporation does not bind itself to accept the lowest or any Tender.

D. H. BISHOP, B.Sc., M.I.E.E., General Manager and Engineer.

Electricity Supply Department, Dudhope Crescent Road, Dundee.
June 24th, 1929.

STAFFORDSHIRE EDUCATION COMMITTEE.

INSTALLATION OF ELECTRIC LIGHT.

TENDERS are invited from firms whose names appear on the National Register of Electrical Installation Contractors for the installation of electric light in the existing Kingswinford Brockmoor Council School and in new buildings now in course of erection on the adjoining site. A specification and drawings may be obtained by application to Messrs. Moffett, Rosher and Mann, Consulting Engineers, Union Chambers, Temple Row, Birmingham, with a cheque for a deposit of £5 5s., which will be returned upon the submission of a *bona fide* tender. Tenders endorsed "Lighting Installation, Kingswinford Brockmoor Council School" must be delivered by the 2nd July, 1929, to the undersigned.

F. A. HUGHES, Director of Education.

County Education Offices, Stafford.
May 29th, 1929.

NOTICE.

ELECTRICITY (SUPPLY) ACT, 1926.

NORTH-EAST ENGLAND ELECTRICITY SCHEME, 1929.

WHEREAS the Electricity Commissioners have prepared and transmitted to the Central Electricity Board a Scheme bearing the above short title and relating specifically to—

The Administrative Counties of Durham and Northumberland;
Parts of the Administrative Counties of The East Riding of Yorkshire and The North Riding of Yorkshire;
The City and Borough of Newcastle-upon-Tyne;
The County Boroughs of Darlington, Gateshead, South Shields, Sunderland, Tynemouth, Middlesbrough and West Hartlepool;

and dealing with the matters mentioned in Section 4 (1) of the Electricity (Supply) Act, 1926.

Notice is hereby given that the Central Electricity Board have caused the said scheme to be published and that any authorised undertakers or other persons interested in the said Scheme and desiring to make representations thereon may do so by forwarding the same by registered letter addressed to the undersigned and posted not later than the 30th day of July, 1929. Copies of the said Scheme and of a volume of Particulars supplementary thereto may be obtained at the prices of One shilling and sixpence and Three shillings and sixpence each respectively from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2, and 120, George Street, Edinburgh.

Dated this 24th day of June, 1929.

RICHARD H. FOX, Secretary to the Central Electricity Board.

Trafalgar Buildings, 1, Charing Cross, London, W.C.2.

EDUCATIONAL NOTICES.

EXAMINATIONS HELD BY THE INSTITUTION OF ELECTRICAL ENGINEERS.

MR. A. J. ANIDO, B.Sc., A.C.G.I. (late R.E.), specialises in the personal preparation of candidates in all subjects of the above examinations. Arrangements are made to suit those engaged in business.

60, Chancery Lane, W.C.2. Telephone, Holborn 5776.

MANCHESTER MUNICIPAL COLLEGE OF TECHNOLOGY.

Principal: B. MOUAT JONES, D.S.O., M.A. (Oxon.).

UNIVERSITY OF MANCHESTER
(Faculty of Technology).

DEGREE COURSES IN TECHNOLOGY.

THE Prospectus gives particulars of the courses leading to the Manchester University Degrees (B.Sc. Tech., M.Sc. Tech., and Ph.D.) and Certificates in the Faculty of Technology, in the following Departments:—

ELECTRICAL ENGINEERING.
(Prof. Miles Walker, M.A., D.Sc., M.I.E.E.)
MECHANICAL ENGINEERING.
Prof. Dempster Smith, M.B.E., M.Sc. Tech., M.I.M.E.)
MUNICIPAL AND SANITARY ENGINEERING.
((G. S. Coleman, D.Sc. Eng., A.M. Inst. C.E., A.M. Inst. M. & Cy.E., F.R. San. I.)
APPLIED CHEMISTRY, including General Chemical Technology, Chemistry of Textiles (Bleaching, Dyeing, Printing and Finishing), Paper Manufacture, Metallurgy and Assaying, Chemical Technology of Brewing, Electro Chemistry Photography, Colouring Matters, Foodstuffs and Fuels.
(Prof. James Kenner, D.Sc., Ph.D., F.R.S.)
TEXTILE TECHNOLOGY.
(Professor W. E. Morton, M.Sc. Tech.)
INDUSTRIAL ADMINISTRATION (Post-Graduate Certificate Course.)
(J. A. Bowie, M.A., D.Litt.)

Prospectus will be forwarded free on application to the REGISTRAR, College of Technology, Manchester.

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PATENTS, TRADE MARKS.

KINGS PATENT AGENCY, LTD. (B. T. King, Regd. Pat. Agent, G.B., U.S. and Can.), 146a, Queen Victoria Street, London, E.C.4. Phone: Cent. 0682. Advice Handbook and Consultations free. 43 years' refs.

THE Proprietor of British Patent No. 221 206, dated August 28th, 1923, relating to "Improvements in electric furnaces," is desirous of entering into arrangements by way of a licence or otherwise on reasonable terms for the purpose of exploiting the above patent and ensuring its practical working in Great Britain.—All inquiries to be addressed to B. SINGER, Steger Building, Chicago, Illinois.

PREMISES TO LET.

NEWMAN STREET, W.1.—Showrooms, Offices and Store Rooms. Spacious ground floor and basement, with total floor area of nearly 3 000 sq. ft. To let, at moderate inclusive rental, for term of 7, 14, 21 years.—Apply Messrs. HILLIER PARKER MAY AND ROWDEN, 27, Maddox Street, W.1. Tele: Mayfair 6710.

APPOINTMENTS VACANT.

BOROUGH OF BASINGSTOKE.

ELECTRICITY DEPARTMENT.

APPLICATIONS are invited for the position of Assistant Engineer in the Electricity Department of the Corporation.

Applicants must be British subjects under the age of 35 years, and have had experience in the operation and maintenance of Diesel Engines, direct and alternating-current machinery, and distribution. Salary £300 per annum.

Applications in candidates' own handwriting, stating age, education, Diesel Engine experience, technical qualifications and experience, etc., together with copies of three recent testimonials, must be forwarded to the undersigned in sealed envelope, endorsed "Assistant Engineer" not later than 9 a.m. on Tuesday the 2nd July, 1929

Canvassing Members or Officers of the Council directly or indirectly will disqualify.

F. H. SMITH,
Town Clerk.

Municipal Buildings,
Basingstoke,
June 17th, 1929.

DRAUGHTSMAN required for high and low tension switchgear. Experience in outdoor E.H.T. gear desirable.—Apply stating age, full experience and salary required to the GENERAL ELECTRIC CO., LTD., Witton, Birmingham.

WANTED, for service in South America, four first-class Cable Operators; single men: age not over 30 years. Must have good references. Three-year contract: first-class passage out and home. Good prospects.—Apply ALL AMERICA CABLES, Room 137, Bush House, Aldwych, W.C.2.

BRADFORD EDUCATION COMMITTEE.

TECHNICAL COLLEGE.

APPLICATIONS are invited for appointment as ASSISTANT LECTURER IN ELECTRICAL ENGINEERING in the College. Salary according to the Burnham Scale, which is from £186 to £480 per annum. Commencing salary according to qualifications and experience.

Further particulars of the appointment and forms of application may be obtained from the Director of Education, Town Hall, Bradford, and completed forms should be returned to the Principal of the College not later than July 10th, 1929.

THOS. BOYCE,
Director of Education.

COUNTY BOROUGH OF WEST HAM.

APPOINTMENT OF ELECTRICAL ENGINEER AND MANAGER.

THE Council of the County Borough of West Ham invite applications for the position of ENGINEER and MANAGER of their ELECTRICITY UNDERTAKING.

Candidates must have had considerable experience in connection with large electricity supply undertakings, including sales and wiring departments, and a sound knowledge of the commercial management of such undertakings. He will be entirely responsible also for advising on and carrying out all extensions to plant and mains, and such other duties as are appropriate to the management of an electricity undertaking. The successful candidate will be required to devote his whole time to the duties of the office.

The salary will be at the rate of £1 750 per annum, with advancement to the appropriate grade of the A.M.E.E. scale in operation at the end of two years' satisfactory service. Housing accommodation, on terms, is available if desired. Canvassing is strictly prohibited.

The appointment will be subject to the provisions of the Local Government and Other Officers' Superannuation Act, and to a medical examination for the purposes of that Act, and the statutory contributions to the Superannuation Fund will be deducted from the salary.

Applications, on forms which may be obtained from the undersigned, accompanied by copies of three recent testimonials, must be returned not later than 12 noon on Saturday, 13th July, 1929.

GEORGE E. HILLEARY,
Town Clerk.

Town Hall, West Ham.
27th June, 1929.

ENGINEERS.—Information unobtainable elsewhere concerning all professional examinations and enabling you to recognise the qualification that will most benefit YOU, such as:
A.M.I.E.E., A.M.I.Mech.E., A.M.I.A.E., A.M.Inst.B.E.,
Radio Association, C. and G., B.Sc. London Univ., etc.,
together with nearly 200 Courses—the widest selection of Engineering Correspondence Courses in the world—are in the
MAGNIFICENT NEW 112 PAGE BOOK,
"THE ENGINEER'S GUIDE TO SUCCESS."
This great book is available to you just at a time when a revolutionary change in promotion conditions has taken place throughout engineering—a change that gives to engineers the greatest chance they ever have had to attain to worth-while posts and equally worth-while pay. Get this Book—the Key to certain advancement in modern-day engineering—write NOW for FREE copy.
The T.I.G.B. Guarantees Training until Successful.
THE TECHNOLOGICAL INSTITUTE OF GREAT BRITAIN
(*Established* 1917)
164, TEMPLE BAR HOUSE, LONDON, E.C.4.

WANTED.

SCRAP Accumulator Plates and Sediment wanted. As actual smelters we pay top prices, any quantities.—'Phone or write, ELTON, LEVY AND CO., LTD., Charterhouse Chambers, E.C.1. Clerkenwell 7811-2-3.

WANTED immediately, copy of "The Mechanical Design and Construction of Commutators," by R. Livingstone.—Apply Box A.R.S., ELECTRICIAN Offices, Bouverie House, 154, Fleet Street, London, E.C.4.

FOR SALE.

30 YEARS GUARANTEE.

400 D.C. and A.C. MOTORS.

London Stock.

CITY ELECTRICAL CO., EMERALD STREET, W.C.1.
Phones: Holborn 9722 (4 lines). Repairs and Rewinds: Clerkenwell 2083.

FOR SALE.—Complete power factor correction condenser equipments by British Insulated Cables, with or without auto transformer and switchgear 200 volts; one three-phase 73 kVA, another 185 kVA, also two-phase equipments 98 and 197 kVA. All 600 volts 50 cycles, suitable any voltage with transformer.—Box A.R.T., THE ELECTRICIAN Offices, Bouverie House, 154, Fleet Street, London, E.C.4.

GENERATING SETS.

50 kW Siemens D.C. Generators, direct coupled to 100 H.P. Aster Paraffin, Gas or Petrol Engines, new, with high grade Switchboard, etc., in stock, voltages 80 to 500. 35 *kVA Alternators*. Any voltage, direct coupled to 46 H.P. oil engines, new and complete with exciters, etc. The above are offered at less than half makers' present-day prices. Write for our complete catalogue.—FARROW AND SONS, LTD., Spalding.

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ELECTRIC LAMPS. ELECTRIC LAMPS.

FINEST QUALITY ELECTRIC LAMPS (Pipless)
At Astounding Prices.
The new "Triumph" Electric Lamps are a Triumph in Price and a Triumph in Quality.
EVERY LAMP FULLY GUARANTEED.

Prices:	M.F. 10/60 watts, ...	5½d.
	Traction, 10/60 watts, ...	7½d.
	Half Watt—30/60 watts, ...	8d.
	75 watts, ...	8½d.
	100 watts, ...	9½d.
	Opal, plus 25%	
	Wireless Valves, Dull Emitter, 2, 4, 6v.—·06 amp.	1s. 9d.
	" " Power 2, 4, 6v.—·15 and ·25 amp.	2s. 4½d.

Terms Cash with Order or per C.O.D. post. Postage extra. Money returned without question if not highly satisfied.
Faulties and broken lamps replaced FREE.
THE TRIUMPH ELECTRIC LAMP CO.,
92, LONDON ROAD, and CLUBGARDEN WALK,
SHEFFIELD.
Phone: 21539.

H. & G. O. LEWTAS, LTD.
(IN VOLUNTARY LIQUIDATION.)
THE WHOLE OF THIS STOCK OF
TABLE AND HANGING OIL LAMPS
GLOBES, CHIMNEYS,
THREE-LIGHT ELECTROLIERS
ELECTRIC FITTINGS, UNITS,
GLASSWARE,
ONE AND TWO-LIGHT GAS PENDANTS,
BRACKETS,
IS OFFERED AT GREATLY REDUCED PRICES.
Write for prices to the purchaser—
F. STOCKDALE
(late H. and G. O. Lewtas, Ltd.)
NATIONAL LAMP WORKS,
CHESTER ROAD, MANCHESTER.

SCRAP FOR CASH.—Copper, brass, lead, cable, accumulator plates, sediment, etc. All descriptions old plant and machinery for dismantling purposes bought. Any distance. Any quantities. 'Phone, Bishopsgate 7288-9, or wire "Irometamer Edo London."—W. & H. COOPER, LTD., Brady Street, Bethnal Green, E.1.

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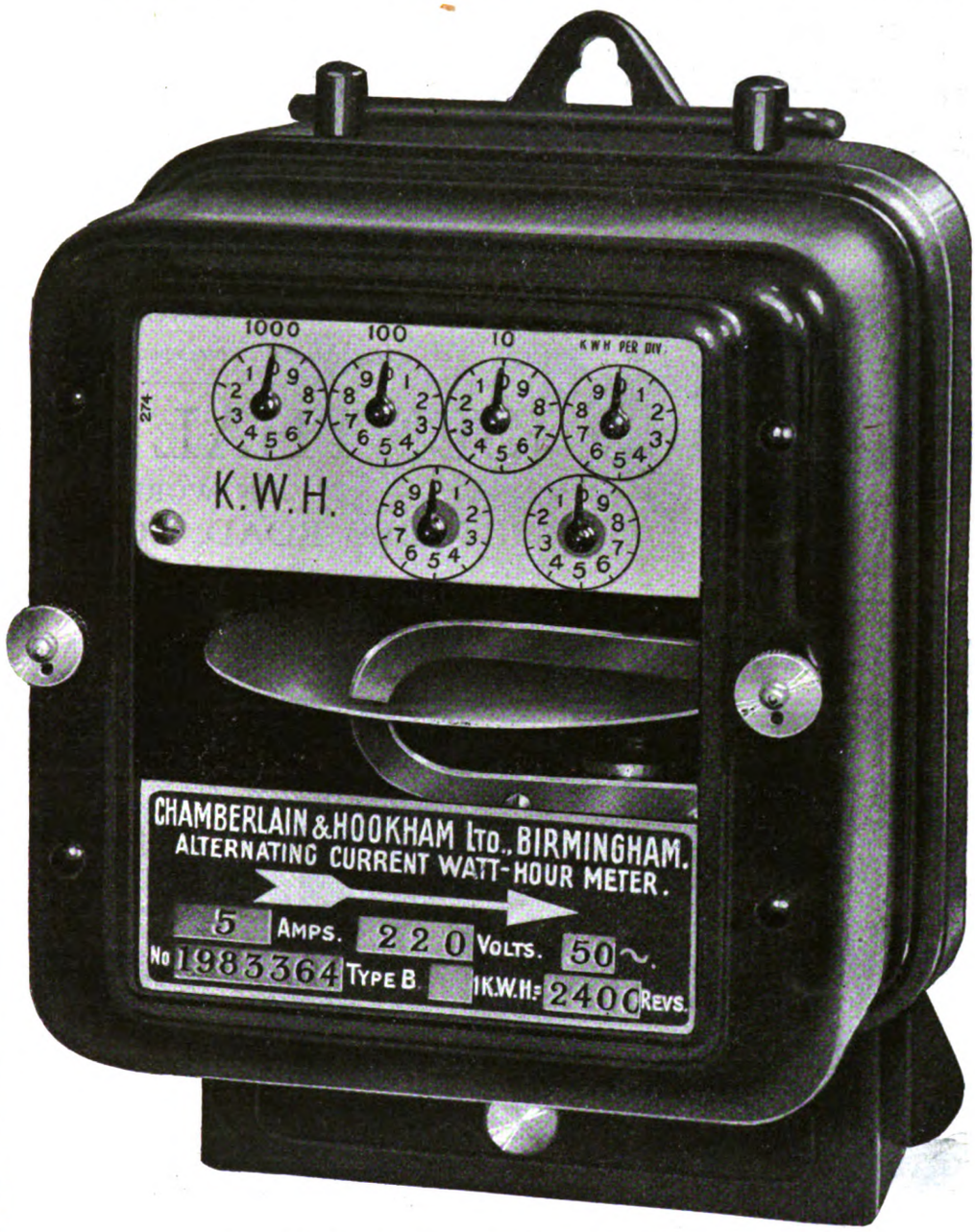
C&H METERS

CONFORMING ENTIRELY WITH THE MOST EXACTING REQUIREMENTS IN ACCURACY AND RELIABILITY.



C. & H. Single Phase Meter of the latest type.

Manufactured by:

CHAMBERLAIN & HOOKHAM, LTD.,

SOLAR WORKS, BIRMINGHAM.

London Office & Test Room:—MAGNET HOUSE, KINGSWAY, W.C.2.

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AUTOMATIC VOLTAGE REGULATORS
FOR LARGE HYDRO-ELECTRIC PLANT.

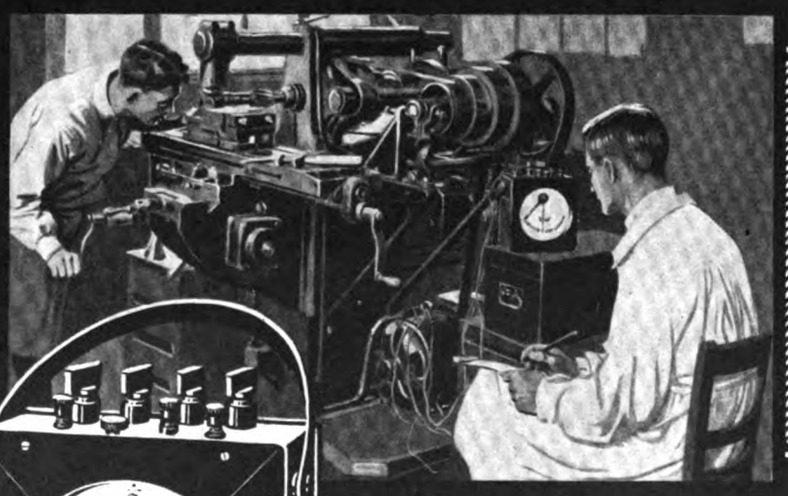
"N.C." TYPE REGULATORS
are suitable for
DIRECT OPERATION
OF THE LARGEST FIELD RHEOSTATS:
THEY AVOID VIBRATING CONTACTS.

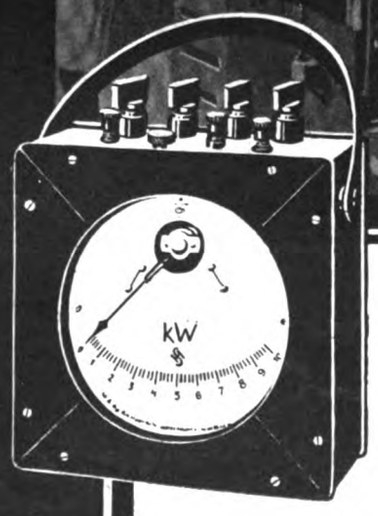
RECENTLY INSTALLED FOR THE CONTROL OF
30,000 kVA SETS SUPPLYING ENERGY FOR
THE "SHANNON" SCHEME.

Also used for Automatic Operation of Induction Regulators.
Descriptive literature upon request.

ISENTHAL & CO., LTD.
DUCON WORKS,
VICTORIA ROAD, LONDON, W.3
'Phone: Chiswick 3904.

PORTABLE SEMI-STANDARD INSTRUMENTS.





PORTABLE SEMI-STANDARD INSTRUMENTS, are used for ordinary test bench purposes to control driving or operating machinery, and are essential for reliable control.

The experienced Works Manager needs these constantly for checking the current consumption, output, voltage, power factor, frequency of his machinery and supply.

Our instruments are mechanically and electrically robust, light in weight and easy for handling all tests, which are quickly taken in any position.

Further particulars are obtainable from

SIEMENS-SCHUCKERT
(GREAT BRITAIN) LTD.
NEW BRIDGE STREET HOUSE,
30/34, NEW BRIDGE STREET, LONDON, E.C.4

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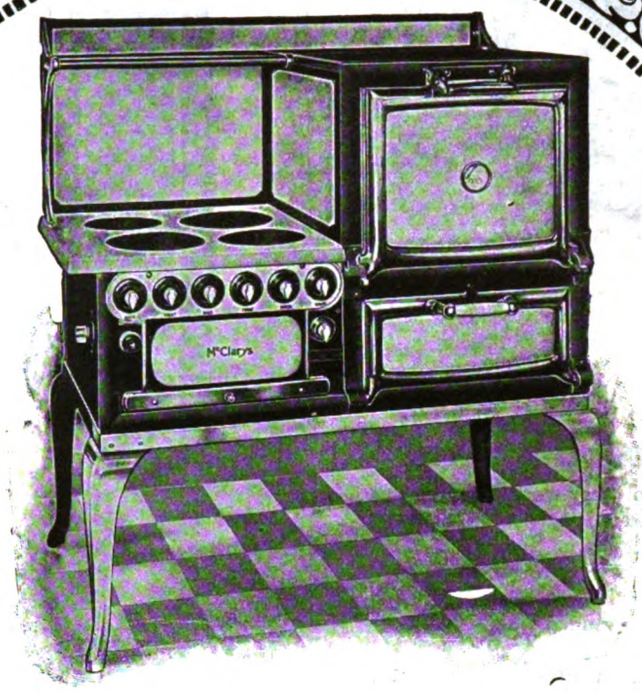
BERRY-McCLARY COOKERS



BERRY-McCLARY COOKERS
like all other Berry Products Lead in Design and Performance.

Our Standard Models are of the best possible in every detail. There are no extras.

Write to-day for particulars of various models, and trade terms.

The Berry-McClary Cooker is designed with detachable Heating Units throughout.
All the fittings of the oven are removable, leaving a perfectly smooth and seamless interior with round corners. Other advantages are: Enamelled, rustless top. "Speediron" protected element. Spill proof, damage proof cooking top, heating up rapidly. Compensating thermometer. Bottom of legs solid castings, rounded off so as not to injure floor covering.

BERRY'S ELECTRIC (1928) LTD.
TOUCHBUTTON HOUSE,
85, 86 & 87, NEWMAN STREET,
OXFORD STREET, W.1.
Telephone: Museum 4914 (3 lines), and Museum 6800 (3 lines).

MANCHESTER:
Touchbutton House,
5, Deansgate.

NEWCASTLE-ON-TYNE:
Electricals, Ltd.,
13, Saville Row.

SOUTH WALES AGENTS:
Luen Electric Supplies,
98, 100, Queen Street, Cardiff.

Works:
LONDON—Wembley.
BIRMINGHAM—Hall Green
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67/73 Kingsway - LONDON, W.C.2

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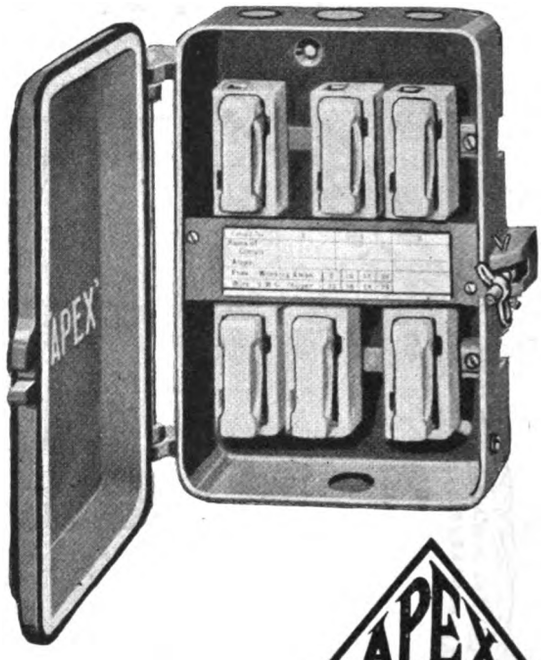
INTERCOMMUNICATION TELEPHONES

Telephone Pioneers — and still leaders.

INTRODUCING THE NEW D.B.A. SERIES OF 2 TO 5 WAYS

Additional and cheaper range to our standard D.B. Series



APEX

Registered Trade Mark

1. All Fuses and Busbars can be wired from the front of the Box without moving the Fuses.
2. The Boards are considerably smaller and lighter than our D.B. tilting Fuse type and can be sunk into the walls.
3. Box and Cover are cast iron and of the Waterproof type.
4. Conduit clearance holes are cast in and stopped off with suitable plugs.
5. The Fuse is our standard low voltage type with double spring Contacts tending to retain the Fuse Carrier in position.
6. The Busbars are protected by insulation and a "way" naming label is provided.

FOSTER

ENGINEERING CO., LTD.
MORDEN WORKS, WIMBLEDON, S.W.19
(One minute South Wimbledon Tube.)

Wimbledon 5466-5470 (5 Lines) (Private Exchange).
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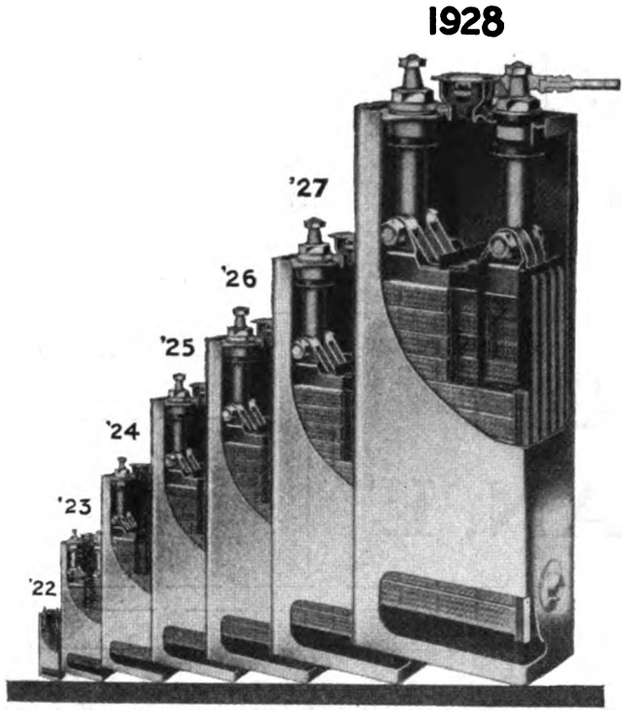

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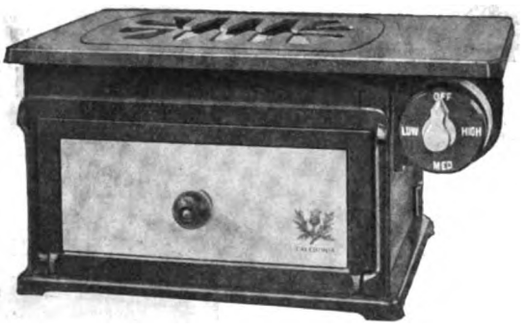

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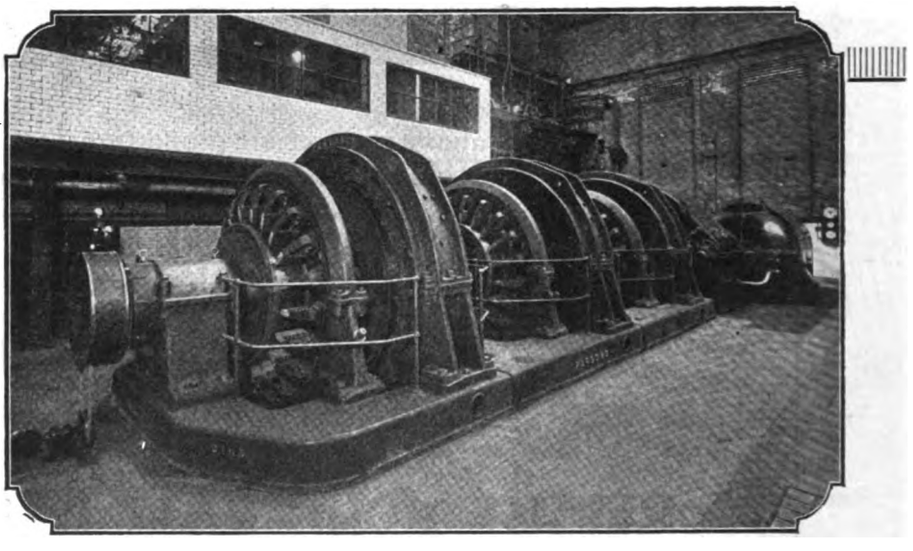

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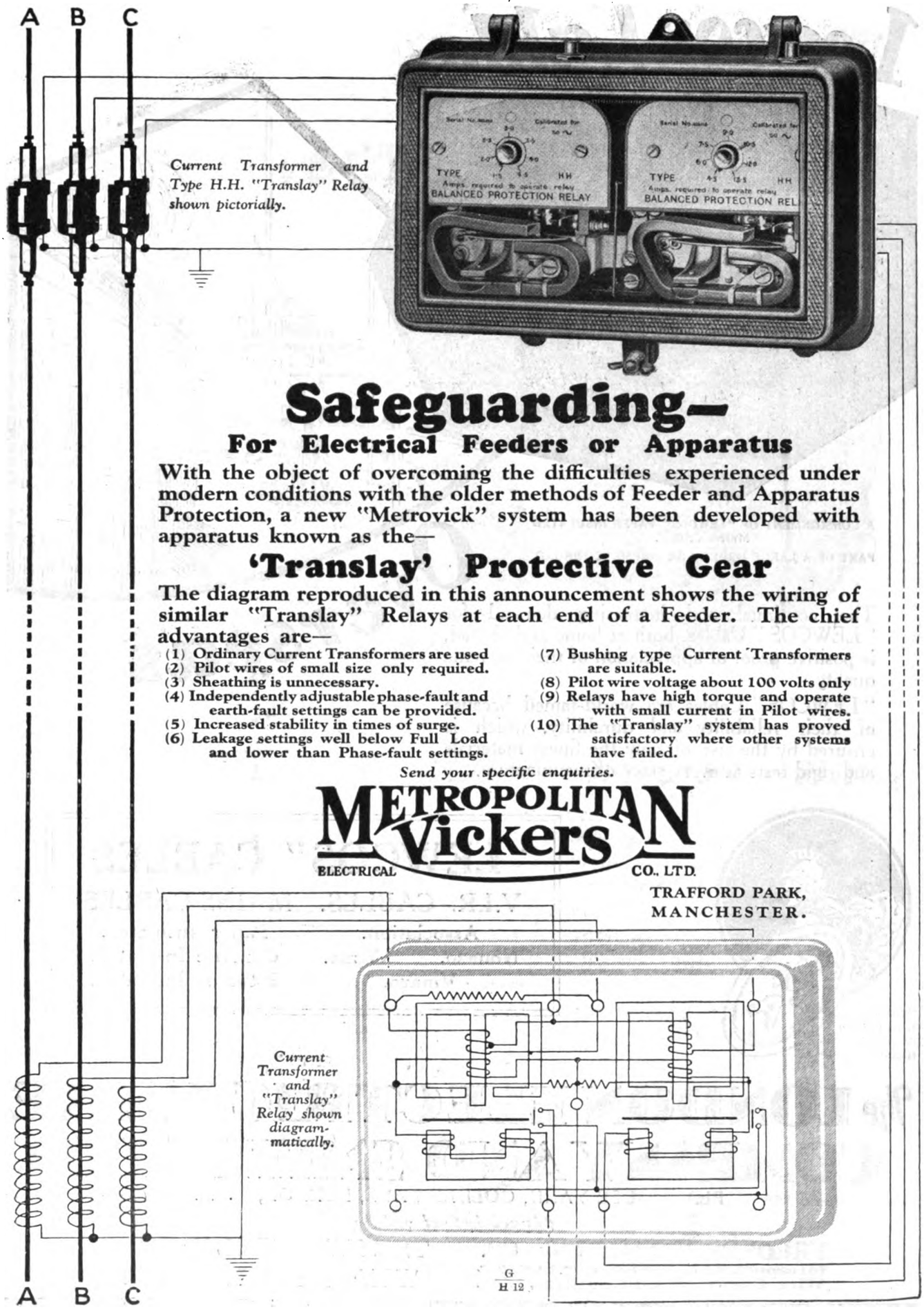

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Current Transformer and "Translay" Relay shown diagrammatically.

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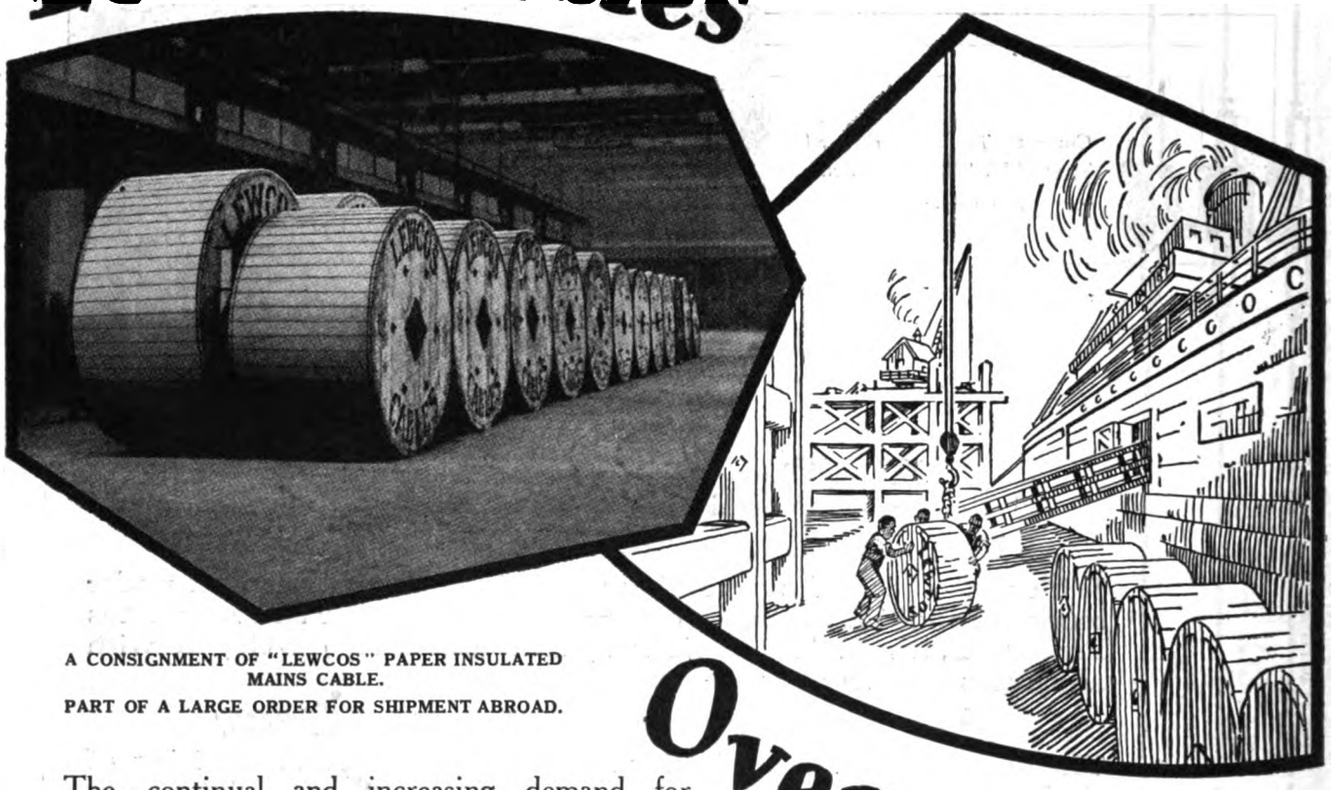

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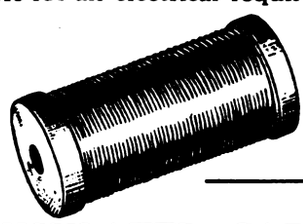

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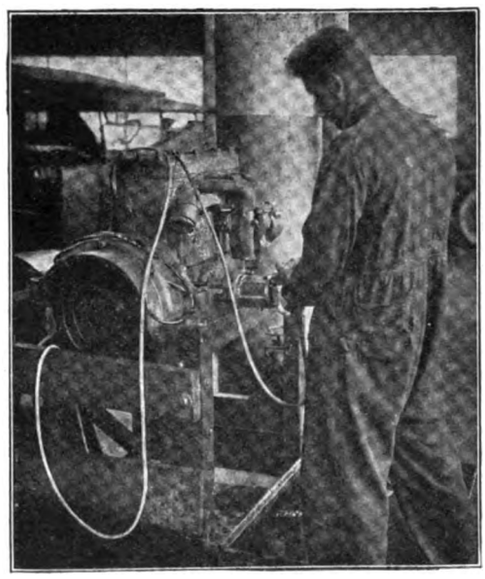

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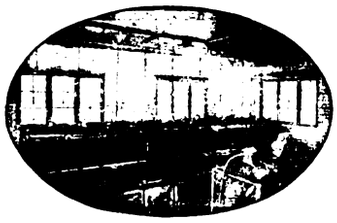

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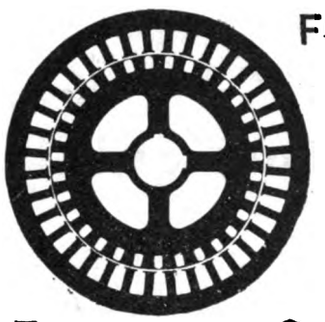

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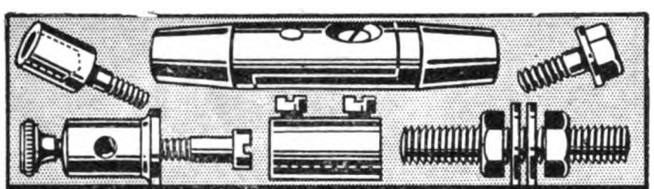

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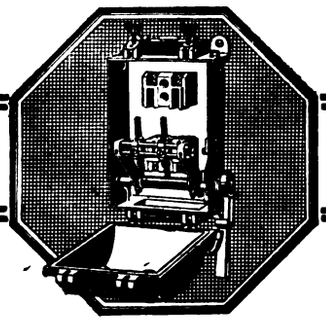

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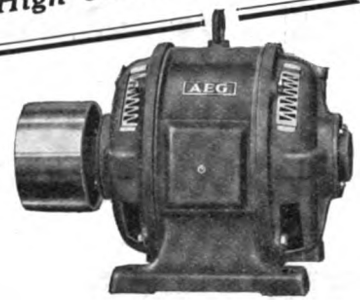

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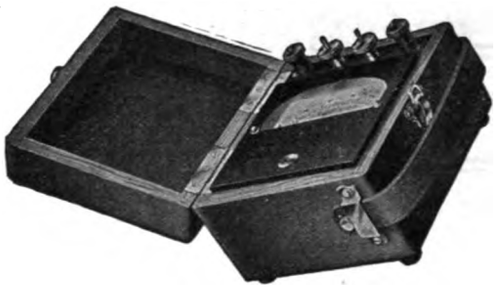

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